# PATENT, TRADEMARK AND COPYRIGHT JOURNAL OF RESEARCH AND EDUCATION
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# The Patent, Trade-Mark, and Copyright Journal of Research and Education

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# The Patent, Trademark, and Copyright Journal of Research and Education

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THE PATENT, TRADEMARK, AND COPYRIGHT JOURNAL OF RESEARCH AND EDUCATION is:

- Devoted to the publication of scientific research regarding the principles, the facts, and the practical operations of the patent, trademark, copyright and related systems of the United States and other countries;
- Calculated efficiently to educate and inform across broad fields the general reader and those with special interests from business, industry, the sciences and the professions with respect to the functioning of these systems; and
- Dedicated to convey to these publics the relation of the systems to industrial and social progress.

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Address all communications to: The Patent, Trademark, and Copyright Foundation; The George Washington University; Washington 6, D. C.


The Patent, Trademark, and Copyright Foundation sponsors objective research in accordance with the Declaration of Trust establishing the Foundation. This purpose is set forth in Article IV, Section 1 of the Declaration as follows: "The purposes and objects of the Foundation shall be promoted and carried on without regard to, and independently of, the special interests of any group or body politic, whether political, legal, social, or economic."

The positions taken by authors of articles in the JOURNAL which are not the product of the Foundation's research program are not necessarily those of the Foundation.

# FOREWORD

*The Patent, Trade-Mark, and Copyright Journal of Research and Education* is (1) devoted to the publication of scientific research regarding the principles, the facts, and the practical operations of the patent, trade-mark, copyright and related systems of the United States and other countries; (2) calculated efficiently to educate and inform across broad fields the general reader and those with special interests from business, industry, the sciences and the professions with respect to the functioning of these systems; and (3) dedicated to convey to these publics the relation of the systems to industrial and social progress.

The *Journal* will serve as the medium of communication for the work of The Patent, Trade-Mark, and Copyright Foundation, and will also be available for the work of individual scholars.

The first issue contains an introductory section on the Foundation generally, reports on completed projects, and interim reports on projects in process. Future issues will include contributions from individual scholars and students, and a miscellaneous section containing articles, annotated bibliographies, book reviews, etc.

The *Journal's* Editorial Committee comprises the Foundation's officers and selected members of the Staff. A sub-committee of the Advisory Council will be appointed to devote itself solely to the business of the *Journal,* and from time to time the National Directors, Area Committee Chairmen, and selected members of the Foundation will serve as the contributing editors.

Two issues are contemplated in the year 1957 and it is expected that the *Journal* eventually will be published quarterly.

# The Patent, Trade-Mark, and Copyright Foundation

## INTRODUCTION

THREE YEARS ago The Patent, Trade-Mark, and Copyright Foundation was placed in operation by The George Washington University as part of the University's research and educational facilities. It was established under a Declaration of Trust executed by the Board of Trustees of the University which declares that the research of the Foundation will be carried on without regard to, and independently of, the special interest of any group, or body politic, whether political, legal, social, or economic. The scope of the objectives of the Foundation is set forth in the Declaration of Trust as follows:

> The Board of Trustees of the University . . . will . . . devote the income . . . to research and education and to increase the understanding and knowledge of the people of the United States of America of the nature and value of the incentives granted under the Constitution to authors and inventors to promote the progress of science and the useful arts, including the fields of patents, copyrights and trade-marks. . .

### BACKGROUND AND PHILOSOPHY

Within the broad fields of its endeavors a university should always be responsive to a recognized need for research and education. The George Washington University has recognized the existence of such a need for gathering and disseminating knowledge concerning the fundamental principles, the facts, and the impact of the operation of the patent system and related systems upon the industrial and social structure of the United States and the various nations of the world. Recognizing this need and in the traditional role of a university as an independent searcher for truth and understanding, it has found a new channel through which the dynamic flow of its educational work is expressed.

The American people have created and fostered an industrial system from which inventive resourcefulness, technical know-how, investment of risk capital and development costs, and persistent scientific research have given to the citizenry a progressively higher standard of living. This industrial progress has been due to more than the exploitation of rich stores of raw materials. Our people have traveled a road of steady industrial advance under the impetus of beliefs based on the concept of individual enterprise. The patent system of the United States was conceived and developed in the context of traditions, interests, and ideals whereby citizens were to determine their fate and national destiny primarily by the fruits of their individual enterprise.

Against the background of these beliefs The George Washington University has launched a program of more systematic and continuous research and education, in order to secure greater knowledge and understanding for appraisal of the contributions made to the progress of science and useful arts through the patent system, the copyright system, the system of laws governing trade-marks and trade names, and all related bodies of law pertaining to industrial, literary, artistic and intellectual creations.

### A FRESH APPROACH

The startling fact is that the existing literature in the fields covered by the Foundation's research does not reflect any previous undertaking by a university to pool, analyze, and systematize factual information and principles across the entire range of the functioning and impact of patents, trade-marks, and copyrights upon the American national economy and in the international sphere. Literature from sources other than universities undeniably has had, and will continue to have, an important place in fostering understanding about patents and related fields. A wealth of views has come from many walks of life and from the three branches of Government—the Legislative, Executive, and Judicial. In this literature is sometimes reflected a clash of viewpoints essential to democratic processes that give free play to advocacy. Lawyers, scientists, engineers, industrialists, legislators, government administrators, and the courts have given eloquent testimonial to their interest in the never-ending search for understanding and appraisal of what the patent and related systems have meant to America and to the world.

### UNIVERSITY RESEARCH DISTINGUISHED

The University offers an ideal agency for conducting research and education free from self-interest, a guarantee of objectivity, the hallmark of free inquiry vital to the success of such an undertaking. By the very nature of its educational goals and organization such a university approach gives assurance of a coordinated and systematic treatment of the problems. In order to evaluate adequately the purposes and results of the various systems of laws and their functioning in society, the resources of a university are needed to marshall all the facts concerning the operation of the patent and related systems. These facts must be subjected to continuous analytical scrutiny. Further, a fresh approach to the complex problems of these systems requires a synthesis of the various views set forth in the literature produced from sources outside the University by persons of varying educational and professional backgrounds. The conclusions reached in these writings represent the several viewpoints with different perspectives as to the objectives and operation of the systems under consideration. At times these views are seemingly incompatible or flatly contradictory. No other approach than the one described above can hope to command the confidence of the American citizenry in that free inquiry so necessary to reconcile these divergent views.

There are other reasons which dictate the need for research and education concerning these fields of inquiry. Patents, trade-marks, and copyrights, and other embodiments of ideas and discoveries touch upon all of the physical and social sciences. When these disciplines of learning overlap in the never-ending search for better integration of our national resources and under the pressures created by social changes and world conditions, inevitably there is interaction of political and economic concepts. There are claims relating to private interests and to the public interest, allegations regarding the relative merits of the contributions made by the individual inventor and the industrial laboratory, and a multiplicity of other disputed questions with respect to private incentives and rewards and public policy considerations.

The university is the traditional means of weighing these factors and of bringing factual and constructive analytical resources in aid of the resolution of these differing opinions. In so doing, the university must take into account a scale of values imbedded in the beliefs of the people who live under a particular political and social order.

### PUBLIC INFORMATION

Another basic reason for the University's interest in the Foundation is the gap now existing because of the lack of educational means of conveying to the citizenry of the country the basis for a factual and intelligent comprehension of the patent and related systems. The patent system needs further study and explanation for the benefit of the many citizens who today know little about the effects of the system upon their everyday life. Professional and scientific writings are obviously not designed to accomplish the purpose of explaining to "John Q. Public" the fundamental principles and salient facts of the patent system. While certain organizations have already distributed written material on the elementary aspects of inventions and patents, no university has yet undertaken such a task as an organized educational activity which may gain wide public acceptance for its authoritative and objective character. The Foundation is an excellent medium for such a project. It can perform this task not only in dissemination of published material but also in adult education programs of instruction and lectures.

There is also recognition of the need for educational measures to convey more systematically and with breadth of coverage, knowledge about the patent system as part of the curricula of elementary and high schools and colleges. From those classrooms go forth the citizens who join the ranks of future scientists, engineers, and business executives. Directly or collaterally they will be dealing with the patent and related systems. This national resource in knowledge about such systems can be seriously impaired unless such persons are made aware of the basic principles and operative effects of the patent system. We believe that a research and educational foundation under university auspices is the logical channel through which to formulate and put into effect courses of instruction and training programs for utilization by the educational institutions of this country.

### BALANCE BETWEEN THEORY AND PRACTICE

Lest the objectives of the Foundation be not fully appreciated, it should be stated that the research and educational program is not envisioned as an academic venture solely into the realm of pure theory.

No university worthy of its traditions could fail to strike a proper balance between theory and practice. Supporters of the Foundation have the right to expect from the Foundation a high level analysis and largeness of coverage of all phases of the systems of laws related to both the essential concepts and realities of the arts and sciences from which flow invention, authorship, industrial and artistic discoveries.

Frontiers of these areas of learning must be continuously expanded. Study and organization of the vast body of knowledge in these fields require orderly processes for gathering information and for making it meaningful in terms of the national and international economic and social organisms.

Yet a university should avoid the doctrinaire approach of the researcher in an ivory tower. Knowledge is power only when it comes to grips with the realities of the world within which it is used. Hence, the Foundation conducts its inquiries by going to the laboratory, to the factory, to the business executive, to agriculture, to labor and to the consumer to bring this knowledge into relation with the aspirations and practical problems faced in all of these interrelated areas of our national life.

## COOPERATIVE ENTERPRISE DEVELOPS

In a broad sense, The Patent, Trade-Mark, and Copyright Foundation represents an experiment in interdisciplinary, or perhaps better, multidisciplinary research. It is an experiment in the reintegration of specialized information, in the re-establishment of the community of knowledge. An interdisciplinary approach would always seem to be pertinent to the study of phenomena that have wide cultural implications, regardless of the particular contexts in which these phenomena may arise. Such an approach seems implicit in the concept of a university. In any case, the need for a coordinated attack on problems of knowledge is becoming more generally appreciated, as is evidenced by the founding of new journals that cut across the boundaries of conventionally recognized subjects, by the reorganization of university courses and departments, by the development of "operations research," "team research" and similar group activities at the schools and in industry.

In its own area of interest, The Patent, Trade-Mark, and Copyright Foundation has sought to derive the benefits of both specialization and recombination. Investigators and consultants for particular research projects are commonly drawn from different disciplines and professions. They work together on such projects, contributing according to their particular education and experience. They also participate ex officio in critical reviews of plans, procedures, findings, and reports for projects for which they do not have primary responsibility. This integration, this intellectual cross-fertilization, has proved fruitful.

Although successful interdisciplinary research leads to a whole that is greater than the sum of the parts, the administrative burdens are heavy and the psychological strains are great. Experts in particular fields work with premises, words, and mental models that are at least familiar to, if not always approved by, their own colleagues. But when they have to communicate with and persuade experts in other fields, the task may at first seem hopeless. The initial prejudices of insularity are strong; the challenge and response need not always take a constructive course.

The Foundation's brief experience has shown that rapport can eventually be established, that good working relationships can with patience and tolerance be achieved. After the first bristling contacts and exchanges, unlearning and new learning occur. New bonds of group unity are formed, and cooperative productive enterprise becomes possible.

## FOUNDATION OPERATION

The Foundation is employing a fourfold method of attack. Projects are to be: (1) pre-planned, (2) interdisciplinary, (3) empirical, and (4) objective. The first task of the Foundation after it was placed in operation by the Board of Trustees of The George Washington University in February of 1954 was to construct an overall plan of investigation. This plan is being carried out in seven major areas. The definition of these areas is based either upon the uniqueness of the combination of disciplines to be employed or upon the fact that the particular subject matter could best be studied in a unified approach.

Although the over-all Foundation program first envisaged has since been elaborated in ways not then foreseen, the gradual fulfillment of the program, as conceived at that time, is being achieved more and more as our projects develop and are completed. Of course, each step forward reveals the need for taking still more steps and the map that guides us has to be redrawn constantly, but as a result of our experience to date we have been using our over-all plans ever more confidently.

The principal objective of the Foundation is to illuminate the significance of the patent and related rights in the past development, current operation, and future course of the American enterprise system. This interest has naturally led to the engagement on research projects of scholars able to handle economic, accounting, statistical, psychological, and other social science tools. Such interdisciplinary cooperation is beset by various difficulties, but it also affords important opportunities for the advance of knowledge along a common path into new fields.

The experience of the Foundation suggests the nature of the barriers that have to be overcome to establish interdisciplinary rapport. Mistrust of certain disciplines or professions is not uncommon among certain others. In the case of law, for example, it stems perhaps from the historical primacy of law among the social sciences and from the aspiration of some practitioners of other social sciences to the public status that lawyers have traditionally occupied. But much more important and more immediate is the difficulty of communication. Differences in training and experience give rise to dissimilar "gestalts," research tools, and modes of thought and expression. As in the antitrust field, a workable concept and language relationship between the disciplines has to be worked out. Indeed, the Foundation's experience indicates that the energy displayed in the initial semantic and conceptual jousts is being turned to constructive uses, that the heat is being converted into light. The achievement of a wholesome type of competition, a true interdisciplinary cooperation, is leading to unanticipated benefits, as well as to the gradual fulfillment of the Foundation program.

The work of the Foundation is based on empirical research (the third method of attack referred to above). In all cases, whether it be an exploratory, a pilot, or a larger study the conclusions reached are based entirely on the facts found by the investigators. These facts reveal the actual operation of the patent and related systems. From an analysis of these facts we hope eventually to be able to determine and evaluate the impact of the systems on the American industrial and social structure.

Finally, the Foundation has from the beginning been conscious of the importance of objectivity and non-partisanship. It is concerned with free investigation and interpretation for the social good. This aspect of the Foundation is assured by the fact that it is an integral part of the University, a private institution, with a proud tradition of free inquiry for over 136 years.

## HISTORY

Located in the Law School on The George Washington University campus, the Foundation has evolved from a rudimentary idea to a fully developed organization.

The story of the Foundation goes back to February 15, 1949, when the American Patent Law Association, by resolution at its stated meeting and subsequently by referendum vote, recognized the need for research and education under university auspices in the field of patent and related systems of law. The George Washington University, in accordance with this resolution and a referendum of the Association, agreed to undertake the establishment of the Foundation.

Among the people primarily responsible for the University undertaking this task were Dr. Cloyd H. Marvin, President of the University; Professor S. Chesterfield Oppenheim, then Acting Dean of the Law School; and Mr. Conder C. Henry, of Washington, D. C. Great assistance in the formulation of the Declaration of Trust was provided by Mr. Henry R. Ashton, of New York; Mr. Virgil E. Woodcock, of Philadelphia; and Mr. Robert C. Watson, of Washington, D. C. Important assistance in establishing the Foundation was also rendered by Mr. Max McGraw, of Chicago, and Mr. Frank A. Howard, of New York, a Trustee of the University.

On July 1, 1950, an office for The Patent Foundation, as the Foundation was then called, was opened in the Law School of the University with an administrative secretary. The work of the office was devoted mainly to the preliminary organizational work, the editing and production details on a brochure announcing the Foundation, compilation of mailing lists of prospective Foundation members, and in securing the cooperation of various patent law associations in the endeavor. Men of national importance who indicated their interest in the enterprise by agreeing to serve as Honorary Members of the Foundation were Joseph W. Barker, Vannevar Bush, Cyrus S. Ching, John W. Davis, Charles F. Kettering, and Max McGraw.

### LOCATION OF FOUNDATION

A Declaration of Trust was signed by the Board of Trustees of The George Washington University August 3, 1950. This University became the site of the Foundation because of certain factors of its history and location in the nation's capital.

The George Washington University Law School is well known for its traditional interest in providing instruction and training for patent lawyers. Decades of this education in patent law have built up a body of alumni spread across the nation as members of the patent bar and including many leaders in the activities of the patent law associations of national, state, and local membership. This national representation is a natural sequence of the fact that the student body of the Law School is constantly drawn from the 48 states.

Location in the nation's capital is a geographic factor of national importance. The District of Columbia is not a local community. It belongs to the nation. It is the hub of the wheel from which radiate spokes that reach all corners of the land. Location of the Foundation in Washington is in keeping with the national character of the problems of our patent system.

In the nation's capital is the focal point of all matters patent. Here are available the deliberations, decisions, and complete records of such agencies as the United States Patent Office, the Court of Customs and Patent Appeals, the Department of Justice, the Patent Subcommittees of the House and Senate Judiciary Committees and the Supreme Court of the United States.

In the nation's capital are also rich resources in library collections such as those of the Library of Congress and other governmental libraries and in the collections of private organizations. Numerous national and international, professional, scientific and business organizations in fields directly or indirectly related to the work of the Foundation have headquarters in the nation's capital.

## FIRST PUBLIC ANNOUNCEMENT

In June, 1951, the establishment of the Foundation was first publicly announced at a press conference in Washington. Coverage was given by such nationally circulated newspapers as the New York *Times,* New York *Herald Tribune,* Washington *Post,* and Washington *Evening Star,* and by the press in such wide-spread places as Youngstown, Fort Worth, and San Francisco. Trade and professional journals took note of the establishment of the Foundation, and gave considerable space in both news columns and editorial pages.

Then in July, 1951, a 24-page brochure, "The Patent Foundation in the Nation's Capital," was sent to patent attorneys, general counsels, business and industrial executives, public officials, educators, editors, and publicists. This brochure, 10,000 copies of which were distributed, set forth in considerable detail the need for, and the purposes, objectives, and working operations of this research foundation. With the brochure was sent a copy of the Declaration of Trust under which the Foundation was established, and a letter of invitation to become a member of the Foundation from the President of The George Washington University, Dr. Cloyd Heck Marvin.

In response to industry inquiries aroused by this literature, Acting Director Colclough, then Dean of the Law School, sent a supplementary letter on details of contributions to executives, and discussed the project with many of them. He explained the Foundation on various occasions in talks before the American Patent Law Association, the Section on Patent, Trade-Mark, and Copyright Law of the American Bar Association, and the National Council of Patent Law Associations. The Section on Patent, Trade-Mark, and Copyright law adopted a resolution in 1951 endorsing the Foundation, which was subsequently approved by the House of Delegates of the American Bar Association. Through the assistance of the National

Council, 14 and later 15 of 18 state and city patent law associations endorsed the Foundation.

In July, 1952, three distinguished patent attorneys, Colonel Lawrence C. Kingsland, of St. Louis (former Commissioner of Patents) ; Mr. Fulton B. Flick, of Pittsburgh; and Mr. Robert C. Watson, of Washington, as National Directors of the Patent, Trade-Mark, and Copyright Foundation Membership Committees, circularized the membership of the American Patent Law Association, urging further support of the Foundation. In January, 1955, the Honorable Mr. Watson withdrew from the committee by reason of his appointment as Commissioner of Patents, and Brigadier General Harry H. Semmes of Washington, D. C., became a Director in his place.

Originally called The Patent Foundation, the organization's new name, The Patent, Trade-Mark, and Copyright Foundation, was authorized by the Board of Trustees of the University. The desirability of this change stemmed from a recognition that the broad scope of the Foundation's work, as provided in the Declaration of Trust, embraced these systems, as well as the patent system. The new name is, therefore, more accurately descriptive of the Foundation's scope.

## FUND RAISING CAMPAIGN

During this organizational phase of the Foundation, assistance was received from the Alfred P. Sloan Foundation through two grants-in-aid. These funds, kept separate from member and donor contributions, provided for (1) an administrative secretary who managed the Foundation office, (2) the expenses of that office, and (3) the costs of the fund-raising program.

The geographical spread and the prestige and influence of attorney and corporate members were lively indications of the quality of interest in this undertaking. It needed, however, to be further established that nationwide support, intellectual and financial, of the quality and quantity necessary to success, would be realized before the Foundation could be put into actual operation by the Board of Trustees of The George Washington University.

In April 1953, when Executive Director L. James Harris became an officer of the Foundation, committees to assist the Foundation in obtaining financial support were reorganized and activated on a regional basis, new ones formed and their duties expanded to include eventually cooperation in the actual work of the Foundation. These area committees, in metropolitan centers of the United States, were comprised of representatives of industry, business, science, and the legal profession who had an abiding interest in patent, trade-mark, copyright and related systems of law.

During this formative period, Executive Director Harris, in view of the importance of bringing the story of the Foundation to the American public, concentrated on traveling throughout the United States, visiting numerous cities in the industrial areas. He made personal contacts with key industrial, foundation, and association executives and patent and general counsels through visits, interviews, and speeches. He, in general, helped lay the groundwork for the regional committees by facilitating responsiveness in potential members and donors and in gaining financial support for the new Foundation.

#### FOUNDATION OPERATIONS BEGIN

Early in 1954 the fund-raising campaign, having reached a goal which gave reasonable assurance that the Foundation would have sufficient funds to be established on a sound financial basis, culminated in the Foundation's being placed in operation at the University. At that time Oswald S. Colclough and L. James Harris were appointed Acting and Associate Directors, respectively, to administer the Foundation and direct its research program. During the period June-October 1954, an Advisory Council, comprised of men of national importance, was appointed by the President of the University with the approval of the Board of Trustees. Their first annual meeting was April 21, 1955.

All facets of the problem of establishing the initial agenda for the Foundation research program were examined, and with the advice and assistance of the Advisory Council and selected members, pilot projects and a staff to carry them out were chosen. The Foundation was ready, then, to launch its inquiry into the patent, trade-mark, copyright and related systems of law.

## ORGANIZATION

The Foundation has a Director, an Executive Director, an Office Staff, and a Research Staff. The organization also includes the Advisory Council, National and Area Committees. All plans and operations originate with or are initiated through the office of the Foundation and a large part of the actual procedures of certain projects are carried out in that office.

#### OFFICERS

The Director, Oswald S. Colclough, Vice-Admiral (Ret.) United States Navy, is Dean of Faculties of The George Washington University and Acting Dean of the Law School. The Director has supervision of all aspects of the work of the Foundation.

The Executive Director, L. James Harris, formerly Committee Counsel to the Judiciary Committee, House of Representatives, and Counsel to its Sub-Committee on Patents, Trade-Marks, and Copyrights, a Professorial Lecturer in Law at The George Washington University Law School, directs and coordinates the administrative and research work of the Foundation. Personnel, projects, publications, and programs are under his immediate supervision and management.

#### ADVISORY COUNCIL

An Advisory Council,[1] consisting of nationally recognized men in the fields of commerce, education, science, manufacturing, labor, finance, and the professions,

[1] Members of the Advisory Council, past and present, are:

Willard C. Asbury, Vice President, Esso Research and Engineering Co.
Joseph W. Barker, Chairman of the Board, Research Corporation
Vannevar Bush, former President, Carnegie Institution of Washington
*Emanuel Celler, Chairman of the House Judiciary Committee
Cyrus S. Ching, Industrial Relations Consultant
†John W. Davis, Davis, Polk, Wardwell, Sunderland & Kiendl

advises on policy determination and the formulation of specific programs. The Chairmen of the House and Senate committees having jurisdiction over patent, trade-mark, and copyright legislation of the United States, and the United States Commissioner of Patents have the rights and privileges of ex officio members of the Advisory Council to the extent they may wish from time to time to exercise them and so long as they hold their respective offices. At the annual meeting of the Council, held at the University in the spring, the Council reviews the Foundation's progress, evaluates the current research projects, discusses decisions concerning new projects, and advises on future plans. Officers for this year, elected at the April 11 meeting, are:

Chairman—Lawrence R. Hafstad, Vice President in Charge of Research, General Motors Corporation

Vice-Chairman—Mervin J. Kelly, President, Bell Telephone Laboratories

The Advisory Council renders to the Board of Trustees of the University an annual report of its views and recommendations.

## AREA AND NATIONAL COMMITTEES

Area committees in 11 large metropolitan centers of the United States assist in the Foundation's work and in soliciting members. Eminent patent attorneys serve as Chairmen of the Area Committees[2] and as National Directors[3] of these commit-

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Laurence B. Dodds, President, Hazeltine Electronics Corp.
Thomas K. Finletter, Partner, Coudert Brothers
Luis de Florez, President, de Florez Engineering Company, Inc.
Lee J. Gary, Gary, Desmond & Parker
Edwin R. Gilliland, Professor of Chemical Engineering, Massachusetts Institute of Technology
Lawrence R. Hafstad, Vice President in Charge of Research, General Motors Corp.
†John M. Hancock, Partner, Lehman Brothers
Learned Hand, Judge, United States Circuit Court
J. King Harness, Harness, Dickey and Pierce
Mervin J. Kelly, President, Bell Telephone Laboratories
Charles F. Kettering, Chairman of the Board, Kettering Foundation
†*Harley M. Kilgore, Chairman of the Senate Judiciary Committee
David E. Lilienthal, Chairman of the Board, Development and Resources Corp.
Max McGraw, President, McGraw-Edison Company
John M. Olin, Chairman of the Board, Olin Mathieson Chemical Corporation
H. J. Rand, President, Rand Development Corporation
David Sarnoff, Chairman of the Board, Radio Corporation of America
Glenn T. Seaborg, Professor of Chemistry, University of California
*Robert C. Watson, Commissioner of Patents
Edward R. Weidlein, former President, Mellon Institute of Industrial Research
Charles E. Wilson, Chairman of the Executive Committee of the Board of Directors, W. R. Grace and Company
William T. Woodson, Woodson, Pattishall and Garner

† Deceased.
* Ex Officio members of Advisory Council.

[2] Area Committee Chairmen are:

| | |
|---|---|
| Boston | Merwin F. Ashley |
| Chicago | James P. Hume |
| Cleveland | Albert R. Teare |
| Detroit | G. H. Willits |
| Milwaukee | Harold S. Silver |
| New York | George W. Hastings |
| Philadelphia | John D. Myers |
| Pittsburgh | Karl B. Lutz |
| San Francisco | Paul D. Flehr |
| St. Louis | Alfred W. Petchaft |
| Washington | John W. Malley |

[3] The National Directors are:

Fulton B. Flick, Lawrence C. Kingsland, Harry H. Semmes tees. As the Foundation proceeds with its research and educational projects the Committee serves as a point of contact in its area.

### RESEARCH STAFF

The Foundation's Research Staff[4] is composed of outstanding men in such fields as economics, statistics, law, and industrial psychology. These people, all busily engaged in their own specialties, have joined in the work of the Foundation because of their keen interest in the opportunity which the Foundation affords to participate in the opening of this relatively new field of research to systematic university investigation. Professor S. Chesterfield Oppenheim, of the University of Michigan Law School, is Adviser on Research. Professor Oppenheim, author of books and articles in antitrust and trade practice laws, was co-chairman of the Attorney General's National Committee to Study Antitrust Laws (1953-55). Mr. John C. Green, Consultant to the Foundation, is Director of the Office of Technical Services and Executive Director of the National Inventors Council, Department of Commerce.

### FOUNDATION MEMBERSHIP

The Foundation's membership is comprised of individuals, firms, companies, foundations, and associations who believe in and wish to support the work of the Foundation. By contributing to the Foundation, members and donors make it possible for the Foundation to conduct its research, and in turn are kept informed by means of reports and publications of the results of that research and of other research work in these fields.

Four classes of membership are: Life Members, contributing in any one year $10,000 or more; Sustaining Members, contributing from $500 to less than $10,000; Participating Members, contributing from $100 to less than $500; and Members, contributing from $10 to less than $100. All memberships other than Life are for a period of one year. Contributors to the Foundation who do not wish to apply for membership are designated as Donors.

## PROGRAMS

### PROJECTS

All the projects being explored or undertaken by the Foundation at this time are concerned generally with obtaining a better understanding of the nature and value of the patent, trade-mark, and copyright systems. This over-all purpose is being carried out in seven selected areas to provide as comprehensive a picture of patents, trade-marks, and copyrights as can be obtained with current resources and techniques at the Foundation's disposal. The projects undertaken are starting points of a series of integrated research studies in the respective areas.

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[4] See pages 13-14.

The seven areas selected for investigation and the pilot projects undertaken are:

| *Areas* | *Pilot Projects* |
|---|---|
| 1. Utilization of Patents, Trade-Marks, and Copyrights | 1a. Patent Utilization |
| 2. Patent, Trade-Mark, and Copyright Evaluation | 2a. The Value of the Patent in the United States |
| 3. Impact on the Development of New Industries and Community Growth | 3a. Effect of Patents on the Creation and Growth of Small Industrial Units |
| | Patent and Other Factors in the Development of Firms in the Custom Heat-Treating Industry |
| | Patent and Other Factors in the Future Organization of the Steel Industry |
| | Patent and Other Factors in the Growth of the Electronics Industry in the Boston Area |
| 4. Relationship to Antitrust and Trade-Practice Laws | 4a. Effects of Certain Antitrust Decrees Involving Patents as a Major Factor |
| 5. Foreign Patents, Trade-Marks, and Copyrights | 5a. Relation of American Patents, Trade-Marks and Techniques, and American-Owned Foreign Patents to Foreign Licensing |
| 6. Public Attitude and Invention Incentives (Socio-Psychological Studies) | 6a. Public Attitudes Toward Patents, Trade-Marks, and Copyrights |
| | 6b. Attitudes of American Inventors Toward Defense Invention |
| 7. Governmental (Ownership of Patents; Atomic Energy; Evaluation of Copyright Office, Patent Office, and Judicial Procedures; Taxation) | 7a. The Taxation of Patents |

By means of the pilot projects, facts are being collected and analyzed on a limited basis, as for example, from a comparatively few chosen firms, a segment of an industry, or a relatively small random sampling of individuals or companies. The purpose of the pilot project is to find out (1) what information is available, and (2) how to develop proper methods for extending the project, as for example, to an entire industry or on an industry-wide basis.

The projects are conducted by qualified research men on a task assignment basis. Advice and assistance in carrying out the projects come from the Foundation's Advisory Council, National and Area Committees, and selected members. The Foundation conducts its research by going to the laboratory, factory, business executive, agriculture, labor, consumer, and to all related areas of our national life. Facts are collected and analyzed, and the results are made available to all interested individuals, organizations, companies and the general public. A brief description of each project follows.

The Foundation's Project 1a, "Patent Utilization,"[5] is designed to determine what happens to patents after issue, what types are further developed and marketed, and how this is accomplished and why. The Principal Investigator is Dr. Joseph Rossman, patent attorney of Philadelphia, who is Patent Counsel of the Marathon Corporation. Dr. Rossman, editor of the *Journal of the Patent Office Society* from 1931 to 1935, is an author of books and articles on legal and technical subjects. The Research Associate is Dr. Barkev S. Sanders, Research Consultant of the Program Development Branch of the Division of General Health Services, U.S. Public Health Service. He is a lecturer in Statistics and Economics at Johns Hopkins and Catholic Universities, has developed and conducted statistical surveys, and contributed articles to technical journals.

The purpose of the project, on "The Value of the Patent in the United States,"[6] No. 2a, is to develop a methodological framework within which the value of the patent system can be estimated. The Principal Investigator, Dr. Jesse W. Markham, who has specialized in the fields of industry studies and public policy toward business for 12 years, is Professor of Economics at Princeton University. Dr. Markham's publications include books and articles. From 1953 to 1955 he served as Director of the Federal Trade Commission's Bureau of Economics. The Research Associate is Mr. James S. Worley, an economist who is now at Princeton on full scholarship granted by the General Education Board as a candidate for the Doctor of Philosophy degree. The Research Assistant is Mr. Dwight S. Brothers, a former instructor at Princeton, who is Assistant Professor of Economics at the Rice Institute.

Project 3a, "Effect of Patents on the Creation and Growth of Small Industrial Units,"[7] comprises three case studies, each of which is intended to cast light on the role of patents, in context with other factors, in the origin and evolution of new firms and industries. The Principal Consultant for Project 3a is Dr. Irving H. Siegel, Director of Research, American Technology Study for Twentieth Century Fund; Member of the Staff of U.S. Council of Economic Advisers; and author and lecturer on economic and technical subjects. Research Associates are Dr. Nathan Belfer, formerly Associate Professor of Economics at Pennsylvania State University; Dr. Robert M. Weidenhammer, Professor of Finance at the University of Pittsburgh; and Dr. Weldon Welfling, Director of the School of Social Science at Simmons College in Boston.

Another project, No. 4a, has as its objective ascertaining whether there are measureable criteria for judging the technological and economic "Effects of Certain Antitrust Decrees Involving Patents as a Major Factor."[8] Mr. George E. Frost, patent attorney of the firm of Frost & Verhoeven in Chicago, is Principal Investi-

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[5] See page 74.
[6] See page 20.
[7] See pages 57, 112, and 119.
[8] See page 127.

gator. Mr. Frost, member of the Attorney General's National Committee to Study the Antitrust Laws (1953-55), is author of treatises on patent, trade-mark, and copyright law. Professor S. Chesterfield Oppenheim is Principal Consultant for this project. Mr. Neil F. Twomey of the University of Chicago Law School is the Student Research Assistant.

A project on foreign licensing, No. 5a, is seeking to obtain information on licensing operations abroad by American business. "Relation of American Patents, Trade-Marks, and Techniques and American-Owned Foreign Patents to Foreign Licensing"[9] is primarily focused on the relation of American patents, trade-marks, and techniques to such licensing. Dr. J. N. Behrman, Professor of Economics at Washington and Lee University, is Principal Investigator for the project. He is author and co-author of economic texts and articles. Mr. Jerome Jacobson, Washington economist, is Consultant. Mr. John Lindeman, the former Principal Investigator, is currently in Burma as an economic consultant.

An industrial psychological study of "Public Attitudes Toward Patents, Trade-Marks, and Copyrights,"[10] Project 6a, is designed primarily to provide guidance for an effective public relations program. Principal Investigator is Mr. James N. Mosel, Associate Professor of Psychology at The George Washington University and research consultant on advertising, communication, and public opinion. Professor Mosel has conducted numerous surveys of public reaction for advertising agencies, industrial organizations, and the United States Government.

Another project in this area, No. 6b, "Attitudes of American Inventors toward Defense Invention,"[11] conducted pursuant to an agreement with the National Inventors Council, involves a survey of American inventors to determine their attitudes toward invention for defense and explores further incentives that might stimulate such invention. Professor James N. Mosel is Principal Investigator for this project; Dr. Irving H. Siegel and Dr. Barkev S. Sanders are Principal Consultants.

A new project, No. 7a, "The Taxation of Patents," has been undertaken by the Foundation. The purpose of this project is primarily exploratory and devoted to surfacing problems on the tax aspects of patents. Based on samplings, it seeks to determine among other things the availability and accessibility of data. This feasibility study is being used to collect sample data and will serve as a guide on how we might proceed to more comprehensive and practically useful empirical studies on larger projects in the future. Dr. Robert B. Bangs and Mr. Joseph P. Driscoll are Co-Principal Investigators on this project. Dr. Bangs is Chief, Far East Section, Division of International Finance, Board of Governors of Federal Reserve System. Mr. Discoll is an Associate Professor of Law at The George Washington University.

Two of these pilot projects have been completed and final project research reports are presented in this *Journal*; other studies are nearing completion. The completed pilot projects are: "The Value of the Patent in the United States" and

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[9] See page 145.
[10] See page 159.
[11] See page 168.

"Patent and Other Factors in the Development of Firms in the Custom Heat-Treating Industry."

The Foundation is aware of the special problem of patents in the utilization of atomic energy for industrial purposes, and has been exploring the feasibility of undertaking projects relating to the peaceful uses of atomic energy.

In addition to the above-mentioned pilot projects, graduate students of promise and ability are carrying on a continuing series of studies under the auspices and direction of the Foundation. These are comparatively definitive studies that can be done in a short time, such as an up-to-date study of the treatment of patents by the courts.

## REPORTS AND PUBLICATIONS

Periodic progress reports on the work of the Foundation are sent to the members and donors. The first in this series was sent November 1954; the fourth was mailed last December. These reports summarize developmental aspects of the Foundation and present the status of each research project in the Foundation's current program.

Early pamphlets of somewhat the same nature were the Foundation's "Progress Report 1951-52" and Newsletters for members and donors. Another early publication was the brochure, "The Patent Foundation in the Nation's Capital," described previously.

The 1956-57 Bulletin, the first of a series to be issued by the Foundation, was mailed in November to patent attorneys; general counsels; business, industrial, and foundation executives; public officials; educators; editors; and publicists. The Bulletin contains an outline of the organization of the Foundation, a list of members and donors, a description of current projects and the educational program of the Foundation.

The Foundation distributes annotated bibliographies from time to time to the Research Staff. This annotated bibliography is developed primarily from a list of newly published or reported material (such as books, pamphlets, periodicals, etc.) which has been found of interest to the members of the staff. They screen this material and submit it to keep the other members abreast of developments relating to the Foundation's work in disciplines other than their own. A compilation selected from these bibliographies will be included in future issues of the *Journal.*

*The Patent, Trade-Mark, and Copyright Journal of Research and Education* serves as the medium of communication for the Foundation's work.[12]

## STUDENT RESEARCH ASSISTANTSHIPS

A limited number of Student Research Assistantships, a means of training students in original research, are available to candidates for degrees at The George Washington University and to graduate students at other universities in cases where the field of specialization of the student is pertinent to the research program of the Foundation. Each Research Assistant receives an appropriate remuneration

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[12] See the *Journal* Foreword, page iii.

and follows an approved program of research under the direction of a member of the Foundation's Research Staff. In appropriate cases, academic credit is given for satisfactory completion of the program.

### SEMINAR AND LECTURE SERIES

Another means adopted for achieving the Foundation's objective to promote education and training is a patent, trade-mark, and copyright seminar which has recently been established jointly with the faculty of The George Washington University Law School on the current developments in the fields of the Foundation's work. This seminar and lecture series is particularly helpful to students who plan to become patent specialists, to teachers of the law, to law students who plan a career in the social and physical sciences, and other qualified and interested professional persons. The series is conducted by Executive Director Harris, Professorial Lecturer at the Law School. Students are introduced to the patent, trademark, and copyright systems as functioning legal, social, and economic institutions. One of the primary objectives in this type of teaching is to achieve the advancement of the students with the progress of research. The inclusion of the interdisciplinary aspects of research provides the students with a more comprehensive understanding of the systems to the end that they will be better able to make informed contributions to these systems. Scholars in the various disciplines involved in the work of the Foundation participate in the series.

### KETTERING AWARD

The establishment of the "Charles F. Kettering Award for Meritorious Work in Patent, Trade-Mark, and Copyright Research and Education" as an annual award by the Foundation was announced April 1 of this year. Dr. Kettering, in whose honor the award is named, is a member of the Advisory Council of the Foundation. He was one of six nationally known leaders in research who were named Honorary Members of the Foundation during its inception, and he aided in its formal establishment in 1954. Dr. Kettering was honored in 1955 by the Society of Industrial Realtors as "Industrialist of the Year," recognition of his outstanding contribution to American industry. He is now Chairman of the Board of the Charles F. Kettering Foundation and a director and research consultant to the General Motors Corporation.

The Kettering Award, which will be presented at the end of each calendar year for outstanding work done in research and education in the field of patent, trademark, and related areas during that year, will be granted for the first time in December, 1957. The recipient will be presented with a bronze plaque carrying an appropriate citation and will receive an honorarium of $100. Recommendations for recipients of this award will be made to the Foundation by members of its Advisory Council, Research Staff, and National and Area Committees throughout the country.

A board of review of recommendations and final selection will consist of Dr. Kettering and the President of The George Washington University, the Director and Executive Director of The Patent, Trade-mark, and Copyright Foundation, the Chairman of the Foundation's Advisory Council, a member of the Foundation's Research Staff, and a member of the Foundation's National or Area Committees.

## THE PUBLIC CONFERENCE

The First Public Conference of The Patent, Trade-Mark, and Copyright Foundation will present to the public final and interim reports on the Foundation's first research projects. It will be held June 13 and 14 at the Shoreham Hotel in Washington, D. C.

The purpose of the Conference is to provide a broad and representative perspective and furnish a constructive atmosphere in which to explore the nature and significance of the findings resulting from the Foundation's projects; formulate the areas that need further research and gathering of facts; and discuss the general information which exists for the resolution of those larger problems which these first projects have defined. In this atmosphere of give and take reciprocal discussion will provide those in attendance opportunity for commenting on the work of the Foundation and making suggestions for future study.

In attendance will be representatives from the fields of activity throughout the nation, the fields of commerce, education, science, manufacturing, labor, finance, and the professions.

The program follows:

## THURSDAY, JUNE 13, 1957

8–9:30 a.m. REGISTRATION

WILLARD C. ASBURY, *Moderator*

9:30 a.m. WELCOME: CLOYD H. MARVIN, *President*, The George Washington University.

**Presentation and General Discussion of The Patent, Trade-Mark, and Copyright Foundation:**

O. S. COLCLOUGH, *Director;* L. JAMES HARRIS, *Executive Director;* S. CHESTERFIELD OPPENHEIM, *Adviser on Research.*

10:30 a.m. **Effects of Certain Antitrust Decrees Involving Patents as a Major Factor** (Project 4a).

Report presented by S. CHESTERFIELD OPPENHEIM and GEORGE E. FROST.

*Discussants:* V. H. DOANE, of Burns, Doane, Benedict & Irons, Washington, D.C.
ALFRED E. KAHN, *Professor of Economics*, Cornell University.
JERROLD G. VAN CISE, of Cahill, Gordon, Reinde & Ohl, New York.

12:00 m. LUNCHEON honoring the National Directors and the Area Committee Members of The Patent, Trade-Mark, and Copyright Foundation.

1:30 p.m. **Patent and Other Factors in the Future Organization of the Steel Industry.***

Report presented by IRVING H. SIEGEL and ROBERT M. WEIDENHAMMER.

*Discussants:* H. B. MCCOY, *Administrator*, Business and Defense Services Administration, Department of Commerce.
LEONARD P. POOL, *President*, Air Products, Inc.
HOWARD TURNER, *Vice President for Research*, Jones and Laughlin Steel Corporation.

3:00 p.m. **Patent Utilization** (Project 1a).

Report presented by JOSEPH ROSSMAN and BARKEV S. SANDERS.

*Discussants:* W. DUANE EVANS, *Assistant Commissioner*, The Bureau of Labor Statistics, Department of Labor.
P. J. FEDERICO, *Examiner-in-Chief*, Board of Appeals, Patent Office.
JACOB PERLMAN, *Study Director for Surveys*, National Science Foundation.

4:30 p.m. **Patent and Other Factors in the Development of Firms in the Custom Heat-Treating Industry.***
Report presented by IRVING H. SIEGEL and NATHAN BELFER.

*Discussants:* CARL L. IPSEN, *Executive Vice President*, Industrial Heating Equipment Association.
HORACE KNERR, *President*, Metlab Corporation.
W. BROWN MORTON, JR., of Pennie, Edmonds, Morton, Barrows & Taylor, New York.

6:00 p.m. Adjournment.

6:30 p.m. Reception.

7:30 p.m. DINNER honoring the Advisory Council of The Patent, Trade-Mark, and Copyright Foundation. Guest speaker: FRANK A. HOWARD, *President*, Sloan-Kettering Institute for Cancer Research; member of the Board of Trustees of The George Washington University.

## FRIDAY, JUNE 14, 1957

O. S. COLCLOUGH, *Moderator*

9:30 a.m. **The Value of the American Patent System: An Inquiry into the Possible Approach to its Measurement** (Project 2a).
Report presented by JESSE W. MARKHAM.

*Discussants:* GERHARD COLM, *Chief Economist*, National Planning Association; *Professorial Lecturer in Economics*, The George Washington University.
ROBERT F. LANZILLOTTI, *Research Associate*, Brookings Institute.
PHILIP L. YOUNG, *Secretary*, Esso Research and Engineering Company.

11:00 a.m. BRIEF PROGRESS REPORTS ON FOUNDATION PROJECTS AND GENERAL DISCUSSION:

**Relation of American Patents, Trade-Marks and Techniques, and American-Owned Foreign Patents to Foreign Licensing**
(Project 5a): J. N. BEHRMAN.

**Public Attitudes Toward Patents, Trade-Marks, and Copyrights**
(Project 6a): JAMES N. MOSEL.

**Attitudes of American Inventors Toward Defense Invention**
(Project 6b): JAMES N. MOSEL.

**Patent and Other Factors in the Growth of the Electronics Industry in the Boston Area.***
WELDON WELFLING.

**The Taxation of Patents** (Project 7a):
ROBERT BANGS and JOSEPH P. DRISCOLL.

General Discussion (Question and Answer Period).

**Present Status and Future Prospect:**
S. CHESTERFIELD OPPENHEIM and L. JAMES HARRIS.

12:30 p.m. Adjournment of Conference.

* *One of three case studies comprising Project 3a,* **Effect of Patents on the Creation and Growth of Small Industrial Units.**

## CONCLUSION

Research as a method of resolving conflicts and of obtaining information in the social and natural sciences is long established. Much of the progress in the fields of engineering and medicine, for example, has been due to painstaking investigation and evaluation. The results in terms of social gains and human welfare are immeasurable. The need for research is no less in the law and particularly, because of its great but little understood social, economic, and technological impacts, in the law applicable to the patent, trade-mark, and copyright systems.

The Patent, Trade-Mark, and Copyright Foundation, recognizing the need for both legal and interdisciplinary research, is collecting facts concerning the actual operation of the patent, trade-mark, and copyright systems, and the relation thereto of the antitrust and trade practice laws, from all available sources of information. The Foundation is pooling this factual information in systematic and coordinated form, and subjecting these data to continuous analysis in order to permit reliable conclusions to be drawn as to the part played by these systems in industrial programs, sound business practices, the employment picture, community growth, the standard of living, and other national and local problems of private and public concern. The Foundation is acting as a clearing house for marshalling and dissemination of data regarding the principles, the facts, and the practical operation of these systems and will convey the information to business, industry, and the public in terms it can understand.

# The Value of the American Patent System: An Inquiry Into Possible Approaches to Its Measurement*

JESSE W. MARKHAM, Principal Investigator
JAMES S. WORLEY, Research Associate
DWIGHT S. BROTHERS, Research Assistant

## A Summary of Findings

### I.

THIS IS AN INQUIRY into methods of valuing the patent system. It should be made clear at the outset that the value of the patent system cannot be quantitatively measured in the relatively precise manner in which such economic variables as the national income and its various components are measured. The system embraces a host of components such as expectations of financial reward and scientific fame, the urge to create, and changes in the stock of scientific knowledge. Some of these are by definition of a qualitative nature, and accordingly are no more susceptible to quantitative measurement than are such social institutions as libraries, private universities, the Land Grant College system, or, indeed, the various United States constitutional provisions, one of which establishes the legal basis for the patent system. Institutions such as these exist not because society has "measured" them in any concrete sense and found their value to be "great" or "small," but because society has judged them "good."

Nevertheless, it is surely worthwhile to attempt to measure the value of the patent system. This study does not aspire to this goal, but rather to the less ambitious one of identifying the most promising—and the least promising—methods by which such an evaluation can be made. It is, from this point of view, a preliminary study—a screening of fruitful from unfruitful approaches. The screening process involves both theoretical and practical considerations. The theoretical aspects of the study consist of developing measures of the value of the system which are conceptually sound; practical aspects consist of considering possibilities of developing data which can be used for such measurement.

Because of the desire to develop operable measures, global formulations were considered and rejected. For example, in the beginning stages of the study the measurement problem was cast in terms of the "net economic value" of the patent system. One such formulation might be expressed as follows:

* Mr. Worley and Mr. Brothers in large part drafted this research report on *Project 2a*, **The Value of the Patent in the United States.** Mr. Bernard Udis, of the University of Tennessee, and Mr. Marshall M. Levinson, of the University of Massachusetts, assisted on this project.

$$V_s = (p_1 + p_2 + \cdots + p_n) - (n_1 + n_2 + \cdots + n_n)$$

where: $V_s$ = the *net* economic value of the patent system, and

$p_1 \cdots p_n$ = all gross positive contributions of patents to social wealth, and

$n_1 \cdots n_n$ = all gross negative contributions of patents to social wealth.

It is apparent that this formulation of the problem is not operable, even apart from the difficulties of defining *p's* and *n's* so that they are additive. The *p* values include additions to the net national product from autonomous investment, production cost reductions from new patentable inventions, new knowledge created and disseminated through the patent system, etc.; the *n* values include monopoly rewards from patent protection, the time lag in the commercial use of new knowledge, investment foregone elsewhere in the economy, etc. Data are available for very few if any of these variables. Hence, such global formulations were rejected.

Other approaches were then formulated and tested against available data and through interviews (built around a questionnaire) with officials in 12 organizations, including industrial firms having a long history of patenting, a firm of patent attorneys, the U.S. Patent Office, and a commercial research firm engaged in patenting and licensing to manufacturing firms and in conducting research under contract to manufacturing firms. Of the approaches considered, some are judged to be inoperable while others appear to be more promising. A discussion of the more positive findings constitutes the second portion of this summary. Those approaches offering little or no promise are briefly outlined below:

1. One possible method of estimating the value of the patent system would be to ascertain the incremental value which granting of patent rights adds to inventions. The commercial value of inventions depends upon the amount and time distribution of the income they are expected to earn, the certainty with which these expectations are held, and the time preference of those making the valuations. Theoretically, the present value of an invention can be determined by the formula:

$$\text{Present Value} = \frac{\text{Expected future stream of income}}{1 + R}$$

where R is the rate of discount. The difference in the present value of an invention when patented and when unpatented would be the increment in value resulting from patenting. The sum of all such differences would indicate the contribution of patent rights to the total dollar value of all existing patented inventions.

But practical application of formulas such as the above presents insuperable obstacles. Research, including interviews with officials in business firms, revealed that newly patented inventions are arbitrarily valued for accounting purposes. Furthermore, they are not amortized at rates designed to approximate actual reductions in value, but in the light of tax considerations and accounting conservatism. Hence, a summation of the balances of all "patents" carried on the books of business firms and independent inventors would not accurately indicate the commercial value of patented inventions. Investigation also disclosed that the commercial value of patented inventions cannot be determined from data on market transactions in which they are involved, or by means of conventional appraisal techniques. Finally, even if commercial value of patented inventions could be ascertained, the problem of establishing the contribution of patent rights to this value would still remain.

2. One of the most evident benefits of the patent system is the stimulation it gives to corporate research expenditures and, in turn, to inventive activity. In 1952 S. C. Gilfillan, in his study published in the *Review of Economics and Statistics*, estimated that "All in all, it would seem a fair statement, even if regrettably lacking in logical and statistical accuracy, to say that patents motivate 15 or 20 per cent of American inventing today." But if more recent estimates of the relative shares of public and private sources of research funds are substituted for Gilfillan's 1947 data, and if expenditures on basic research and on research conducted by or for governments and non-profit organizations (which the patent system is not designed to stimulate) are excluded, the system may very well motivate as much as 50 per cent of inventive activity in industry. The point here is not that the estimate of 50 per cent is more accurate than Gilfillan's estimate of 15 to 20 per cent, but rather that the percentage reached in any case will vary greatly with the assumptions made. Further, the desired relationship is that between the patent system and technological change. But present measures of technological change are themselves ambiguous. For these reasons, we conclude that existing data cannot be used to compute a reliable quantitative relationship between the patent system and inventive activity, and that they are even less adequate for purposes of computing the relationship between the patent system and technological change. We conclude that case studies can be devised to resolve some of these difficulties.

3. One of the most important costs involved in patenting, once an invention has been made, is the cost of disclosure to competing firms. The competitive disadvantage of disclosure willingly incurred in order to qualify for patent protection, if it could in some way be measured, would indicate the lower limit of the economic advantage expected from patenting. However, data needed in order to measure the cost of disclosure with any degree of precision are not available, and there appears to be no way by which such data could be developed.

4. The value of the patent system can also be defined in terms of its contribution to our total stock of national wealth. Such value can be viewed as the aggregate commercial value of patented inventions in the business accounting sense or, in a broader sense, as the value of the scientific and technical knowledge flowing from the disclosure of patented inventions. From a practical standpoint neither of these can be computed. The commercial value of patented inventions cannot be determined from business records, and the value of the total stock of knowledge or of any increments to this stock defies measurement.

## II.

The foregoing comments demonstrate the inapplicability of certain approaches to the value of the patent system. Consequently, one of the principal contributions of this study is its warning to other investigators of the difficulties these approaches involve. This is particularly true of the aggregate or global approaches because such aggregate measures require a body of information which, in fact, is lacking. Consequently, initial attempts should be directed toward the development of the necessary data rather than the construction of the measures themselves.

The study elaborates on this positive finding. Throughout most of this study the patent system is viewed in terms of the inducements it offers decision-making units to invent, disclose, and innovate. Since in a free-enterprise society the business firm is the principal decision-making unit, it follows that approaches which develop information on the impact of the patent system on business decisions should be highly rewarding. The necessary information may be sought through interviews with officials in business firms and other persons well-acquainted with the operation of the patent system, and through intensive case studies on both the company and industry level.

1. Valuable data on the effect of the patent system on inventions can be developed through extensive interviews. A measure of the effect patents have on a firm's research activity would indicate the possible breadth of their influence on invention. So far as it can be determined, such a measure is not now available, but it could be obtained by asking officials in firms to estimate the proportion of the firm's research expenditures leading to patented inventions. Systematic analysis of the results could provide a rough measure of the patent system's influence on inventions.

This measure would also serve to identify those firms and industries warranting more intensive investigation. It is likely that the strength of the patent incentive varies among firms and among industries. Since the proportion of research expenditures leading to patented inventions can be regarded as an index of the degree of use of the system, firms or industries could be ranked on this basis. Further research may then disclose the reasons for the differences among firms and industries in their use of the system.

By applying this technique to sales or production rather than to research expenditures, similar information could be developed concerning the system's influence on innovation. It might also be possible to determine changes in the system's influence on particular firms, especially where such changes are significant.

2. Research consisting of both interviews and case studies can also aid in providing useful insights into the value of the disclosure requirement. The limited interviewing conducted for purposes of this study indicates that information about inventions and discoveries made public as a result of the disclosure requirement is quite valuable in furthering scientific and technological progress. It may therefore be possible to establish more conclusively the extent to which information about inventions and discoveries disclosed in this manner contributes to such progress. In particular, it appears that it would be possible to determine (a) whether information disclosed in exchange for patent rights is in general sufficiently comprehensive to permit understanding of the invention involved; (b) whether the classification and indexing system used by the Patent Office could be improved as a device for facilitating searches for such information; and (c) the number of

individuals engaged in scientific and technical research activity who take advantage of the opportunity to study Patent Office material and find it useful in their own research. It would be necessary, of course, to separate usage of such information for purely legal purposes from usage for purposes of furthering the search for additional inventions and discoveries.

3. Large-scale interviews, or possibly mailed questionnaires, are especially useful when confined to questions designed so that the answers can be combined, but there are limits to the depth of the information obtainable through this device. In order to arrive at well-documented conclusions concerning the role of the patent system, there is no adequate substitute for thorough and comprehensive industry case studies. Examination of three industry case studies which are not specifically focused on the role of patents shows that useful conclusions on the effect of the patent system can be established. Further studies specifically focused on the influence of the patent system would probably reap even greater returns.

If a body of specific information such as that described above were available, it might then be possible to employ aggregative measures of the value of the system. One of the most ideal aggregative measures of the economic value of the patent system is its contribution to the size and growth of national income. At the moment, as pointed out earlier, attempts to make such an estimate are premature. However, an intensive study of a well-selected sample of firms might allow the investigator to estimate the amount of investment induced by the patent system, and hence its effects on the national income.

4. There is an alternative approach to the measurement of the value of the patent system which does not involve attempts to determine either the extent or the effect of the economic incentive which it affords. It has been pointed out that the "net economic value" approach to the problem was rejected on the grounds that it is impossible to estimate the net difference between social cost and social benefit flowing from the patent system. However, it might be possible to determine whether various changes in the system would reduce its social cost or increase its social benefit without being concerned with the absolute cost or benefit involved. For example, one could seek to determine whether a reduction in the length of the period of patent protection would lead to any reduction in inventive activity, in the number of inventions patented and hence disclosed, or in the rate at which newly invented products and processes would be introduced commercially. If it were found that little or no reduction in these actions would result, then it could be concluded that such a modification of the system would lead to a closer approximation of its optimal value as a social institution. Other changes likely to have some influence upon social cost or social benefit could also be examined.

This approach would yield a measure of the efficiency of the patent system. It would furnish insights into how well the system is performing its function while largely avoiding the difficulties confronting attempts to measure how much incentive is afforded or how effective this incentive is in inducing invention, disclosure, and innovation. On the other hand, there are no means for determining the reliability of the answers to the necessarily hypothetical questions on which the approach is built.

## I. INTRODUCTION

THE CONTINUED EXISTENCE OF THE PATENT SYSTEM presumably reflects a belief on the part of most people that scientific and technological progress would not be sufficiently rapid without the incentive which it affords. But the extent of the system's influence is not known with any certainty. Yet, since it affects everyone in some degree, attempts to measure its value should be a matter of interest to all. This study is a methodological inquiry into the value of the patent system to society.

It is abundantly clear that the patent system's value is not susceptible to the relatively precise measurement to which we subject such economic variables as national income and its components. The system embraces not only the hope for financial reward but also the desire for scientific fame, the urge to create, increments to our accumulated stock of scientific knowledge, and many other economic, psychological, and sociological aspects. In short, it impinges upon many of the determinants of the state of the scientific and mechanical arts, of which only a few are amenable to measurement in either quantitative or qualitative terms. Hence, at the outset, a methodological inquiry into the problems of measuring the value of the patent system must stake out certain boundaries beyond which it does not propose to go. This inquiry focuses on the economic value of the system; more specifically, it is concerned with its influence upon invention, disclosure, and innovation. In limiting the scope of the inquiry to economic value the authors do not wish to imply that sociological, philosophical, or even political aspects are unimportant. It is believed, however, that some of the approaches developed may be adaptable to the non-economic aspects of the patent system.

It should also be emphasized that this inquiry does not aspire to the goal of actually measuring the economic value of the patent system, but to the less ambitious goal of identifying the most promising methods by which such an evaluation might be made. Its purpose embraces both theory and analysis. The theoretical part of the inquiry is addressed to developing alternative concepts of the value of the patent system and to measures of such value; the analytical part is concerned with the application of such alternative concepts to data already available, or to data which might be developed. The object is therefore not merely to develop theory, but to develop operational theory; that is, to develop measures of the value of the patent system which can serve as the basis for empirical research.

This restriction of operability eliminates on a priori grounds several measurement formulations which would commend themselves to the sophisticated economic theorist. For example, in the early stages of this inquiry the problem was cast in terms of what might be called the "net social balance," or "net economic value," approach to the problem. This method consists of identifying all the negative ($n_1$, $n_2$, $n_3$ - - - $n_n$) and positive ($p_1$, $p_2$, $p_3$ - - - $p_n$) effects which the patent system might conceivably have on economic welfare, such as are set forth in the following table:

| | Social Costs | | Social Revenues |
|---|---|---|---|
| $n_1$ | Monopoly gains from patent protection | $p_1$ | Addition to national income through autonomous investment |
| $n_2$ | Foregone production elsewhere in the economy | $p_2$ | Addition to national income through induced investment |
| $n_3$ | — — — — — — | $p_3$ | — — — — — — — — |
| $n_n$ | Lag in use of new know-how for 17 years | $p_n$ | Positive changes in the state of the arts: (1) production cost reductions; (2) new knowledge; (3) new know-how; (4) new experimental base |

The value of the system at any moment of time would be equal to the difference between the sums of the two sides. But it soon became apparent that this formulation of the problem was inoperable, even if the difficulties involved in defining social cost and social revenue items so that they would be additive could be overcome. No data are available on the social cost items and data on most of the revenue items are very limited. Consequently, this approach to the problem was abandoned.

Ideally, evaluation of the patent system involves two steps: (1) measuring its contribution to invention, disclosure, and innovation; and (2) measuring the amount of economic value created by the system through its impact on these activities. Thus the first step involves approaches which consider the effect of the system on the decisions and actions of firms who patent inventions, whereas the second step goes beyond this and considers the system's effect on certain variables which are related to economic welfare. Sections II and III of this report are organized around these steps. Section IV considers an alternative approach. It seeks to ascertain whether the system is functioning optimally. Thus this approach may be viewed as a measure of the system's efficiency.

Consideration of the various approaches leads to the conclusion that some offer little promise as bases for empirical research. This conclusion is not regarded as entirely negative, since the function of a pilot study is not only to identify promising areas of investigation but also those in which further research will very probably be unrewarding.

## II. ANALYSIS OF THE CONTRIBUTION OF THE PATENT SYSTEM TO INVENTION, DISCLOSURE, AND INNOVATION

### A. THE PATENT INCENTIVE AS INDICATED BY THE CONTRIBUTION OF PATENT RIGHTS TO THE COMMERCIAL VALUE OF PATENTED INVENTIONS

The value of the patent system as an incentive device is dependent upon the expected economic benefit of patenting. The best measure of the incentive to invent, disclose, and innovate afforded by the patent system, therefore, would be given by information showing the increase in the commercial value of inventions[1] expected to result from patenting.

### *Relation of Patent Rights to the Commercial Value of Inventions*

The commercial value of inventions is dependent upon their expected contribution to the production of goods and services which satisfy human wants and upon the scope of ownership rights exercised over the inventions by individuals or business firms. Without rights of ownership (i.e., rights to possess, use, and dispose), inventions would have no commercial value. Patenting, by extending ownership rights over inventions, usually increases the commercial value.

Certain rights of ownership over inventions are usually capable of being exercised, at least for a time, without patent protection. That is, inventions may have commercial value whether patented or not. In fact, in some cases the commercial value of inventions is greater in the absence of patenting because the scope of ownership rights would be reduced by patenting. This situation exists where the disadvantages involved in disclosing information about inventions to competitors, actual or potential, outweigh the advantages obtainable from patenting. For example, inventions which can be effectively concealed and thereby protected from infringement without the recourse available under the patent law, or inventions which, if disclosed, could be infringed without detection, are likely to have a greater commercial value when unpatented. In other cases advantages to be gained from patenting might be expected to be largely offset by the competitive disadvantages of disclosure so that inventions would have about the same commercial value unpatented as patented. Only in the case of inventions which, if unpatented, would be of less commercial value than when patented does patenting increase the scope of ownership rights. Consequently, only in the case of such inventions is patenting economically advantageous.

The commercial value of inventions to individuals or business firms in a position to exploit them by exercise of ownership rights, regardless of whether the inventions are patented or unpatented, depends upon their estimated capacity to earn income. This value depends upon the amount and time distribution of income expected to be produced, the certainty with which expectations concerning these matters are held, and the time preference of those making the valuations. The difference in the present value of a patented invention and that value the same invention would have if unpatented is equal to the contribution of patenting to the prospective profitability of the invention.

### *The Incentive to Invent, Disclose, and Innovate Afforded by the Patent System*

Investment in the search for new products and processes[2] remains a highly risky venture even though the patent system exists; but to the extent that it is

[1] By "the commercial value of inventions" is meant the dollar value to the going concern or the market value, whichever is higher.

[2] The term "products and processes" is employed in this study to include a process, a machine, a manufacture, and a composition of matter.

believed that discoveries of new products and processes would be patentable, and that patenting would increase the commercial value of any such newly discovered products and processes, the incentive to invest in inventive activity is enhanced by the patent system. This incentive does not result from the prospect of a specific economic benefit but rather from confidence engendered by the existence of the system that "on the average" such activity will be more rewarding than it otherwise would be. Evidence of the extent to which patenting of inventions in the past has enhanced the commercial value of patented inventions necessarily is the most important factor tending to establish such confidence.

Once new products or processes are discovered or invented, regardless of whether they would have been discovered or invented without the incentive afforded by the patent system, decisions must be made concerning the wisdom of patenting them. As already indicated, in some cases it might be decided not to patent because there is no prospect of benefit from patenting. In such cases there is no incentive afforded by the patent system to disclose information concerning new discoveries and inventions. On the other hand, an economic incentive to disclose such information does exist where patenting promises to increase the commercial value of newly patented products and processes, the extent of the incentive being equal to the amount by which such commercial value is expected to be increased.

Of those inventions whose commercial value is expected to be enhanced by patent protection, some probably would promise sufficient earnings to justify commercial exploitation in the absence of the patent system. Some others, however, might have little or no prospect of commercial success without patent protection and therefore would not be exploited commercially without it. An incentive to introduce inventions incorporating newly discovered products and processes is afforded by the patent system in all cases in which the earning power of inventions is believed to be enhanced by patenting, but only in those cases where earning prospects would not justify commercial exploitation in the absence of patent protection can it be said that innovations are introduced as a result of that protection.

### *The Commercial Value of Patented Inventions*

Since the economic incentive to invent, disclose, and innovate afforded by the patent system is dependent upon its influence on expectations concerning the profitability of such actions, precise measurement of this incentive would require a quantitative determination of the system's influence on profit expectations. However, there is no way by which subjective profit expectations and changes in such expectations can be determined. The economic incentive afforded by the system can be measured, if at all, only in terms of indexes which indirectly reflect the influence of the patent system on expectations of economic rewards for invention, disclosure, and innovation.

Perhaps the best index of the incentive effect of the patent system would be given by data showing the extent to which patent rights actually have contributed to the commercial value of patented inventions in the past. The same data would also provide a measure of the economic inducement afforded by the patent system to disclose information about the inventions. And finally, data showing the extent to which patenting in the past has enhanced the commercial value of patented inventions would indicate to some extent the stimulus the patent system gives to innovation.

In order to determine the contribution patenting has made to the commercial values of individual patented inventions it would be necessary to determine (1) the commercial values of such inventions after patenting, and (2) what portion of such values is attributable to the exclusive rights over the inventions conferred by patents. Problems likely to confront an investigator in search of these two sets of data are considered below:

*Accounting data.*—The values for "patents" (i.e., patented inventions) shown in balance sheets of business firms are usually quite arbitrary. According to a strict application of accounting principles, the values should be the capitalized cost of the patented inventions, including experimental outlays, cost of obtaining patents, and legal cost incurred in defending against infringement. In practice, however, the choice between writing off this cost currently and capitalizing it is influenced by tax considerations and accounting conservatism. Consequently, a large part of such cost is commonly charged to current operating expense and patented inventions are initially recorded at nominal values on balance sheets.

Where patented inventions are acquired by purchase, the basis of balance sheet values is generally the purchase price. Where going concerns are purchased and patented inventions are involved, that amount of the purchase price in excess of the value of the concern's tangible assets is sometimes considered to be attributable to the patented inventions and is accordingly shown on the purchasers' balance sheets as the value of patents. Again, tax considerations and accounting conservatism operate to cause book values to be reduced to nominal amounts as rapidly as permitted by tax law and accounting convention.[3]

Therefore, regardless of whether patented inventions are initially recorded on the basis of cost or at nominal values, the book values of these assets are likely to be arbitrary. Hence, balance sheet data are of little aid in determining the actual commercial value of patented inventions.

*Market transactions.*—Very few patented inventions are sold outright for a fixed sum of money. The usual practice is to enter into licensing agreements calling for royalty payments equal to some percentage of the selling prices received for patented products, or equal to some fixed amount per unit produced of the patented products or by the patented processes. The percentages or per-unit amounts licensees are able to negotiate as royalties differ from one licensing agreement to another depending upon the strength of licensees' bargaining positions. But the terms of such agreements do not provide a basis for estimating the commercial value of the patented inventions involved. In fact, it seems reasonable to believe that the popularity of licensing agreements involving royalty payments rather than fixed fees is largely attributable to uncertainty as to the commercial value of patented inventions on the part of both licensees and licensors at the time such agreements are negotiated.

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[3] William A. Paton and William A. Paton, Jr., *Asset Accounting* (New York: Macmillan Co., 1952), pp. 485-506.

Compilation of the total amount of royalties received by licensors over the 17-year period of patent protection, when royalties constitute the only income derived from their inventions, would give a retrospective measure of patentees' income from their inventions. However, such data would not necessarily indicate the extent of the income realized by licensors as a result of utilization of the inventions. And in the case of neither the licensees nor the licensors would such data give an indication of benefits received of a strategic sort as a result of patent rights.[4]

*Appraisal techniques.*—The fundamental principle underlying appraisal of the value of property of all kinds is the discounting to the present of the expected future income attributable to the property. This approach is employed by professional appraisers whenever possible, although it often cannot be used because of the difficulty in estimating future income and in selecting proper rates of discount. Consequently, appraisers often employ the market value of property similar to that whose value is being sought and the reproduction cost of the property in question as a check on, or substitute for, the capitalized income approach.

The market value of one patented invention obviously would be of no aid in attempting to appraise the value of any other patented invention because each invention is necessarily unlike any other. And the reproduction cost approach could not be employed since reproduction cost when applied to patented inventions is a meaningless concept; patented inventions cannot be reproduced. Even if this latter method of appraisal were modified so as to involve only an attempt to determine the original cost of production of patented inventions, it is likely that values arrived at would be arbitrary because of the problem of allocating joint costs, particularly those incurred in research and experimentation.

There remains for consideration the possibility of employing the capitalized income approach to property appraisal as a means of determining the value of patented inventions. The fundamental difficulty with this approach is the lack of certainty with which estimates of the future earning power of patented inventions can be made.[5] The various possible commercial applications of inventions usually are not evident at the time the inventions are patented. But even if all the possible uses of inventions could be anticipated, their commercial value would be highly conjectural because such value would depend upon accurate sub-estimates of such items as production cost, marketing and sales cost, and market demand. Ordinarily there would be no basis for making allowances for competition from substitutes and for the possibility of obsolescence as a result of succeeding patented inventions. In addition, estimates of the market success of patented inventions might not be

[4] Examples of strategic benefits which might result from patent rights are the ability patent protection sometimes affords to forestall introduction of processes or products which would involve obsolescence losses on existing facilities, the increased bargaining power that patentees might acquire in business not involving the patented inventions in any direct way, and the goodwill and market position likely to persist after the patent protection has expired. There does not appear to be any way to reduce the benefits from such strategic characteristics to dollar terms.

[5] Of course, some patented inventions can be recognized as having commercial value from the moment patent rights are obtained, but the problem under consideration is that of determining the amount of value.

indicative of their value to patentees because the strategic value of the inventions which often would be important in determining their commercial value would be omitted from consideration.

Appraisal of the commercial worth of patented inventions might become somewhat more feasible when a period of time has elapsed after patenting during which their actual performance in commercial situations has been observed. However, until the legal validity of patentees' claims has been established by successful court tests the commercial value of patented inventions is likely to remain highly uncertain, depending, of course, upon the likelihood that the claims might not withstand such tests. Even after the commercial applications of patented inventions have been determined and their legality established, many problems in appraising their commercial value remain. In most cases it would be exceedingly difficult, if not impossible, to determine the earnings records of such inventions.[6] And there could be little assurance that records of past earnings provide an indication of future earnings because of uncertainties regarding future competition, shifts in demand, technological obsolescence, general business conditions, and public regulation. And as already suggested, past earnings and estimates of future earnings of patented inventions might not reflect strategic benefits which patentees receive.

In summary, data concerning the commercial value of patented inventions would be difficult, if not impossible, to find already compiled or to derive. Business firms ordinarily make no attempt to value such assets for accounting purposes in any but the most arbitrary fashion. Patented inventions are not often sold outright but rather are licensed on a royalty basis, so that records of market transactions are not useful. And conventional appraisal techniques are largely inadequate for the valuation of such intangible and unique property.

## *The Contribution of Patent Rights*

Since the commercial value of patented inventions cannot be determined in most cases, it is largely academic to consider the problems which would arise in attempting to determine the contribution patenting makes to such value. However, assuming that information regarding the commercial value of patented inventions was obtainable, it usually would not be possible to judge the extent to which such value is

[6] Patented inventions are usually employed in conjunction with other factors of production and no method exists for accurately assigning the total earnings of an operation to the various factors in accordance with their contribution. However, certain rather arbitrary rules of thumb have been suggested for application in cases in which it is necessary to estimate earnings attributable to patented inventions. One procedure that has been proposed is as follows: A part of total earnings equal to a certain rate of return on tangible assets employed in the operation is set aside and the remainder of the earnings are then capitalized at some rate of discount to determine the value of intangible assets contributing to the operation. See George Hart Morse, *The Valuation of Patents* (Strasburg, Va.: Shenandoah Publishing House, 1933), p. 9.

However, under this procedure the problem of allocating the value of intangible assets between goodwill, patented inventions, and other intangibles would remain. And even if earnings attributed to patented inventions as a group were accurately determined, there would remain the problem of dividing this amount according to the contribution of individual patented inventions in order to arrive at earnings records for individual patents. The crudity of such a procedure is evident.

dependent upon patent protection. Only in those cases where inventions would have no commercial value if unpatented could the contribution of patenting to commercial value be definitely established. In the case of most patented inventions, even if their commercial value could be determined, it would be impossible to predict accurately beforehand or to determine in retrospect the contribution of patent rights to such value.

### B. THE VALUE OF THE PATENT SYSTEM AS A STIMULUS TO CORPORATE RESEARCH AND INNOVATION

One of the most striking changes taking place in the American economy is the significant growth in corporate research and development activity. Almost non-existent in 1900, industrial research expenditures amounted to $2.4 billion in 1953.[1] As recently as 1930 it was estimated that American industrial firms spent only $116 million on research and development.[2] The percentage increase since 1930 is over five times the percentage rise in gross national product.

At the same time that industrial expenditures for research have been rising, individual invention apparently has declined, indicating a shift in the source of invention. This shift is most clearly revealed by the behavior of patent statistics.[3] Alfred B. Stafford found that, for the five major class groupings of the Patent Office, the percentage of subclasses within each major group showing increasing rates of change declines regularly. Those groups with the highest positive rates of change are related to chemistry and physics, whereas the other groups relate to the mechanical and industrial arts. The former are the ones in which the corporate form of enterprise is predominant, while the latter (where the rate of patenting has fallen) have been less affected by corporate growth.[4]

Taken together with Stafford's finding, Jacob Schmookler's work can be used to provide further evidence on the shift in the source of invention. Schmookler found that the number of patent applications per 1,000 probable inventors in the population was stable from 1870 to 1940. But this stability conceals divergent move-

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[1] National Science Foundation, *Science and Engineering in American Industry: Final Report on a 1953-1954 Survey* (Washington: Government Printing Office, 1956), p. 3. The survey was conducted by the Bureau of Labor Statistics. This figure excludes $1.4 billion of research and development work conducted by industry for the federal government and includes over $100 million conducted by universities, research organizations, and other agencies for industry.

[2] U.S. President's Scientific Research Board, *Science and Public Policy* (Washington: Government Printing Office, 1947), I, p. 10.

[3] The following discussion is based upon two recent studies: Alfred B. Stafford, "Trends of Invention in Material Culture: A Statistical Study of the Class-wise Distribution of Inventive Effort in the United States as Determined by Patents Granted during the Period 1914-45"; Jacob Schmookler, "Invention and Economic Development." Both studies are doctoral dissertations, Stafford's having been submitted to the University of Chicago in 1950, and Schmookler's to the University of Pennsylvania in 1951. They have been summarized in papers presented before the Conference on Quantitative Description of Technological Change, sponsored by the Committees on Economic Growth and on Social Implications of Atomic Energy and Technological Change of the Social Science Research Council, April 6-8, 1951. Page references will be to these papers.

[4] *Op. cit.*, p. 14.

ments within the inventing population. There has been a relative increase in the number of scientifically trained people who are responsible for the bulk of inventive activity. On the other hand, there has been a decline in the extent to which others are participating in invention. The group which constitutes the major source of invention is in large part employed in corporate research laboratories.

Statistics of patents issued show that, whereas in 1900 less than 20 per cent went directly to corporations as assignees, by 1954 corporations were assigned more than 60 per cent.[5] Although the proportion going to corporations has been relatively constant since 1936, it seems clear nevertheless that the corporate sector of the economy is now the dominant source of invention.[6]

It has been argued that the rise of corporate research and development activity and the decline in individual invention has given the patent system a new and entirely different rationale. Clair Wilcox states: "The patent system thus finds its function less in the stimulation of invention than in the promotion of corporate research and development."[7, 8] It has also been argued that large firms do not derive much benefit from the opportunity to patent inventions.[9] Given the present importance of corporate invention and the role which it is likely to play in the future, and given that the relation of the patent system to the corporate sector is said to differ from its relation to other sectors of the economy, it is clear that any inquiry into the value of the patent system must consider carefully the stimuli which the opportunity to patent inventions offers to corporations. Therefore this section is devoted to a discussion of possibilities of developing methods of measuring such stimuli. For analytical convenience, the discussion relates primarily to the effects of the system upon invention and innovation. The value of the system via the disclosure requirement is discussed subsequently.

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[5] Figures taken from a chart furnished by Mr. P. J. Federico of the United States Patent Office.

[6] The declining role of the lone inventor is well known but the reasons for such a decline are not clear. A sampling of the opinions of inventors might provide interesting information on this point. It seems clear, however, that the lone inventor has not been forced out of his traditional fields of activity by corporations, since Stafford found these fields to be less affected by corporate growth.

[7] Clair Wilcox, *Public Policies Toward Business* (Homewood, Ill.: Richard D. Irwin, Inc., 1955), p. 143.

[8] However, it is difficult to perceive such a clear distinction between corporate research and development activity and invention. It is true that not all corporate research expenditures are devoted to invention, since development effort is also included. But development expenditures consist in part of innovation costs, which the patent system might also stimulate.

It is also true that the nature of invention has changed, from individual effort to team research, and it is sometimes argued that the output of corporate research laboratories is of a different order than "invention" in the traditional sense of the term. Perhaps this idea is implicit in the foregoing quotation. This argument raises the problem of appropriate standards of invention, and is related to the difference between the standards of the courts and those of the Patent Office. While this issue is of crucial importance to the future of the patent system, we have sought to avoid imposing our own standard, on the grounds that the issue is proper subject matter for another study. In this study emphasis is placed upon the patent system as it now functions.

[9] S. C. Gilfillan, "The Prediction of Technical Change," *Review of Economics and Statistics,* XXXIV (November, 1952), p. 376.

Two approaches have been selected for analysis:

1. The possibility of establishing a quantitative relationship between the patent system and corporate research expenditures in order to estimate its contribution to corporate inventive activity;
2. The possibility of developing useful information about the patent system's influence in industry, in the event that establishment of a rigorous quantitative relationship between the system and research expenditures is not possible:
   a. Through interviews
   b. Through detailed industry and firm studies.

### 1. *The Quantitative Relationship Between the Patent System and Corporate Research Expenditures*

It can be inferred that, where corporations patent inventions, the returns expected to be derived from so doing are greater than, or at least equal to, the costs associated with patenting (including as costs not only the necessary monetary outlays but also the competitive cost of disclosure).[10] However, it cannot be inferred that all of these inventions are a *result of* the patent system, because some of them might be forthcoming even in its absence.[11] The amount of invention that would occur without the ability to patent is not known; yet it is essential to develop this information if the causative role of patents upon research is to be ascertained.

At first glance it might appear feasible to conduct interviews with corporate executives responsible for decisions involving research expenditures, asking them how their research activity would be affected if the system did not exist. But it is doubtful if precise quantitative answers could be expected. There are at least two reasons for such doubts. In the first place, to the extent that a firm's research activity is partly stimulated by that of other firms, interviewees would be forced to estimate other firms' reactions if the patent system were removed. A more basic reason, however, stems from the fact that the patent system has been in existence for many years. Firms have become so accustomed to its existence that its influence may not be consciously recognized in decisions involving research. The effects of its removal would therefore be difficult to estimate. It seems more likely that attempts to establish a relationship between the patent system and corporate research expenditures will require detailed case studies involving a study of records of decisions and actions concerning specific changes in firms' technology and in their product lines as well as interviews with company officials. Specific information on a number of points needs to be developed, such as: the volume and relative signifi-

[10] This statement should not be understood to mean that the expected return from *each* invention outweighs the cost of patenting it. Firms may not be able to calculate specific returns with any high degree of accuracy. Decisions to patent may instead be a matter of company policy, established as a general rule applying to all patentable inventions; any decision relating to a specific invention would be an exception to the general rule. The above statement would then mean that on balance firms feel that the expected returns from patenting all patentable inventions outweigh the costs.

[11] Interviews conducted with a number of firms by members of this project (to be summarized later in this section) indicate that this statement is correct.

cance of unpatentable invention; the amount of patentable invention not patented, and the reasons for not patenting; the extent to which secrecy is possible and effective, given the increased integration of science with industry and the desires of scientists to exchange and publish information; the role of the patent system in firms of different size; particular features or characteristics of industries which affect patent policies (e.g., the automobile industry as compared to the chemical industry).[12]

### 2. *Information on the Influence of the Patent System in Industry*

a) *Interviews*

In order to test the feasibility of the interview technique, members of the project made a number of exploratory interviews. Firms falling in six industry classifications were contacted, in addition to a well-known firm of patent attorneys, officials in the Patent Office, and a commercial, non-manufacturing research firm. In selecting questions for discussion in the interviews, two criteria were followed. It was felt that the greatest value could be derived from the interviews by confining the questions largely to the interviewees' own experiences. Secondly, since knowledge of the role of the patent system in industry is nebulous, making it difficult to frame specific questions that would elicit pertinent answers, the questions were of the "free-response" type, deliberately designed to evoke as much discussion as possible.

The interviews contained questions in several areas, as follows:

i. The method of accounting for patented inventions.
ii. Whether, in the event that the accounting valuation was only nominal, an attempt was made to estimate true value for internal use by the firm.
iii. The firm's experiences concerning the relationship of the patent system to the creation and dissemination of technical knowledge.
iv. The influence of the patent system upon research activity.
v. The relationship of the patent system to sales, output, investment, and the growth of the firm.

The information pertinent to the present discussion is largely contained in the latter two areas. Because of its intrinsic interest it is summarized below. Presentation of this information also makes apparent the need for refinement of questions and for the development of means of evaluating interview material. These problems are discussed subsequently.

*The patent system and research activity.* All persons interviewed felt that there is a significant relationship between the patent system and research activity, but the extent and manner of its influence varies widely. In some cases it was felt that the system stimulates a great part of the firm's research activity, and in all cases it was felt that the system encourages exchange of knowledge acquired through research.

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[12] The considerations raised here suggest that attempts to determine reliable quantifiable answers about the patent system's influence upon corporate research activity are premature. However, at least one attempt to establish a relationship between the patent system and research expenditures has been made. It is investigated in Appendix A.

Thus company officials believe that not only does the system stimulate research but without it the level of utilizable knowledge would not increase as rapidly and more duplication of research effort would occur.

Although we recognize that the patent system was not designed to stimulate fundamental, or basic, research directly, it was felt that some relationship might exist. In view of the difficulty of defining fundamental research clearly, interviewees were asked to interpret the term to mean any research not directed toward a specific commercial goal.[13] Many pointed out, as might be expected, that the patent system is not aimed at this type of research, and they did not see any particular connection. Others felt that there is some influence. One interviewee pointed out that his firm tries to refrain from publishing the results of any of their basic research for a while in order to explore commercial possibilities. Others stated that the possibility of obtaining patents on applied aspects leads them to be more willing to sponsor fundamental research. One thought that the extent of fundamental research conducted by industry and the relation of the patent system to it varies widely among industries. Although he did not see any significant relation in his industry, he suggested an investigation of other areas, such as antibiotics.

A point of considerable interest and significance observed in a number of the interviews is the extent of competition in research and the role of the patent system in stimulating it. This was repeatedly emphasized by the interviewees and was often raised in connection with the problem of valuing patented inventions for balance sheet purposes. The existence of a patent on a product or process which is obviously valuable and which places competitors at a disadvantage serves as an incentive for them to increase their research efforts in order to develop effective substitutes. As some pointed out, there is a universal tendency toward developing substitutes, which would occur without patent protection. But this tendency is greatly enhanced by the existence of the patent system. In this connection, one interviewee made an interesting observation. He pointed out that there is a danger involved in setting license fees or royalties too high since it may stimulate greater research effort on the part of competitors.

This information suggests a major difficulty in attempting to measure the value of the patent system as a stimulant to industrial research expenditures. A principal reason why the firms interviewed do not strive to place an accurate value upon their patented inventions is the uncertainty caused by the tendency for competing substitutes to be developed and the consequent fall in the expected stream of future earnings from existing inventions. If this tendency is enhanced by the existence of patents, then it can be said that the patent system, while creating values for particular enterprises, also serves to destroy values in others. The net effect is probably the creation of greater social value through an increase in the available quantity of similar products or processes. The impact of patents on research competition thus suggests a further way in which they may be accomplishing a social purpose and that, by their nature, they may tend to be self-destroying.[14]

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[13] This definition is similar to that used in the recent National Science Foundation survey, though not as complete. *Op. cit.*, p. 18.

[14] This statement largely ignores the "fencing-in" problem, which, if and to the extent that it exists, would tend to lessen the possibility, or at least the rapidity, of self-destruction.

*The patent system and sales or income.* Interviewees were asked to estimate the proportion of total sales involving patented products or processes. All responses to this question indicated that a large part of sales either consists of patented products or is in some way connected with patented processes. Two indicated that over 50 per cent of their sales are related to patents. Another indicated this to be the case if licensed patents are included. One indicated that as much as 50 per cent of sales might be related to patents. The others did not give figures, stating instead that a "healthy share" or "very high percentage" of their sales are so related. In several cases the impossibility of determining the exact percentage of sales related to patents was stressed. Also, two interviewees indicated that the proportion varies a great deal among various items or lines marketed by the firm.

*Other interview information.* Some questions received more diverse answers. Interviewees were asked whether they felt there was a connection between patents and the size and growth of their company. The responses show a wide divergence of opinion. Two indicated a belief that there is a significant relation. Others doubted any influence. Several made the point that the influence is much more important in some industries than in others. One thought that risk capital is more readily available to firms with patent protection. Another thought that some influence exists but, citing restrictive quotas imposed by some licensing agreements, felt that it could work in either direction. Another felt that the influence is more on the industry level than on the firm because of the spread of information brought about by the patent system.

With respect to the influence of patents on product diversification, an equal split in the responses resulted. Half felt that the relation is of little significance while half believed that there is a definite effect. An official in the research firm pointed out that on occasion companies have specifically directed his organization to search for patents in other fields so that they might branch out. Another interviewee stated the belief that the influence exists as a natural consequence of following up unexpected discoveries made in the course of research.

Officials were also questioned about the influence of the patent system on investment decisions. Several indicated it to be of only minor importance. Another indicated that patent protection is definitely considered and that the patent system induces investment of risk capital that would not otherwise be forthcoming. It was also mentioned that large-scale investment is not usually made until after a pilot plant has proved successful, and the construction of pilot plants often depends upon the patentability of the product or process involved.

*Evaluation of interviews.* The foregoing material clearly indicates that those persons interviewed believe that the patent system plays a significant role in their companies. But the heterogeneity of the answers raises questions concerning the additivity of information derived from interviews and hence their usefulness in providing data covering a large number of firms. The ramifications of the patent system within industry are numerous and data, whether quantitative or qualitative, are needed on all of its aspects. But it would place impossible demands upon the use of the interview technique to attempt to specify and measure all of the system's manifestations. These are proper subject matter for a selected number of more detailed industry or firm studies. Extensive interviews can probably be most useful if confined to a limited number of questions, designed in such a way that the results in each case can be compared or combined. With this orientation in mind two related interpretive schemes offering some promise are discussed below.

*The pervasiveness of patents.* It has been repeatedly emphasized that the value of the patent system lies in the fact that it favorably influences expectations concerning the profitability of invention, disclosure, and innovation. Therefore, the possibility of obtaining patents induces firms to direct factors of production into inventive and innovative activity. For reasons already cited, patents are not a *sine qua non* in every case of invention and innovation. Consequently, it cannot be said that the patent system is *solely* responsible for every patented invention or resulting innovation. But it would be correct to state that the system affects the activities of the firm in some way in every case in which a patented invention or a resulting innovation is involved. Its minimum effect would be to encourage the disclosure of information which the firm would otherwise keep secret. The maximum effect would be in those cases where the invention and innovation is completely dependent upon the attainment of a patent.

Since the patent system makes some contribution in every case, it would therefore be interesting to know how widespread is its relationship to the inventive and innovative activities of firms. Although the degree of its contribution would vary in each specific instance, measures of the pervasiveness of patents would nevertheless indicate the possible breadth of the system's influence. Such information does not appear to be presently available, but it might be obtained through interviews.

The best index of a firm's inventive activity would be its expenditures on research and development. Such expenditures would include all effort by the research staff itself in addition to ideas submitted by other individuals upon which further research or development effort is required. They would exclude inventions upon which no research and development effort was required. However, it is argued in Appendix A that the magnitude of such invention probably is not great. Expenditures on research and development also would not include inventions licensed or purchased by the firm. But, if the licensor or seller is another firm, these inventions would be included in their expenditures.

Through interviews company officials could be asked to estimate the proportion of the firm's research expenditures resulting in patented products or processes.[15] Accounting records might provide information of the type desired. Even if this is not the case, research department heads, patent counsel, and other executives responsible for decisions involving patents and research could be asked what they believe this proportion to be.[16] Beliefs, to be sure, are subjective data, but they would be strengthened by the fact that the persons interviewed are intimately connected with research and patent policy. Furthermore, even rough estimates should

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[15] Since any particular invention may involve research effort and expenditure extending over a period of years and since cost accounting techniques may not be sufficiently refined, it would not be feasible to attempt to derive estimates of research cost for each invention.

[16] In the interviews conducted by members of the project, at least one person voluntarily suggested that this information should be obtainable.

be sufficient to allow interesting comparisons. The answers could also be made more reliable and comparable by interviewing several officials in each firm independently. If, for example, all indicated a similar proportion, then the estimates could be accepted as reasonably accurate. Where the estimates differed, the proportion would need to be stated as a range, or perhaps an average of the different estimates.

In a similar way, the pervasiveness of patents with respect to a firm's innovative activity could be obtained. The principal way in which a firm innovates is to introduce new processes of production or new products. These would be reflected in sales or production figures. For purposes of comparison with other firms, sales might be the better variable to employ, since measurements would thus be in dollar terms. As in the case of research and development expenditures, interviewees could be questioned concerning the proportion of sales involving patented processes or products.[17] If necessary, company records of the types and amounts of products sold, and the productive processes involved, could be consulted by the interviewees.

It is believed that the proposed questions will provide useful information on the role of the patent system in industry. Since the system is at least a partial determinant of firms' inventive and innovative activity in every case in which patents are involved, knowledge of their pervasiveness would provide significantly greater insights into the extent of their influence than are now available.

*Relative differences in the strength of patent incentives.* The above information should also be useful for comparative purposes. It may be that there are inter-firm (or perhaps inter-industry) differences in the influence of the patent system upon the incentives to invent and innovate. Some of the interview material suggests this to be the case. The proposed interview scheme may serve as a means of detecting these differences. The proportions of research expenditures and of sales involving patented products or processes can be interpreted as indexes of the degree of use of the patent system by firms. Firms could be ranked on the basis of their degree of use of the system. If significant differences in the degree of use appear, it would be fruitful to ascertain reasons for such differences. Further probing in interviews might be desirable. But this technique should also be useful after interviews are completed, since it would serve as a framework for further analysis. For example, it might be a means of developing some of the information previously suggested as being necessary before quantitative measurements of the causative role of patents can be made. It should also serve to specify those firms and industries warranting more intensive analysis through case studies.

This technique might also be used to measure changes in the influence of the patent system over time. To ask company officials to estimate the proportion of research and development expenditures and sales involving patented processes or products for prior years may appear to place too great a strain on memories and hence might affect the reliability of the results. However, if there have been significant changes in the system's influence, it is likely that persons intimately connected with research and patenting decisions will be aware of them. Therefore

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[17] In the interviews conducted by project members, percentage estimates were in most cases readily obtained.

the use of this technique appears to be warranted as a means of providing some information on the changing influence of the patent system.

b) *Industry and Firm Studies*

Another approach to the impact of the patent system upon invention and innovation in industry is through detailed studies of particular firms or industries. Knowledge of the role of the system in industry being what it is, information gained in this manner would be invaluable. The conclusions reached in each case must necessarily involve the investigator's qualitative judgments. However, this type of approach appears to be essential before highly aggregative attempts are warranted. It should also be noted that these judgments would be those of careful investigators who have spent considerable time in making a detailed analysis of the particular firm or industry.

There are at present a number of excellent industry studies which, though not principally concerned with the impact of the patent system, nevertheless consider its role specifically. A summary of several is useful in indicating the present state of knowledge concerning the effect of the patent system in particular industries and in suggesting the kinds of information that might be developed through further studies. The findings of three studies are presented in Appendix B: Maclaurin's on the radio and television industry,[18] Bright's on the electric lamp industry,[19] and Passer's on the electrical manufacturing industry.[20] Each of the authors has considered the positive and negative effects of the system and has arrived at an over-all judgment concerning its influence. In general it can be stated that each one, especially Maclaurin and Bright, concludes that the patent system has, on balance, been an important incentive to progress in these industries, even though it did not function optimally.

Consideration of these three studies suggests that it is possible to develop well-reasoned and documented conclusions concerning the impact of the patent system in specific cases. Accordingly, the authors of this inquiry deem it advisable to consider that further studies oriented around the influence of the system be undertaken. They believe, furthermore, that case studies of particular firms or industries appear worthwhile, not only in providing qualitative information concerning the role of the patent system, but also (in conjunction with the interview technique previously suggested) as a necessary step in deriving quantitative estimates of its effects. It has been pointed out that attempts to establish a quantitative connection between the patent system and research expenditures are premature, because of the lack of detailed knowledge about the system's influence. For the development of this type of information there is no adequate substitute for case studies.

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[18] W. Rupert Maclaurin, *Invention and Innovation in the Radio Industry* (New York: Macmillan, 1949); also "Patents and Technical Progress—A Study of Television," *Journal of Political Economy*, LVIII (April, 1950), pp. 142-157.

[19] Arthur A. Bright, Jr., *The Electric-Lamp Industry: Technological Change and Economic Development from 1800 to 1947* (New York: Macmillian, 1949).

[20] Harold C. Passer, *The Electrical Manufacturers, 1875-1900: A Study in Competition, Entrepreneurship, Technical Change, and Economic Growth* (Cambridge: Harvard University Press, 1953).

### C. THE COST OF DISCLOSURE AS AN INDICATION OF THE ECONOMIC BENEFIT EXPECTED FROM PATENT PROTECTION

Two important requirements which must be met before patent rights can be conferred under the patent law are: (1) inventions must be made which satisfy Patent Office examiners as to their novelty and usefulness; (2) sufficiently detailed disclosure of the manner of making and using the newly invented products or processes must be made to enable others "skilled in the art" to construct or use them upon expiration of the 17-year period of patent protection.

In a sense, then, patenting involves a contractual agreement between the government and patentees with valuable consideration being given by both parties. The government "sells" patent rights to inventions in exchange for additions to scientific and technical knowledge. Or, looked at from the point of view of inventors, patent rights are "bought," the "cost" consisting of inventions and their disclosure to actual or potential competitors.[21]

While both invention and disclosure are necessary in order to qualify for patent protection, the two acts do not take place simultaneously. Decisions to undertake search for new products and processes are influenced by the possibility of patenting to the extent that this possibility improves the chances that such activity will be profitable. However, once patentable inventions or discoveries have been made inventors must decide whether it is in their best interests to disclose the information about the new products or processes necessary to qualify for patent protection. That is, they must judge whether the commercial value of individual inventions promises to be enhanced by fulfilling the disclosure requirement or whether competitive disadvantages likely to be incurred as a result of disclosure will nullify or overbalance the benefits expected from patent protection.

#### *Parameters of the Cost of Disclosure*

The cost involved in patenting inventions consists not only of the competitive disadvantages involved in disclosing information about the inventions but also of filing and issuance fees and legal expenses. In most cases, however, the competitive disadvantages of disclosure would be the most important factor figuring in decisions concerning the desirability of patents. Fees and legal expenses are likely to be important considerations only in the case of inventions not expected to have any outstanding commercial success.

Disclosure of information concerning inventions might prove costly because of the aid it will provide actual or potential competitors in their search for other patentable inventions which will hasten the obsolescence of the inventions originally disclosed. Disclosure might also prove costly because the inventions happen to

[21] Throughout the remainder of this section the inventors' point of view is maintained. That is, the "cost of patenting" refers to the cost incurred by patentees, not the cost incurred by the government or society. What constitutes cost for patentees constitutes benefit from the point of view of society. Likewise, the "value of patent rights" refers to the value of such rights to patentees. Obviously such exclusive rights represent the cost incurred by society as a result of the government's entering into patent contracts with inventors.

be of the sort that are easily infringed upon without detection. And disclosure might prove costly as a result of the stimulation it provides to competition in the production or use of patented inventions after the 17-year period of exclusive rights has expired. In the case of any given invention, therefore, the cost of disclosure tends to vary with the amount of information required to be disclosed to the Patent Office, the extent to which such information as is disclosed is made available in useful form to competitors, the likelihood that such information will enable competitors to discover superior products or processes or to infringe without detection on the rights of the patentee, and the likelihood that the invention will be commercially successful for longer than the 17-year period of patent protection.

### *Determination of the Cost of Disclosure*

Where it is decided to patent inventions there is presumptive evidence that the cost of disclosure is not expected to exceed the advantage of patent protection or, in other words, that the commercial value of the inventions is expected to be enhanced by patenting.[22] The competitive disadvantage expected to result from disclosure cannot exceed the economic benefit expected from patent protection if decisions to patent are made in a rational manner. Therefore, the cost of disclosure willingly incurred by inventors in order to qualify for patent protection indicates the lower limit of the benefit expected from patent protection.

There appears to be no way by which the competitive cost involved in disclosure as anticipated by patentees can be determined or measured with any quantitative precision, yet it might be possible to obtain some information of a qualitative nature on the extent to which such cost is believed to be incurred as a result of the disclosure requirement contained in the patent law. For example, patentees might be asked their opinion as to whether certain patented inventions would have been of greater commercial value if patent protection had not been contingent upon disclosure of information regarding the invention and, if so, to what extent. A broad cross-section of patentees could be polled in an attempt to determine for which industries and for what types of inventions the cost of disclosure is highest. Companies and individuals using information obtained from the Patent Office about patented inventions could also be canvassed to determine their estimates of the competitive benefit of such information, and their estimates could then be checked against those of patentees.

While data on the cost of disclosure obtained in this manner would serve to establish the point that cost is willingly incurred by patentees in order to obtain patent protection and, therefore, that patent protection is expected to be of economic benefit, it probably would provide only limited insight into the extent to which

[22] An exception might exist in those cases in which inventions are patented for reasons of prestige and in those cases in which inventions are patented in accordance with a general policy with no attempt being made to determine the desirability of doing so on a case-by-case basis. On the other hand, where it is decided not to patent patentable inventions, nothing is necessarily implied concerning the balance between the expected cost of disclosure and the expected advantage from patent protection since in many cases such decisions are made because the inventions in question show little prospect of commercial success. In such cases the cost of disclosure is not the factor deterring patenting.

patent rights are expected to augment the commercial value of inventions. And, as pointed out above, even if the expected cost of disclosure could be ascertained, it would indicate only the lower limit of the economic advantage expected from patent protection. The expected advantage from patent protection would exceed, and often by a great deal, the competitive cost expected to be incurred as a result of disclosure of information regarding inventions and discoveries. Consequently this approach to measurement of the economic incentive afforded by the patent system shows little promise as a basis for empirical study of the value of the system.[23]

## APPENDIX A

### GILFILLAN'S ESTIMATE OF THE CONTRIBUTION OF THE PATENT SYSTEM TO AMERICAN INVENTIVE ACTIVITY

Gilfillan states that "all in all, it would seem a fair statement, even if regrettably lacking in logical and statistical accuracy, to say that patents motivate 15 or 20 per cent of American inventing today."[24] As evidence he cites the President's Scientific Research Board estimates for organized research in 1947 together with certain supplementary data. In 1947 the federal government accounted for 62 per cent of all research expenditures, industry for 32 per cent, universities for 3.2 per cent, and others (state and local governments, non-profit research foundations, etc.) for 2.8 per cent. Thus non-commercial sources (all non-profit research laboratories) accounted for 68 per cent of all research and commercial sources accounted for the remaining 32 per cent. Of the total volume of applied research (which Gilfillan calls invention proper) 62 per cent stemmed from non-commercial sources and 38 per cent from commercial sources in 1947. Thus, Gilfillan concludes, the patent system could affect at most 32 per cent of all organized research and 38 per cent of invention proper.

To these figures, however, must be added the value of the efforts of the free-lance inventor, which would increase the importance of the patent system by a large but unknown amount. But there are other factors detracting from its significance. Gilfillan points to the extensive use of patent pooling and mutual licensing in many industries, practices which he feels weaken the patent incentive. Furthermore, the prevalence of monopoly elements in the economy weakens the need for patents, even though monopolistic firms may continue to patent. Another weakening influence stems from the legal disfavor in which patents are frequently held. Finally, there is the mass of unpatentable inventions, each one being almost insignificant in value but occurring in such volume as to equal other inventions in aggregate value. As evidence for this, Gilfillan cites the large number of employee suggestions accepted (20 to 30 per cent), each receiving on the average only a small reward ($12), and most not patented (only about 1 per cent).

On the basis of these considerations Gilfillan concludes that the patent system is responsible for only 15 to 20 per cent of American inventing today. But in several respects this estimate is open to question. The figures used are subject to a wide range of error. In fact, the revised estimate for 1947 by the Research and Development Board attributes 47 per cent of all research to industry, as compared to the 32 per cent figure cited by Gilfillan.[25] Furthermore, industry's share is not constant from year to year. By 1952, its share had fallen to 38 per cent but it rose to an estimated 45 per cent in 1953.[26] Also, if a breakdown between basic and applied research were made, then industry's share of applied research would probably exceed 40 per cent (since a larger proportion of basic research is probably performed by universities and by or for the government than by industry).

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23 While data concerning the competitive cost of disclosure might not be of much aid in judging the incentive afforded by the patent system, such data would give some insight into the usefulness of scientific and technological information made available as a result of the patent system.

24 *Ibid.*, p. 377.

25 Bureau of Labor Statistics Bulletin No. 1148, *op. cit.*, p. 58.

26 Derived from the National Science Foundation study, *op. cit.*

It is likely that the use of postwar figures alone could be misleading. An examination of the estimates for research in the decade of the thirties reveals that in no year did the government's share exceed 20 per cent, while industry's share fluctuated between 60 and 70 per cent.[27] It is undoubtedly true that the government will continue to sponsor research on a vastly larger scale. But the extreme difference between the picture in the 1930's and that today suggests that a large portion of government-sponsored research is directly related to war—either actual or potential—and throws little light on the government's contribution in peacetime.

A more basic objection relates to the use of total research expenditures as the basis for measurement of the patent incentive. The patent system was not designed to stimulate government and university research, or basic research, wherever located.[28] Therefore, in examining the role of the patent system, the really relevant question is: of the sources and type of invention that the system might be expected to influence, what proportion can be attributed to it? On these grounds, the appropriate research figure to use would be the expenditures by industry and free-lance inventors upon applied research. Gilfillan's estimate of the influence of the patent system upon total inventive activity appears to be approximately from 40 to 50 per cent of the 38 per cent figure for applied industrial research. Thus on the basis of his computations, but limiting inventive activity to that which the patent system could be expected to affect, it could be argued that the system accounts for almost 50 per cent.

A final objection to Gilfillan's estimate concerns the relative amount of unpatentable invention, consisting of the research efforts of government laboratories and non-profit institutions, unpatentable discoveries, and the mass of little inventions which, whether patentable or not, are usually not patented. Gilfillan states that the 1947 research figure includes all of the above and feels that the value of small inventions, re-inventions, and discoveries is equal to that of patented inventions in the aggregate. For this to be the case, their number would have to be very great because of the low value per invention. In view of the declining role of the individual inventor (Schmookler's "Less Probable Inventor" category), this would not seem likely. As for unpatentable discoveries, the volume of basic research in industry probably serves as a good indication of their significance apart from those developed by governments or non-profit institutions. In 1953, only 4 per cent of total expenditures for industrial research and development was devoted to basic research.[29] Finally, it is doubtful if the 1947 research figure includes all of the little inventions. It is more probable that it includes only those inventions which are accepted and upon which some research and development effort has been expended.[30] Because of such expenditure it is likely that, if patentable, they would be patented. Other inventions upon which no research funds were spent would need to be added to the 1947 figure in order to measure total inventive activity. However, the magnitude of these inventions is open to question. Gilfillan feels that, from the evidence cited concerning the proportion of employee suggestions accepted and their low average value, two conclusions can be drawn: "the practical incapacity of workmen or amateurs to make serious inventions under modern conditions; and the abundance of minor invention which is adopted and constitutes technic progress, yet is not patented."[31] These conclusions are undoubtedly correct, but it is difficult to see how a judgment can be drawn from them that the mass of little inventions and discoveries are equal to patented invention in value. In short, the evidence concerning the relative importance of unpatentable invention (outside of governments and non-profit institutions) is unimpressive. The argument that such invention is not so important can also be made with some force.

## APPENDIX B

### A SUMMARY OF THREE INDUSTRY STUDIES ON THE ROLE OF THE PATENT SYSTEM

In its early days the radio industry was characterized by individual inventors. Because they possessed patents, these men were able to secure financial aid which would probably not other-

27 President's Scientific Research Board, *op. cit.*, p. 10.

28 However, much government-sponsored research is performed by industry. To the extent that corporate research facilities owe their existence partly to the patent system, then it can be logically argued that there is an indirect connection between patents and government research. Furthermore, in many, if not most, government contracts the firm performing the research has the right to patents on inventions developed under the contract, with the government having the right to a royalty-free license. This must surely encourage industry to perform government research.

29 National Science Foundation, *op. cit.*, p. 18.

30 This would certainly seem true of the 1951 and 1953 surveys, since questionnaires were sent only to companies known or thought to have research staffs and the questions asked related strictly to research activities.

31 *Op. cit.*, p. 375.

wise have been offered. Outside aid was necessary since resort to established companies was apparently out of the question because of lack of interest in the inventions. Accordingly, Maclaurin concludes, the patent system provided an important stimulus to individual inventors.[32]

Maclaurin doubts that patents were a direct incentive to radio research by established companies. Radio offered a threat to the American Telephone and Telegraph Company's investment in wire telephony. This in itself constituted sufficient incentive for it to undertake radio research. But the situation facing General Electric and Westinghouse was different. Research in radio was outside their area of normal operations. Without the prospect of monetary rewards, they probably would not have entered the field; or if they did enter they probably would not have remained long because the keenness of competition would have driven profit margins down. Since he feels that GE and Westinghouse made important contributions to technological progress in the industry via their well-equipped laboratories and large staff of technical experts, Maclaurin concludes that the contribution of the patent system to research and invention by established firms in the industry was significant.[33]

Maclaurin believes, however, that there were forces weakening the patent incentive. In particular, he cites the tendency for smaller firms to rely on the research efforts of RCA because of its overwhelming patent structure and the tendency on the part of Philco, after acquiring a patent position, to spend money on research for its protection rather than on further developments. Nevertheless, his general conclusion remains that "the patent system, in spite of its weaknesses, did operate to encourage research and invention during the period under review."[34]

Concerning the television industry Maclaurin concludes that:

> One of the significant features of the television story is that some protection against the "perennial gale of competition" was essential to television research. The technical obstacles to be overcome were exceedingly difficult, and there were many who believed that it would be years before sets could be sold in large volume. Research expenditures have been enormous and could not have been forthcoming under conditions of perfect competition. For the development of such a product *by industry* some degree of monopoly is essential.[35]

He feels that we are justified in relying on the patent incentive to foster the type of progress illustrated by television, provided that abuses in the system can be significantly reduced.[36]

Bright's study of the lamp industry draws similar conclusions:

> There is no doubt that the patent incentive has provided a very strong stimulus to progress in electric-lamp technology. That incentive has applied both for individual inventors and for large corporations. The early Edison laboratory was concerned almost entirely with patentable inventions, and financial returns were expected from all developments. Most of the other pioneer arc-lamp and incandescent-lamp inventors likewise sought profits through patent-protected invention. The desire for strong new patents was also a fundamental factor in the foundation of the General Electric Research Laboratory and in much of the technological activity of the mature lamp industry.[37]

But there have been weakening forces. The patent laws have tended to protect the corporation more than the original inventor. Firms have been induced to protect their patent position through the acquisition of other patents. The commercial application of certain new devices may have been retarded. Quotas and other licensing restrictions have been instituted, causing many small manufacturers to be forced out of business in the twenties. Infringement suits over patents of doubtful validity occupied much time and expense on the part of the unlicensed lamp producers. Despite these weaknesses, however, Bright's over-all judgment of the role of the patent system in the electric-lamp industry is that, despite its failure "to keep abreast of changing economic conditions, it has displayed remarkable strength. Progress in the lamp industry, while not optimum, has been noteworthy."[38]

Passer's judgment on the influence of the patent system in the electrical manufacturing industry is more cautious. Conditions in the heavy equipment sector of the industry approximated those of a stabilized oligopoly, whereas those in the lighting elements sector approximated pure competition. Patents were important in a.c. power, electric railways and in incandescent lamps after 1892, but unimportant in arc carbons. As might be expected, the price of electric lighting fell, inducing its substitution for other forms of lighting. Prices of heavy equipment

32 *Invention and Innovation in the Radio Industry*, p. 259.
33 *Ibid.*, p. 260.
34 *Idem.*
35 "Patents and Technical Progress," p. 157.
36 *Ibid.*, p. 151.
37 *Op. cit.*, p. 468.
38 *Ibid.*, p. 476.

were more stable, but there was little evidence of monopoly pricing. On the other hand, the quality of the product was higher than it would have otherwise been. Concerning the specific influence of patents, Passer states:

> Patents also influenced competitive conditions. They were a prime cause of the numerous consolidations and mergers which finally resulted in only two full-line producers. Furthermore, patents permitted competition to take place on a system basis instead of with reference to single items of equipment. Manufacturers could refuse to allow the use of particular patented apparatus except as a part of a complete lighting or power system. While this kind of competition was intended to take advantage of certain key patents, it should be noted that the economical and reliable operation of a number of interconnected items of equipment was also involved. The seller could contend, with considerable justification, that he was merely protecting the reputation of his products in requiring that only items of his manufacture be combined into one system.[39]

Each of the above studies points to the tendency for pioneer innovations to be introduced by newcomers to the industry and concludes that it is necessary for society to depend upon new firms and entrepreneurs as an important ingredient of technological advance. A point about which there seems to be widespread agreement is that patents facilitate the entry of newcomers. If this is the case, then a traditional argument for the patent system can be said to be fulfilled.[40]

Bright and Maclaurin offer interesting comments concerning certain revisions of the patent system which are frequently suggested. Maclaurin rejects compulsory licensing on the grounds that it would discourage large-scale expenditures. Bright makes the same point and also feels that it might lead to a refusal to patent, thus keeping "know-how" secret. He also feels that while compulsory licensing might be useful in particular cases, such as the oppressive use of a patent position, its use in the lamp industry would not have caused significant changes from the developments which actually took place.

Concerning restrictive license agreements, Bright points out that, as long as the holder of the patent has the right to grant licenses or not, then a prohibition on restrictive agreements might lead him not to license at all, causing possibly more harm than good. This would not be the case, however, when restrictive provisions are incorporated in a general pooling agreement. Maclaurin does not view cross-licensing with favor. Feeling that competition in research is important for all firms, whether large or small, he fears that cross-licensing features might discourage research competition between large patent-holders.

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39 *Op. cit.*, p. 352.

40 This statement largely ignores the possibility that a well-fortified patent position on the part of existing firms may make it more difficult to enter the industry.

## III. ANALYSIS OF THE ECONOMIC VALUE CREATED BY THE PATENT SYSTEM

### A. THE CONTRIBUTION OF THE PATENT SYSTEM TO NATIONAL WEALTH

One measure of the economic value of the patent system would be the contribution it makes to national wealth. However, serious problems of both a theoretical and a practical nature are encountered in attempting to ascertain this contribution. National wealth accounting has not reached a state of refinement similar to that of national income accounting. Not the least of the many conceptual problems which have been encountered in attempts to draw up national wealth estimates is the question of the proper treatment of intangible assets, especially patent rights. The answer depends in large part upon the purpose for which the wealth estimate is being made. If the purpose is to analyze the size distribution of wealth among individuals or groups, then national wealth estimates should include all assets that can be sold in the market, valued as far as possible at their market prices.[1] Thus, the full commercial value of all patented inventions (including the increment of value which the conferring of patent rights adds to the invention) would be included as a component of national wealth when national wealth is so conceived. If, on the other hand, the purpose of estimates of national wealth is to facilitate comparison of the total stock of wealth over time or between countries, only the aggregate value of reproducible physical assets would be included in the estimates.[2] The value which patent rights add to inventions by increasing the scope of ownership would therefore be excluded from such estimates.

The various conceptions of national wealth have been established largely as a result of the efforts of Simon Kuznets and Raymond W. Goldsmith to develop concepts and procedures for accounting for national wealth analogous to those employed in national income accounting.[3] Goldsmith has distinguished two types of national wealth estimates, labeling the first "national business accounting" and the second "national economic accounting." National business accounting is based upon accepted accounting practice while national economic accounting "goes beyond the figures found in business records and beyond the rules of business accounting as far as is demanded by economic theory."[4]

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[1] Franco Modigliani, "Comment" on R. W. Goldsmith, "Measuring National Wealth in a System of Social Accounting," *Studies in Income and Wealth*, Vol. XII (New York: National Bureau of Economic Research, 1950), p. 144.

[2] *Ibid.*, p. 145.

[3] Simon Kuznets, "On the Measurement of National Wealth," *Studies in Income and Wealth*, Vol. II (New York: National Bureau of Economic Research, 1938), pp. 3-61; Raymond W. Goldsmith, "Measuring National Wealth in a System of Social Accounting," *Studies in Income and Wealth*, Vol. XII, pp. 33-186.

[4] Goldsmith, *Studies in Income and Wealth*, Vol. XII, pp. 25-28. Goldsmith admits that "the theory of national economic accounting is relatively new, complex, not uncontroversial, and not yet tested in practical application."

### *Value of Patented Inventions in National Wealth Estimates Derived by Application of National Business Accounting*

National wealth in the business accounting sense is derived by consolidation (as distinct from combination or summation) of the balance sheets of all economic units within the nation into a national balance sheet. In the process of consolidation, claims and corresponding liabilities within the nation are canceled,[5] leaving only the value of individually-owned assets which are not offset by entries in the books of other economic units as the consolidated net worth statement.

The value of patent rights and other intangible assets would not be canceled in the process of consolidation since claims of this sort owned by one economic unit do not give rise to any offsetting entries in the books of other such units. Goldsmith explains this as follows:

> Offsetting entries do not have to be made in the books of other economic units simply because they would as a rule represent the capitalized increase in price over a hypothetical price payable by the buyers or users of the goods and services into which the patent or other right enters. Such entries obviously would not reflect a legal liability or even a calculable cost. Hence they are correctly omitted in business accounting.[6]

But while, from the conceptual point of view, the aggregate commercial value of patented inventions should be included as a part of national wealth conceived in the business accounting sense, any attempt to determine such value in practice would appear to be a "fruitless undertaking."[7] As pointed out in an earlier section of this study, data on the commercial value of individual patented inventions usually are not available. Therefore, while the aggregate value of patented inventions constitutes a component of national wealth when the term is conceived of as a stock of net claims, accurate measurement of this aggregate value is not feasible.

### *Value of Patented Inventions in National Wealth Estimates Derived by Application of National Economic Accounting*

Estimates of national wealth derived in accordance with the national economic accounting approach do not include the value of patent rights.[8] As Bronfenbrenner points out, this approach to national wealth estimation "requires elimination of values uncorrelated or negatively correlated with economic welfare—primarily capitalized monopoly gains . . . and evaluating all reproducible assets at the marginal social money costs of their physical reproduction."[9]

Simon Kuznets agrees that such estimates should not include the value of patent rights insofar as they represent merely a legal privilege. However, he would presumably be willing to include the contribution patent rights make to the total stock

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[5] Assuming that corresponding claims and liabilities are valued equally and at the same time on the books of both debtor and creditor.

[6] Goldsmith, *Studies in Income and Wealth,* Vol. XII, p. 46.

[7] C. Reinold Noyes, "Comment" on Goldsmith, *Studies in Income and Wealth,* Vol. XII, p. 174.

[8] Goldsmith, *Studies in Income and Wealth,* Vol. XII, p. 47n.

[9] Martin Bronfenbrenner, "Comment" on Goldsmith, *Studies in Income and Wealth,* Vol. XII, p. 138.

of knowledge through disclosure if it could be established and were it not for the inconsistency involved in so doing while overlooking other contributions to the total stock of knowledge of even greater importance.[10]

From a practical standpoint neither the aggregate commercial value of patent rights nor the value of scientific and technical knowledge attributable to the patent system is determinable. Therefore, although the patent system can be said to be related to national wealth when defined as the aggregate net claims on wealth of individual economic units and so as to include the total stock of knowledge, its contribution to national wealth cannot be measured. This conclusion follows with respect to aggregate net claims of individuals because the commercial value of patents is not determinable. It follows with respect to the "stock of knowledge" concept for the obvious reason that the value of the national stock of knowledge or any additions thereto by particular institutions defies measurement.

### B. THE CONTRIBUTION OF THE PATENT SYSTEM TO TECHNOLOGICAL CHANGE

During the first half of this century output per man-hour increased at a rate of about 2 per cent per year. Since the trend is slightly rising, 2 per cent can be regarded as the minimum rate of growth for the years ahead.[11] Numerous factors are responsible for the sustained rise in American productivity. A major one is the process of technological change—changes in the level of technological possibilities of production available to a firm.[12] Inventions, either of new processes or new products, and their commercial introduction (i.e., innovations) would therefore constitute major elements of technological change.

Since the patent system is designed to stimulate invention and innovation (as well as disclosure), its basic function may be viewed as the promotion of technological change. Its contribution to technological change, if it could be estimated, would probably constitute the best gauge of its value as a social institution. However, attempts to make such an estimate encounter two formidable obstacles: the lack of an adequate index of technological change and the problems involved in relating patented inventions to such an index. These difficulties warrant further investigation.

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10 Simon Kuznets, "Comment" on Goldsmith, *Studies in Income and Wealth,* Vol. XII, p. 178.

11 In the war decade of the 1940's the rate was 2.9 per cent and the estimate for the 1950's is 2.3 per cent. See J. Frederic Dewhurst and Associates, *America's Needs and Resources: A New Survey* (New York: Twentieth Century Fund, 1955), pp. 42-46.

This figure is cumulative; thus an increase in output per man hour of 2 per cent per year means that total output per man would double about every 35 years. Stated in another way, if man hour output should continue to increase at a yearly rate of 2 per cent, then the standard of living of an average citizen scarcely more than half a life span away would be double that of an average citizen today. Considering that measures such as these fail to take into account the decline in the work-week, leaving increased leisure time to enjoy income, and recognizing that such measures inadequately reflect new products and improvements in quality of existing products, such a rate of growth is truly amazing.

12 Broadly conceived, this process would include the introduction of all cost-saving methods of producing existing products which are possible under a given set of relative prices of products and factors of production, as well as the introduction of new or qualitatively better products which are possible under given conditions of market uncertainty.

### *The Inability to Measure Technological Change*

On the industry-wide or economy-wide level, technological change is often indicated by productivity indexes—ratios of the change in output per unit of some input. Since labor is more easily measured, labor productivity indexes are commonly employed. But not all changes in labor productivity are due to the forces of technological change.[13] Yet labor productivity indexes might possibly indicate the *direction* of technological change reliably, even to the point of allowing comparisons over time, although not permitting inferences about the actual amount of change. That the two move together seems to be correct. But to say that they move in the same ratio, so that a change in productivity implies a proportionate change in technology requires the use of several assumptions of questionable validity. One must assume that the nature of technological change is such as to lead to a major pattern of substitution between other inputs and labor, thus assuring that the productivity index would be affected by such change. Furthermore, where substitution between inputs other than labor takes place (which would not be reflected in the index), one must assume that the rates of substitution between them are the same as the substitution rate between labor and other inputs. The authors of *Cost Behavior and Price Policy* have remarked:

> Since no way exists of verifying the importance of these possibilities, one cannot place much confidence in indexes of output per man-hour as measures of technical change. The mere fact that they move in the direction that might be expected cannot instill any faith in the magnitudes they indicate.[14]

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[13] "First, a change in the rate of plant utilization may influence output per manhour, depending on the character of the input-output relations. Second, a change in relative factor prices may induce a substitution among labor services and other factors; for instance, a rise in the price of high quality raw materials may mean that a cheaper material requiring more labor is used. Third, since all skills of labor are equally weighted by the hours of employment, a change in relative wage rates may induce a substitution among different types of labor and a change in output per manhour. Fourth, a special difficulty arises when data for more than one firm are combined to present industry figures (and all indexes of 'productivity' are of this character). The addition of less 'efficient' firms at high levels of industrial output, coupled with their disappearance from business in periods of depression, introduces another factor which may induce changes in output per manhour or per wage earner. Fifth, variations in the size and scale of plant may result in an altered combination of factors and hence a change in output per manhour. Sixth, an index of output per manhour may vary because of technical changes . . . resulting from the substitution of other factors for any type of labor included in the manhour data. This heading includes the impact of 'undermaintenance' of equipment and other resources upon output.

"To designate as a change in 'productivity' the variation in output per manhour arising from the first five of the above factors is certainly a mistake, or at best a peculiar conglomerate useful only for specialized purposes. For the system as a whole there may be some sense in indicating the way in which output per manhour has fluctuated. A study of the path of output per manhour may be useful in predicting the probable increase in output for small changes in increased man hours of application. Such data might be especially interesting for war economies, but certainly they could hardly be expected to give an accurate picture of the variation in technical change as defined here. In addition to including the effects of too many factors, indexes of output per manhour may ignore certain types of technical change or give rise to incorrect inferences concerning their magnitude."—E. S. Mason, *et al., Cost Behavior and Price Policy* (New York: National Bureau of Economic Research, 1943), pp. 150-151.

[14] *Ibid.*, pp. 153-154.

Similar problems would be encountered in attempting to employ productivity indexes based upon some other input. Thus, it is necessary to make refinements in order to isolate technological forces. The following technique has been used, although its imperfections for such a purpose will be apparent.[15] In a composite or aggregate productivity index we may distinguish three principal elements: the volume of inputs used, technical efficiency, and economic efficiency. Technical efficiency is the increase in output of specific goods and services relative to input. Economic efficiency refers to increases in output due to shifts of inputs from one use to another. For instance, if labor inputs are transferred from low productivity to higher productivity sectors, the productivity index would rise. Since the transfer would be due to shifts in demand, the term "economic efficiency" is used to describe such phenomena. Such changes in productivity should be represented in an over-all productivity index, but they are not the result of changing technology, and should be eliminated in an index purporting to represent changing technology. The usual method of isolating technological forces is to use constant weights in combining individual industry index numbers. This, in effect, means that shifts of factors of production between industries are prohibited by statistical means. But it does not preclude intra-industry shifts between firms of differing efficiency. Furthermore, technological changes in one industry may draw factors from other industries, particularly in periods of full employment; thus some inter-industry movement may be the result of technological forces.

In addition to the difficulties involved in isolating the technological element in productivity indexes, there is a deeper problem stemming from the fact that all of the forces of technological change are not adequately reflected by the indexes. The late Wesley C. Mitchell has said:

> . . . the best of our production indexes give inadequate representation to new industries, to services as compared with commodities, to "secondary" production, to the utilization of by-products, and to improvements in the quality of products. All of these inadequacies tend to introduce a downward growth bias into the indexes. This bias is offset only in small part by the omission of industries which have ceased to exist and the under-representation of decadent industries. Hence all the long-ränge production indexes now available, and probably the best long-range indexes which could be constructed from surviving records, are likely to understate the rate of growth in total production.[16]

There are reasons for believing that these factors responsible for the understatement of the rate of growth of production are largely the result of technological progress. Kuznets has remarked:

> Technological changes in conditions of work have meant not so much increased capacity to produce the same things with less effort as capacity to produce things that could not be made earlier—products that either satisfy already established wants more satisfactorily or cater to new tastes and desires.[17]

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[15] The technique discussed in this paragraph is taken from John W. Kendrick, "National Productivity and Its Long-Term Projection," Studies in Income and Wealth, Vol. 16, *Long Range Economic Projection* (New York: National Bureau of Economic Research, 1954), pp. 75-81.

[16] From A. F. Burns, *Production Trends in the United States Since 1870* (New York: National Bureau of Economic Research, 1934), pp. xxii-xxiii.

[17] Simon Kuznets, *National Income, A Summary of Findings* (New York: National Bureau of Economic Research, 1946), pp. 33-34.

Also, the underrepresentation of service industries (in which a growing proportion of the labor force is employed) may obscure technological forces. The growth in this sector of the economy is at least partly the result of technological developments, either in the service industries themselves or in other industries, thereby freeing resources for use in the service industries.

Thus it seems clear that productivity indexes cannot be relied upon to measure technological change, however useful they may be in measuring the over-all growth or level of performance of the economy.[18] In order to uncover the technological element in economic progress, other measures must be utilized. But no adequate one is currently available. One measure which has attracted recent interest involves the use of engineering production functions. Such functions identify the outputs obtainable from input combinations under given production-processes. Measurement of changes in the use of these functions over time, and hence of changes in production processes, would yield information useful in analyzing technological change. However, such a technique raises the problem of comparing new or qualitatively better products in terms of old ones. Thus it would be useful mainly in providing information relating to cost-saving methods of producing existing products. Furthermore, though this technique may be applicable to an individual firm or industry, it presents insuperable difficulties relevant to the measurement of technological change on the economy-wide level. It would be expensive and, practically speaking, impossible to obtain the necessary empirical information involved in the establishment of a production function for each production process used in the economy.

### *The Relationship of Patented Inventions to Technological Change*

These imperfections in current measures of technological change are, of course, recognized. But, since no better alternatives exist, labor productivity indexes are still employed. However, even if a decision is made to employ such an index as a measure of technological change, there are additional problems involved in relating patented inventions to it. To attempt such a task presumes that the contribution of the patent system to technological change can be reliably determined on an aggregate level of analysis. A consideration of techniques that might be employed indicates that this is not the case.

An obvious possibility would be to seek to correlate statistics of patent applications or patents issued with an index of technological change, allowing a time lag for the process of innovation to occur. Patent statistics have been used as measures of inventive activity,[19] but the results of these investigations throw no light on the value of the patent system in *stimulating* invention. It is even doubtful that patent statistics furnish evidence on the volume of inventive activity. By definition, each patented invention is unique. Therefore, they may differ from each other according

[18] For further documentation on this point, see A. J. Coale, "The Measurement of Changes in Productive Processes," Conference on Quantitative Description of Technological Change, *op. cit.*

[19] *Cf.* Schmookler, *op. cit.;* also Erwin Graue, "Inventions and Production," *Review of Economic Statistics* (now *Review of Economics and Statistics*), XXV, (August, 1943).

to the standard of comparison employed. Consequently, numbers of patent applications filed or patents issued are "rubber" indexes, consisting of non-homogeneous items. Since, in the absence of a detailed examination in each case, there appears to be no way to estimate the amount of "invention" connected with each patent, the use of patent statistics does not appear to be promising.

Another possibility offering conceptual promise is to estimate the amount of investment induced by the possibility of obtaining patent rights upon inventions and to relate this, by way of national income analysis, to the size and growth of the national income. Such a measure would furnish a gross index of the economic value of the patent system. It would not reflect those forces of technological change which are capital-saving, nor would it reflect obsolescence caused elsewhere in the economy. Furthermore, its applicability would largely be limited to periods of less than full employment, since changes in investment in a full employment economy would lead to rising price levels in addition to changing output. Finally, it is doubtful if such a technique, though conceptually promising, could be employed on an aggregate level. Detailed knowledge on the level of the firm needs to be developed before this approach merits further study.

## CONCLUSION

This section indicates that highly generalized approaches to the value of the patent system are not appropriate as a starting point. The basic reason for questioning the reliability of such techniques of measurement lies in the fact that the patent system functions by affecting expectations. The degree to which expectations are held and the effects of changes in expectations are difficult to measure. Indeed they constitute one of the thorniest problems of economic analysis. The patent system is only one of many factors influencing the decisions of individuals and firms via changes in the profitability of certain actions. Similar difficulties would arise in measuring the value of any incentive device. Thus the question of valuation of the patent system can be viewed as one aspect of the wider problem of the development of methods for estimating the effects of a variety of incentives.

Since the basic decision-making unit in a free enterprise economy is the firm, it follows that the most promising approaches to the value of the patent system should seek to estimate its impact on firms' behavior. It has been argued elsewhere in this study that the system probably affects firms in different ways and in different degrees. If this is so, better understanding of the *modus operandi* of the system in a wide variety of cases is required before its fruits can be reliably identified. Hence an intensive study of a well-selected sample of firms (the selection being perhaps based upon the results of the interview technique described in Section III) would be invaluable. Such a study would provide a frame of reference for determining the effect of the patent system on inventive activity, innovation, and disclosure. With the information obtained more generalized measures, such as the effects on national income of investment induced by the patent system, might be feasible. But, until these effects have been spelled out in reasonably reliable terms, other approaches to the problem do not appear to be especially rewarding.

## IV. THE EFFICIENCY OF THE PATENT SYSTEM AS A SOCIAL INSTITUTION: AN ALTERNATIVE APPROACH

Preceding sections of this report have been concerned largely with possible approaches to measurement of the effectiveness of the patent system as an economic incentive to invent, disclose, and innovate, and with the contribution of actions induced by the patent incentive to scientific and technological progress. The discussion has been based on the assumption that it is socially desirable to stimulate invention, disclosure, and innovation by means of the patent incentive.

There is an alternative approach to measurement of the value of the patent system which, while still based on the assumption that the system is socially desirable, does not require determination of the effectiveness of the economic incentive which it offers. Instead, this alternative approach involves consideration of whether that amount of incentive afforded by the patent system, whatever it is and however effective it might be in stimulating technological progress, is provided in the best possible manner. That is, this alternative approach to measurement of the value of the patent system is concerned with "how well" the patent system affords the economic incentive that it does afford rather than with "how much" incentive is afforded or "how effective" such incentive is in inducing the desired actions. Through this approach it might be possible to derive data which could be employed as a basis for judging the value of the patent system in terms of how efficiently it functions and of how closely it approximates its optimal contribution as a social institution, rather than in terms of the incentive it affords or of the balance between social cost and social benefit.

If it could be determined that the social cost of the patent system could be reduced without correspondingly reducing its social benefit, then it could be said that the system is not operating as efficiently as possible and therefore that it is not of optimal value as a social institution. Or if it could be determined that the social benefit of the patent system could be increased without correspondingly or more than correspondingly increasing its social cost, then again it could be said that it is not operating in an optimal fashion. The principal social cost of the patent system is the 17-year grant of exclusive rights to inventions or discoveries. The principal social benefit is an increase in the rate of invention, disclosure, and innovation and a consequent acceleration in the rate of technological progress. It might be possible, by means of appropriately designed studies, to determine the effect of certain changes in the patent system on the social cost and the social benefit derived from it. If so, a basis could be developed for judging whether the system as it now exists is the best one that can be devised.

Implementation of this approach would require determination of the changes in the conduct or actions of individuals and business firms which would result from certain specific changes in the patent system. For example, if it could be established that reducing the length of time for which patent rights are granted from 17 to, say, 14 years would not result in any diminution in the amount of inventive activity, in the number of inventions disclosed in exchange for patent protection, or in the rate with which newly invented products and processes are introduced commercially, then it could be concluded that such a modification in the length of patent protection would result in a closer approximation of the system to its optimal value as a social institution. Or, if it could be established that increasing the length of time for which patent rights are granted from 17 to, say, 20 years would not result in further stimulus to inventive activity, disclosure, or innovation, the conclusion would be that such a change would result in the patent system less closely approximating its optimal value as a social institution.

The effect on decisions concerning inventive activity, disclosure, and innovation of other modifications in the 17-year monopoly grant could be investigated. For example, would a period of legal protection varying from, say, 17 to 5 years, depending either upon usage of patented inventions or upon the type of inventions, reduce the incentive afforded by the system to invent, disclose, and innovate? Would compulsory licensing of patented inventions, either immediately upon issuance of patent rights or after some designated period of time, reduce the social cost of the patent system without reducing its efficiency as an economic incentive? Similar questions concerning the effect on efficiency of changes in antitrust provisions involving patents, of changes in Patent Office procedures, and of changes in legal procedures and legal precedents involving patents could be investigated.

It might also be possible to determine whether, by modifying the qualifications for patent protection, the social benefit of the patent system could be increased without at the same time affecting unfavorably its social cost. For example, if a higher standard of invention were initiated which would make it more difficult to qualify for the 17-year period of patent protection, would the contribution of the patent system to the rate of technological progress be affected? If not, then obviously such a higher standard of invention would be desirable since no increase would result in the social cost incurred as a result of individual patent grants, yet fewer grants would be made. Would requirement of fuller disclosure of information regarding an invention in order to qualify for patent protection reduce the incentive afforded by the system to invent, disclose, and innovate? Would a more effective system of classification and of dissemination of such information by the Patent Office operate to reduce the economic incentive afforded by the patent system? If not, then obviously requirement of fuller disclosure and introduction of an improved system for disseminating information concerning patented inventions would be desirable.

Little difficulty would be encountered in evaluating the results obtained in studies of these questions when they indicate that no change in the efficiency of the patent system as an economic incentive would be brought about by a given reduction in the social cost of the system, or when the results indicate that no change in social cost would be brought about by a given change in the system's efficiency. However, if the results of such studies indicate that both changes in the efficiency and the social cost of the system would result from a given change in the system, they might not permit unequivocal interpretation. A similar difficulty would arise if the effect of several simultaneous changes in the patent system were investigated. For example, if it were proposed that some sort of compulsory licensing provision be introduced into the patent law and that at the same time the length of the period of patent rights so modified be extended, and if it were found upon investigation that the resulting arrangement would likely provide about the same economic incentive to invent, disclose, and innovate as previously provided, it might be difficult to judge whether the social cost of the system on balance would be reduced by adoption of the proposal. Judgment of the desirability of such a twofold change in existing features of the patent system involving social cost would be even more difficult if it were anticipated that the change would also affect the incentive afforded by the system. Nevertheless, the results of studies of questions such as the above might be of some use in judging whether the present patent system could operate as effectively as an incentive device at a lower social cost.

Enough has been said to indicate the nature of this alternative approach to measurement of the value of the patent system and the types of questions for which answers would have to be obtained. However, whether techniques could be devised which would permit reliable testing in the manner suggested is beyond our competence to judge. Nevertheless, conceptually such an approach to measurement of the efficiency with which the present patent system operates appears to be sound. If sufficiently reliable information on questions such as those suggested above could be obtained, a basis would be provided for judging whether the patent system could be made into a more valuable social institution and, if so, what changes would result in a more nearly optimal functioning of the system.

# Patent and Other Factors in the Development of Firms in the Custom Heat-Treating Industry*

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SUMMARY

CUSTOM HEAT-TREATING FIRMS constitute a new, dynamic service industry intermediate between metal producers and metal fabricators. Since these firms often operate side by side with the captive shops of large manufacturers, (e.g., steel, automotive, or farm implements), this inquiry was undertaken to ascertain the implications of patents for their origin, survival, and growth. The necessary information was obtained by means of a brief questionnaire drawn up with the aid of the Metal Treating Institute, a new trade association; correspondence with firms not covered by the questionnaire; field interviews; and a trade literature review.

The study shows that:

1. Patents owned by independent heat-treating firms have proved vital to the success of those firms.

2. Patents owned by some heat-treating firms are used by others under license for a fee.

3. "Know-how" and unpatented, but allegedly patentable, inventions are generally regarded as essential ingredients of a firm's economic security.

4. Technical assistance is given to heat treaters by makers of equipment and suppliers of materials and accessories.

5. Extant and expired patents are regarded as major factors in the success of producers of furnaces and other equipment.

6. Trade-marks and patents are regarded as valuable by suppliers of materials and accessories.

## I. INTRODUCTION

### A. PURPOSE OF STUDY

THIS STUDY INQUIRES into the role of patents and other pertinent factors in the development and operations of a new industry comprising independent firms engaged in custom heat treatment of metals. Since it is confined to independent

* Dr. Belfer prepared this research report. This is a report on one of three case studies designed, carried out, and written up under the general direction of Dr. Siegel for *Project 3a*, **Effect of Patents on the Creation and Growth of Small Industrial Units.**

firms, various findings will, of course, not apply to captive heat-treating shops operated by metal fabricating firms.

### B. NATURE OF HEAT TREATING

Heat treatment involves the heating and cooling of a metal or alloy in the solid state for the purpose of obtaining certain desirable conditions or metallurgical properties. It changes the internal structure of metals, whereas other methods designed to give metals special properties, such as plating, finishing, anodizing, and cladding, merely involve surface treatment without effect on internal structure.[1] It helps satisfy the needs of modern industry for metals having extra strength and ability to function under extremely high temperatures.[2] It imparts added strength to carbon steels, case-hardens softer steels, and relieves the internal stresses in worked metals.

Since this research project report is concerned with economic aspects of the industry rather than with the technical or engineering aspects, heat-treating processes are briefly discussed in Appendix I.

### C. NATURE OF THE CUSTOM HEAT-TREATING INDUSTRY

The independent heat-treating industry is a relatively small and young one in the United States. Little has been written about it, and the Census of Manufactures supplies no segregated data concerning it. Virtually all the data on which this research project report is based have been obtained directly from interviews with officials in heat-treating firms and from the Metal Treating Institute, a new trade association.

Heat treatment is nowadays employed widely. Thus, many steel mills treat carbon steel to give it certain desired metallurgical properties before selling it to users. Steel users also frequently have their own facilities for heat treating steel and nonferrous metals. Thus, the automobile and farm equipment manufacturers buy basic types of steel which they then heat-treat to specifications. General Motors, Ford, Chrysler, Allis-Chalmers, and International Harvester are among the many large companies having in-plant facilities for the heat treatment of metals.

But we are more concerned with the group of independent firms that provide heat-treating services on a custom basis. They comprise a service industry for the steel user who buys steel from a mill or from an intermediate warehouser or distributor and may require a change in its properties to meet particular needs. If he does not have his own heat-treating facilities, he may contract with a commercial heat treater to alter the steel's properties to meet the specifications of the product

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[1] For a discussion of such processes, see "A Growing Need for Clad Metals," *Business Week*, August 16, 1952, pp. 61-66; "Texturized Metals," *Steel*, May 24, 1948, pp. 94 ff.; and "The Clad Metal Industry," *Investor's Reader*, July 20, 1949 pp. 14-16.

[2] "The Push to Hotter Temperatures," *Fortune*, January, 1954, pp. 114 ff.

he manufactures. The untreated steel is delivered to the heat treater for custom processing and then returned to the manufacturer. The heat treater does not own the steel (or other metal) being treated; he owns only his plant, furnaces, chemicals, and other equipment and materials necessary for his work.

The specialized service of custom heat treating constitutes a link in modern industry between the producer of basic steel and the producer of finished goods for the consumer. The heat treater rarely deals with the ultimate consumer but typically serves as an intermediary in the manufacturing process. He is somewhat similar to the independent tool or die maker located in most metal-using centers. Although automobile, aircraft, and agricultural implement manufacturers, for example, usually have their own tool and die making facilities, they frequently send work out to independent tool and die shops. These independents have been able to establish themselves within the framework of existing industries, and custom heat-treating firms have done the same.

In essence metal treatment is an old art. The village blacksmith was practicing custom heat treating when he took a piece of iron or steel and, by the use of the forge, bellows, anvil, and hammer, hardened the metal to meet the specifications of his client. Indeed, the blacksmith did virtually all the heat treating required 75 or 100 years ago.[3]

Modern heat treating emerged with the development of mass production. The automobile and farm equipment industries pioneered in the application of heat treatment techniques, and independent heat treating has been nurtured by these industries. However, the independent industry remained quite small until World War II. According to the Metal Treating Institute, there were only about a hundred independent commercial heat treaters in the country in 1935. During World War II, large quantities of metal had to be heat treated for use in airplanes, tanks, battleships, and other armaments requiring metals that were extremely hard, tough, and resistant to gunfire. The producers of military hardware expanded their own captive heat-treating facilities, but many new independent heat-treating firms also were established. The Metal Treating Institute estimates that there were three to four hundred independent heat treaters in the United States in 1955-56.

Today, in contrast with the art of the blacksmith, heat treating is very exacting. It is subject to careful quality control by means of automatic devices.[4] Nevertheless, the skill of the heat treater remains of fundamental importance.

### 1. *Geographic Distribution*

Independent heat-treating firms tend to locate wherever there are users of steel and nonferrous metals. They are found in major centers of manufacturing activity.

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[3] For a brief historical survey of the development of heat treatment of metals see "Heat Treating 1855-1955," *Iron Age*, June, 1955, pp. C2-C5.

[4] John J. Kennedy, "Metals 'Custom-Tailored' Through Controlled Heat Treating," *Metal Treating*, July-August, 1955, pp. 16 ff.

The membership of the Metal Treating Institute was distributed by states as follows in 1955-56:

| | | | |
|---|---|---|---|
| Alabama | 1 | Minnesota | 1 |
| California | 7 | Missouri | 3 |
| Colorado | 1 | New Jersey | 7 |
| Connecticut | 2 | New York | 6 |
| Illinois | 12 | Ohio | 8 |
| Maryland | 1 | Pennsylvania | 7 |
| Massachusetts | 3 | Texas | 3 |
| Michigan | 10 | Wisconsin | 9 |

These 81 firms comprise approximately 25 per cent of the firms in the independent heat-treating industry.

### 2. *Volume*

The Metal Treating Institute has estimated that its members, though constituting only one-fourth of the firms in the industry, account for approximately 80 per cent of the industry's volume. Billings of members of the Institute for the years 1948-1954 are as follows:

| | |
|---|---|
| 1948 | $10,830,000 |
| 1949 | 8,790,000 |
| 1950 | 12,740,000 |
| 1951 | 24,930,000 |
| 1952 | 30,875,924 |
| 1953 | 31,733,067 |
| 1954 | 25,250,000 |

The Korean conflict evidently gave a major impetus to the industry. For the first four months of 1955, billings of Metal Treating Institute members were over $9 million; an annual volume of approximately $30 million for 1955 was indicated. If the Institute membership accounts for about 80 per cent of the custom industry's volume, then the total independent metal-treating industry was doing an annual business of approximately $37.5 million in 1955.

### 3. *Size of Firms*

The independent heat-treating industry is essentially one of small firms. The Metal Treating Institute estimates that only five of its member firms had 100 or more employees. Only two firms—Lindberg Steel Treating Company in Chicago and Pittsburgh Commercial Heat Treating Company—had 300 employees. About 20 firms had between 60 and 100 employees, and approximately 40 firms were in the 20-to-60 employee class. About 16 firms had fewer than 20 employees. Several firms had only 4 or 5 employees.

In spite of their relatively small size, the independent heat-treating firms appear to be economically viable. Although small firms frequently find it necessary to merge for lack of capital, markets, or managerial ability, such absorption does not appear to be typical for the industry. Each firm has carved out a market area for itself in its particular geographic area. The limited area has tended to control size without, however, threatening a firm's existence. Accordingly, the industry may be expected to continue to be dominated by small firms.

### 4. *Customers*

As indicated earlier, the independent heat treater does not deal with the public or the ultimate consumer but works for the manufacturer of an intermediate or final product. His job is to heat-treat the steel or nonferrous metal part that becomes a component of a final manufactured product. Contract work is sometimes done directly for a government facility, such as an arsenal or naval shipyard. As a rule, however, the work is done for manufacturers who, in turn, hold government contracts.

### 5. *Competition in the Industry*

Competition among companies in the heat-treating industry is normally confined to each geographic area. Although the independent metal treaters get most of their work from manufacturers who do not have heat-treating facilities, they also obtain work from manufacturers having captive plants of insufficient capacity. A manufacturer may farm out his work because economy in heat treating may demand a relatively large volume. Although a large manufacturer may operate internal heat-treating facilities economically, a small firm may be ill advised to conduct captive heat-treating operations.[5]

Many instances may be cited in which independent heat treaters have successfully solicited business from companies with captive plants. Thus, one large firm in New York convinced three manufacturers that it was more economical for them to shut down their captive facilities and to contract their work. In the Houston area, many firms that had operated their own heat-treating facilities have turned to contracting in the interest of economy, flexibility, and quality.[6] A Minneapolis heat treater who estimates that 20 per cent of his customers have captive facilities of their own is able to get work from them because he has specialized apparatus and provides special services.[7]

Generally, the captive plants do only their own work. During the Korean conflict the government assisted in the expansion of heat-treating facilities, particularly those owned by metal products manufacturers. As a result, captive shops found themselves with excess capacity after the hostilities. Some of the captive shops accordingly sought business in competition with the independent heat treaters. Instances of this behavior have been observed recently in the San Francisco and Denver areas. Usually, however, captive shops do not compete with the independents.

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[5] Horace C. Knerr, "Facts and Figures on Heat Treating Costs," *Metal Treating*, January-February, 1954, pp. 4 ff. See also "Heat Treaters Cite Short Cuts to More Effective Purchasing," *Purchasing News*, September 15, 1953, pp. 20-21.

[6] *Steel*, December 13, 1954, p. 61.

[7] *Metal Treating*, May-June, 1955, p. 41. See also *Strategic Use of Outside Heat Treating Facilities Can Cut Costs*, Metal Treating Institute, New Rochelle, N. Y., 1955.

### D. SUPPLIER FIRMS

Metal-treating firms must purchase a considerable amount of equipment and materials. Among their purchases are furnaces, salt baths, temperature controls, quenching oils, refractories, agitators, heat-treating fixtures, cleaning equipment, heating elements, industrial gases, salts, tool steels, and gas generators.

Since the heating furnace is the most essential single piece of equipment to the heat treatment of metals industry, a brief survey was made of suppliers. Modern industrial furnaces are precision machines. Temperatures can be controlled to within a few degrees and impurities kept away from the metal being heat treated. Thus, a high degree of quality control is obtainable.

Industrial heating equipment manufacturers produce a variety of equipment, including ovens, combustion and induction equipment, gas furnaces, industrial furnaces, and flame-hardening machines. They operate in a "feast-or-famine" cycle, which is typical of the capital goods industries in general. High levels of production, defense build-ups, and war have meant prosperity for the industry; non-emergency periods and low levels of industrial production have spelled stagnation. The industry is now enjoying a long-range expansion. In 1939 industry orders totaled about $9 million; in 1955, about $85 million.

According to the Industrial Heating Equipment Association, the industry consists of approximately 155 manufacturers. The 50 members of the Association account for about 75 per cent of the industry's volume. For most of the companies in the industry, heat-treating furnaces are the exclusive product or represent the bulk of output. On the other hand, General Electric, Westinghouse, Leeds and Northrup, and Allis-Chalmers are also large manufacturers of metal-treating furnaces; for these companies, furnaces obviously represent only a small part of the firm's total output. In the case of General Electric, the manufacture of heat-treating equipment is carried on by a separate Industrial Heating Department, which has its plant at Shelbyville, Indiana.

The customers of the industry include steel, automobile, and agricultural implement companies, among others. The independent custom heat treaters, who are the subject of this report, are also important customers, but they absorb only a moderate proportion of the equipment makers' output.[8]

### E. NATURE OF SURVEY

Information on the role of patents in the development and operations of firms in the independent heat-treating industry was obtained by means of a questionnaire, correspondence, and personal interviews. In the development of these data the writer had the cooperation of Mr. C. E. Herington, Executive Secretary of the Metal Treating Institute, who outlined the general significance of patents and other pertinent factors in the operations of the industry. A questionnaire was then drawn up which the Metal Treating Institute sent out under its letterhead to its 81 members.

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[8] A detailed technical description of the various uses of industrial heating equipment is to be found in "Industrial Furnaces," *Iron Age*, February 25, 1954, pp. F1-F32.

The contents of the questionnaire are shown in Appendix II. The questions are of a general nature and only five in number. Mr. Herington advised that a brief questionnaire would elicit the best responses from the members, who were also encouraged to reply in detail if they so desired.

Twenty-one replies were received to the questionnaire—approximately 26 per cent of the number solicited. According to Mr. Herington, the responding companies constituted a fair cross section of the industry, although they did not comprise a "representative sample" in the statistical sense. They included the largest firms in the industry; they also included small and medium-size firms. Thus, replies were received in each of the following size groups: 1-5 employees, 6-20 employees, 21-60 employees, 61-100 employees, and over 100 employees. The responding firms also reflected the geographic distribution of the industry. The replies came from New England, the Middle Atlantic States, the Midwest, and the Far West.

The responses to the questionnaire are summarized in the following table:

| | YES | NO | OTHER |
|---|---|---|---|
| 1. Have developed processes which have been patented.... | 4 | 17 | |
| 2. Use processes patented by others.................... | 11 | 10 | |
| 3. Have developed processes which have not been patented | 10 | 9 | 2 |
| 4. Alter equipment after purchasing it................. | 13 | 6 | 2 |
| 5. Use "know-how" in operations....................... | 19 | 2 | |

Additional firms were contacted by mail on the advice of Mr. Herington that patents were of particular significance to them. Interviews were also held in the field to obtain first-hand information. Finally, reference was made to trade literature to round out the supply of pertinent data.

The results of the questionnaire, supplementary correspondence, interviews, and trade literature review are discussed in the following section of this report. By request, individual firms cannot be identified by name in all cases.

## II. ROLE OF PATENTS AND OTHER FACTORS

### A. CUSTOM HEAT-TREATING FIRMS PROPER

#### 1. *Role of Owned Patents*

Six of the surveyed firms indicated that patents developed through their own research have played a significant role in their rise and operations. In one case the patent has expired, but this fact has not interfered with the firm's activities.

Another firm, in Philadelphia, was founded more than a quarter century ago upon a patent for a type of heat-treating furnace known as the inverted pit. This furnace has been used continuously by the firm for many years, and improvements in it have been made from time to time. However, the firm has not applied for patents on these improvements. Recently, imitations of the furnace have been put on the market by other firms, but the original inventor is satisfied that these imitations do not embody the advantages of the original design.

A few years ago, a firm in Los Angeles instituted use of the patented Sanford process, which gives a hard surface to aluminum and is said to be satisfactorily applicable to all known aluminum alloys. By producing a hard, abrasion-resistant coating, it permits the use of aluminum alloys where formerly only stainless steel, hard chrome-plated metals, ceramics, or hardened steel could be employed. Heat treating of aluminum is of particular value for aircraft and allied products requiring high resistance to corrosion and wear, high strength, and light weight. Sanfordized aluminum parts may be ground, lapped, and otherwise machine-finished like hardened steel. As aluminum can be machined at a great saving in time and cost over steel, hard-surfaced aluminum has replaced hardened steel in various applications.[9] The Los Angeles company has developed a substantial commercial business in heat treatment of aluminum. It has made improvements in the original technique and applied for several additions to the original patent. No patents have been issued to date on these improvements.

A firm in Cleveland has patented a type of flame-hardening machine that it has successfully used in its operations. Another Cleveland company has patented a process for making pin-fin extended-surface heat exchangers. The process has proved technically successful and profitable too.

A New Jersey company has applied for two patents, one on a process for the surface-treatment of steels to be nitrided and the other on a retort-sealing method of heat treatment.

The sixth firm, Lindberg Steel Treating Company, is one of the largest in the industry. A major heat treater, this company found it desirable to design and manufacture many of the furnaces used in its operations. These furnaces were of such excellent quality that other heat-treating firms began to order them. The furnaces were patented, and the company was divided into the Lindberg Engineering Company of Chicago, which manufactures many of the basic furnaces used by heat treaters, and the Lindberg Steel Treating Company of Melrose Park, which operates solely as a heat treater.

### 2. *Role of Patents Developed by Other Firms*

Heat-treating processes have occasionally been developed by firms outside the industry and licensed to heat treaters. The Oil Well Supply Division of United States Steel, for example, has patented the Nitrocycle process. This is a method of high-pressure nitriding. In early 1955 the first license for the use of the Nitrocycle process was granted to the Commercial Heat Treating Company of Pittsburgh.[10] The Nitroalloy Corporation also has a patent on a nitriding process, which adds nitrogen to the treated metal through contact with, say, ammonia. It has licensed several heat treaters to use the process upon payment of a fee for the privilege.

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[9] A. Edward Zezula and John B. Franklin, "New Aluminum Hard Surfacing Process Gives Hard, Abrasion Resistant Coating," *Western Metals*, February, 1954, pp. 53-55.

[10] Reported in *Metal Treating*, March-April, 1955, p. 31.

Twelve of the surveyed firms indicated that they use one or more patented processes developed by other industrial firms. Normally, a royalty or licensing fee is paid for the use of these patents. The firms stated that such licensed patents have played a role of some importance in their operations and development.

Eight of the firms have been licensed to use the nitriding process developed by the Nitroalloy Corporation. The licensing arrangement calls for a royalty based on sales and pounds of metal treated.

Four firms have been licensed to use the Chapmanizing process, which has been patented by the Chapman Valve Manufacturing Company. The royalty fee is generally a flat amount per month plus a percentage of the dollar volume of Chapmanizing sales.

A large firm in Chicago indicated that it paid royalties for the use of three processes patented by others—Malcomizing, nitriding, and Chapmanizing. One heat treater reported use of an induction heating process patented by another firm in the industry.

### 3. *Role of Unpatented Inventions and "Know-how"*

About half of the surveyed companies ascribed considerable importance to unpatented but allegedly patentable inventions. A majority of the firms also stated that they make unpatented alterations in purchased equipment. Almost all of the companies assigned a great role to "know-how" in their operations.

Twelve of the responding firms stated that they had developed processes and techniques that they have not patented. Thus, a New York City heat treater has developed a process for giving treated steel a high surface finish by means of copper plating. A Cleveland firm has developed a continuous furnace for bright-hardening and brazing stainless steel in a hydrogen atmosphere.[11] A Pittsburgh company has developed a radiant flame-hardening machine that is extremely useful in the heat treatment of gears. Although the firm has enjoyed commercial success with the process, it has not sought a patent. An Illinois company has developed a process for the heat treatment of stainless steel, but, wishing to keep the process secret, has not patented it.

Six firms report that they have developed work-feeding devices, quenching devices, fixtures, and special furnace controls that they have not patented. Usually, the firms involved keep private any techniques and processes they have developed. Occasionally, however, they publish such information.[12]

One firm in New York experimented with a quenching oil to be used in an operation normally performed at a temperature of 100 degrees Fahrenheit. It developed a process for heating the oil to 200 degrees in the quenching bath. This change yields a much improved product, but a company spokesman has stated that no patent was sought.

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[11] This is described in *Metal Treating*, January-February, 1954, p. 28.

[12] See, for example, Fred Hunter, "Commercial Bright Hardening of Stainless Steel," *Metal Treating*, July-August, 1955, pp. 20-22; J. H. Bockrath, "New Surface Hardening Unit Provides Accurate Temperature Control," *Metal Treating*, January-February, 1954, pp. 2 ff.

A northern New Jersey firm indicated that it was working on several processes but that it did not intend to patent them after they were perfected. Another New Jersey heat-treating firm, however, indicated that it would attempt to patent any techniques that it developed and which it believed to be patentable. However, the opinion was that the company did not have any patentable improvements.

Fourteen firms indicated that they make numerous alterations in the equipment, chiefly furnaces, that they purchase. This practice is reflected in several of the responses to the question, "How much do you alter equipment—a furnace, for example—after purchasing it?"

> "I would say we alter every piece of equipment we buy."
>
> "A great deal—we frequently add fans, change mechanical features, alter heating burners, etc."
>
> "Considerably—both furnaces and controls (temperature—time—atmosphere)."

Patents have not been sought for these modifications of purchased equipment. The firms either deemed the modifications not patentable, or for other reasons did not take the trouble to apply. It was thought in most cases that the adjustments suited particular needs that were not of general enough significance to warrant patenting.

Two heat treaters in the Philadelphia area and one in Cleveland stated that they design and build most of their own furnaces, but do not seek patents. They cited two main reasons for their activity. First, they can build furnaces for considerably less than the market price. Second, they have frequently found it necessary to repair, alter, and rework furnaces after purchase to meet their individual needs so that building their own furnaces was actually more economical.

Almost all of the firms surveyed indicated that know-how was extremely important in their operations. One old-timer in the industry pointed out that all heat treaters use tricks and "gimmicks," acquired through years of experience, which they have not sought to patent. While heat treatment is essentially a science, they have in effect transformed it into a skilled art.

Simply stated, "know-how" is knowledge that has not found its way into a patent. The courts in Mycalex Corp. v. Pemco, 64 F. Supp. 425 (1946) D.C. Maryland have defined "know-how" as follows:

> "Know-how"—factual knowledge not capable of precise, separate descriptions but which, when used in an accumulated form, after being acquired as the result of trial and error, gives to the one acquiring it an ability to produce something which he otherwise would not have known how to produce with the same accuracy or precision found necessary for commercial success.

Know-how is not necessarily the same as a trade secret. In some cases the innovator of know-how has kept it secret; in others he has made it public.

Many firms indicated that know-how is used most of the time in their operations, and some even ventured the opinion that their operations depend 100 per cent on know-how for success. The great emphasis placed on know-how is indicated by a sampling of answers by the firms to the question, "To what extent do you use know-how in your operations?"

> "Know-how is one of the principal assets in our business, from the head of the firm, his principal assistants, down to the operating heat treater. It takes at least two years to develop a good all-around heat treater, including an apprenticeship course with night school classes."
>
> "It is the predominating factor in many of our operations."
>
> "Use of ingenuity enters into our work daily for best possible metallurgical results and in physical handling of the work best to preserve its shape."
>
> "We use know-how extensively in the use, alteration, and control of furnace atmospheres—also do rough design requirements on new equipment."
>
> "Our operations are determined almost entirely by our experience."
>
> "Know-how represents a considerable part of heat treating."
>
> "It is our know-how that has built our business."
>
> "Know-how is used to a very great extent in our plant."
>
> "A considerable amount of past experience always helps to solve tough jobs—some wouldn't be successful without it."
>
> "Full extent"
>
> "70%"
>
> "Most of the time"
>
> "At least 90%"
>
> "25-40%"
>
> "To a large extent"
>
> "100%"

### 4. *Role of Technical Assistance and Trade Literature*

A considerable amount of research on basic metallurgical problems and on heat-treating techniques is done by the major steel companies, which generally make the results freely available to the independent heat treaters. The steel companies issue various technical publications on heat-treating techniques. Similar bulletins are issued by some of the companies that manufacture furnaces, refractories, quenching oils, chemicals, and salts used by the heat treater.[13]

The surveyed heat-treating firms indicate that they study these reports and find them quite helpful in their operations. Occasionally, heat treaters have been able to use information contained in the trade literature as the basis for making innovations

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[13] Examples of such literature are *Hardenability of Steel,* issued by the Crucible Steel Company of America, 1954; *Heat Treating Hints,* issued by the Lindberg Engineering Co.; *Preheating Chart,* distributed by the Tempil Corp.; *Alloy Steels Pay Off,* published by the Climax Molybdenum Co.; *Induction Heating,* available from Westinghouse Electric Corp.; *The Working of Tool and High Speed Steels,* published by the Allegheny Ludlum Steel Corp.

in their established procedures. Several of the firms indicated that they have received technical assistance from steel manufacturers and heating equipment companies in the improvement of heat-treating techniques.

Trade journals, publications of metal and equipment producers, and information furnished by material suppliers provide heat-treating firms with a considerable amount of technical data which is a factor in their commercial success.

### B. EQUIPMENT PRODUCERS

In this section and the following, a brief sketch is given of the significance of patents and trade-marks to auxiliary industries. This section discusses their role in equipment-producing firms, and Section C considers firms supplying such materials as salts, fixtures, heating elements, and tool steels.

Mr. Carl L. Ipsen, the Executive Vice President of the Industrial Heating Equipment Association, believes that there are no truly basic patents in his industry today. The patents that originally covered the basic furnace designs and other heat-treating equipment have all expired. To be sure, many of the firms hold patents, but it is Mr. Ipsen's conviction that these cover only details and modifications of existing basic equipment. He feels that no firm now owns any controlling patents, so that all firms are free to make almost any type of furnace or other equipment they wish. The preceding does not deny the vital role of both expired and current patents in the development of the industrial heating equipment industry. While a patent existed, the firm holding it enjoyed a considerable advantage. Furthermore, firms have been able to maintain a pre-eminent position in the industry even after their patents expired. Current patents have an acknowledged place in the operations and development of individual firms. The next five paragraphs illustrate the significance of patents in the development of equipment companies.

The Ajax Electric Company of Philadelphia achieved considerable growth through its control of the Swedish Hultgren patents for an electric salt bath furnace. This furnace, which employs closely spaced electrodes, permits the quick and uniform heating of steel. The company achieved a basic position in the heating equipment industry with this patented furnace. Although the patent has expired and other manufacturers are in the field, Ajax still enjoys a predominant position in the manufacture of electric salt bath furnaces.[14]

Leeds and Northrup Company of Philadelphia, as indicated earlier, manufactures heat-treating equipment. The company has a trade-mark on an item known as the "Rayotube" detector. The purpose of the "Rayotube" detector is to provide an accurate method for direct temperature determinations during the heating cycle in the process of metal treating. This "Rayotube" detector has helped Leeds and Northrup maintain an outstanding position in the industrial heating equipment industry.[15]

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[14] A description of some of the furnaces produced by the Ajax Electric Company is contained in two bulletins they have issued: Technical Bulletin 500, "The Present Status of Austempering and Martempering," and Bulletin 700, "Ajax Cataract Quench Furnaces."

[15] J. L. Garrison, "Direct Measurements of Induction Heating Temperatures with L & N Rayotube Detector," *Metal Treating*, July-August, 1955, pp. 28-30.

The Lindberg Engineering Company of Chicago manufactures various types of furnaces, most of which are not patented. However, the company has enjoyed a considerable degree of success because of the quality of its equipment. Many of the country's heat-treating plants, both independent and captive, use Lindberg furnaces. The company recently introduced a low-voltage heating unit on which it has secured a patent.

The American Gas Furnace Company of Elizabeth, New Jersey, has been building reciprocating hearth furnaces since 1921. The patent on this type of furnace was of great importance in the original growth of the company. The company now has a patent on a new reciprocating hearth furnace, but this patent appears to be largely an improvement patent rather than a controlling one.

The Ohio Crankshaft Company of Cleveland enjoyed a long period of growth in the manufacture of heat-treating equipment as a result of basic patents that it developed. Most of these, however, have expired, and anyone is free to manufacture the particular type of equipment involved. Nevertheless, the company still enjoys a prominent position in the industry. It has an established position in the field of induction brazing and owns the trade-mark on a brazing process known as "Tocco."[16]

### C. SUPPLIER INDUSTRIES

As indicated earlier, heat-treating firms use a variety of materials in their operations. Firms supplying these items have secured patents and trade-marks on several types of materials. These patents and trade-marks have played an important role in the development and operations of the companies owning them. A few illustrations follow.

#### 1. *Salts*

Salt solutions may be used in the quenching operation. The American Cyanamid Company, a prominent manufacturer of quenching salts, has a product known by the trade-mark "Aeromet." The company has also obtained trade-mark registrations on the following heat-treating compounds: "Aerocarb," for carburizing compounds; "Aerocase," for case-hardening of metals; and "Aeroheat," which provides a neutral salt bath.

The Park Chemical Company of Detroit manufactures various types of quenching salts, liquid and solid carburizers, metal cleaners, and quenching and tempering oils. It controls the so-called "Neutra-Gas" process, which enables a heat treater to maintain a neutral chemical salt bath. The company charges a process license fee of $25 per year.

#### 2. *Heat-Treating Fixtures*

Heat treaters must use various fixtures, including trays, conveyor belts, and tubing, that are capable of withstanding high heat and heavy loads. The Electro-Alloys Division of the American Brake Shoe Company has registered with the

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[16] The process is described in a technical publication of the Ohio Crankshaft Co., "Typical Results of TOCCO Induction Brazing and Soldering."

United States Patent Office its trade-mark "Thermalloy" to identify a furnace conveyor belt. This furnace conveyor belt is capable of withstanding extremely high temperatures as well as heavy loads of metals to be treated. The company has enjoyed a large volume of sales with this item.[17]

### 3. *Heating Elements*

In the operation of electric furnaces, heating elements are required. Silicon carbide elements, developed in Germany years ago, have been manufactured in this country by the Carborundum Company. The Norton Company has recently produced an improved silicon carbide element, which has the trade-mark "Crystolon." This trade-mark is registered with the United States Patent Office. "Crystolon" heating elements are made of self-binding silicon carbide, with aluminum-sprayed tips and metal-impregnated ends, which minimize resistance to current passage and reduce power loss.[18]

### 4. *Tool Steels*

High-speed tool steels are necessary for treating and shaping metals. In many cases they are sold under special trade-marks, which may or may not be registered. The Crucible Steel Company of America has a high-speed tool steel which it sells under the registered trade-mark "Rex."

## III. SUMMARY OF FINDINGS

The purpose of this study has been to ascertain the role of patents and other factors in the development and operations of independent custom heat-treating firms. The findings of the study are summarized below.

1. Patents owned by independent heat-treating firms have played a considerable role in the commercial development and success of the firms owning them. Six of the surveyed firms indicated that patents which they developed through their own research were vital to their own operations. In one case, the patent has expired, but this did not interfere with the firm's well-established trade position.

2. Twelve of the surveyed firms indicated that they used one or more patented processes developed by other firms. A licensing fee or royalty was paid for the use of such processes, which have been important in the operations and development of the firms using them.

3. Great significance was ascribed to "know-how" and to unpatented but allegedly patentable inventions. Almost all of the independent heat-treating firms indicated that know-how helped establish their reputations and businesses. The comments of the individual firms testify to the important role ascribed to know-how by heat treaters. Eleven responding firms have developed improved techniques and processes which have not been patented, but which have helped in the firm's operations.

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[17] A technical description of this product is contained in "Thermalloy General Catalog, T-225," issued by the Electro-Alloys Division of the American Brake Shoe Company.

[18] "Norton Heating Elements," Norton Company, Refractories Division, Worcester, Mass.

4. Independent heat-treating firms receive technical assistance from equipment makers and suppliers of materials. The trade literature also provides much valuable technical data on the heat treatment of metals.

5. Patents owned by the producers of furnaces and other equipment, both current and expired, have been a major factor in the financial success of the firms involved. Several firms achieved a basic position in the heating equipment industry as a result of owning patents. Even after a patent expired, the firm involved was able to maintain a leading position in the manufacture of specific pieces of equipment on which it formerly held a patent.

6. A brief survey indicates that firms supplying heat treaters with materials including salts, oils, heating elements, tools, and fixtures also have an interest in trade-marks and patents.

## APPENDIX I

### TECHNICAL ASPECTS OF THE HEAT TREATMENT OF METALS

The first step in heat treatment, *heating* the metal to the desired temperature, is accomplished in a special heat-treating furnace in which temperatures may go as high as 3,000 degrees Fahrenheit. The required temperature is determined by the characteristics of the metal being treated and the metallurgical properties desired.

The second step is *soaking*. After the proper hardening temperature has been reached, the metal must be exposed to it for an appropriate period, since complete uniformity of temperature throughout all sections of metal is necessary.

The third step, *quenching*, involves cooling of the metal. The quenching medium used, whether air, water, oil, caustic soda, or brine, depends on the structure of the steel being treated. A caustic soda quench has a faster cooling rate than brine; brine cools steel more rapidly than water; water, faster than oil; and oil, faster than air. The quench medium and quench rate are selected in order best to harden the metal to the desired qualities. The higher the alloy content of the steel, the slower the metal must be quenched to obtain maximum hardness. Plain carbon steels have to be cooled rapidly, and highly alloyed steels (e.g., stainless and high-speed tool steels) must be cooled at a much slower rate.

Frequently, to obtain the best results, two or more quenching media may be used successively, such as oil and air. Proper quenching requires a considerable degree of know-how and skill on the part of the heat treater.

*Tempering* is the fourth step in heat treatment. Heating and quenching harden steel, but the steel must then be tempered to reduce the resulting undesirable brittleness. Tempering involves reheating the hardened steel to some predetermined temperature and then cooling it at the appropriate rate for the product. In addition to reducing brittleness, tempering enables the heat treater to reduce the steel's hardness and increase its toughness by any desired amount.

Various methods are used by the custom heat treatment industry for treating steel. Brief descriptions of the more commonly used methods follow. The last item will refer to nonferrous metals.

1. *Pack Carburizing.* Pack carburizing is the oldest known method. The material to be heat treated is packed in a closed container with a carbonaceous compound, such as bone or charcoal, together with energizer. The container and its contents are then heated to the desired temperature. Since the container is a closed box, no outside air can reach the metal and the internal reactions can go on for the necessary period of time. The container is then cooled slowly by air or by direct quenching in a liquid medium.

2. *Carburizing.* Carburizing, another very old process, was once one of the principal methods of making steel. It is essentially pack carburizing without packing in a container; and charcoal, brought directly into contact with the steel, enables the treated steel to absorb carbon. Heat treaters today use this method to develop a hard shell on the surface of low-carbon steel.

3. *Liquid Carburizing.* Liquid carburizing involves heating the steel to a temperature below its melting point in contact with some liquid. For a long time a cyanide solution was used. In recent years chemical companies, working with heat treaters, have developed new liquid carburizers. The process enables the heat treater to maintain excellent quality control. The metal can be treated on the surface as well as to some depth.[19]

4. *Gas Carburizing.* In the gas carburizing process the metal is sealed in a furnace and completely surrounded with gas. The manufacturers of heat-treating equipment have developed rotary, batch, and continuous types of furnaces.

5. *Stress Relieving.* Modern technology requires casting, rolling, stamping, machining, forging, and welding of steel. Such processes create stresses and strains in the internal structure of the steel; these can cause warpage and distortion when the product is being used. Stress relieving, requiring considerable skill on the part of the heat treater, involves treatment of the steel at the critical points that are likely to warp in use.

6. *Normalizing.* In normalizing, also used to relieve stresses and strains, the steel is heated to a predetermined temperature which restores the steel grains to the previous or normal structure. The steel is then cooled in air. Normalizing is used for steel that has been forged, cast, or hot rolled.

7. *Nitriding.* In the nitriding process nitrogen is used as the hardening agent rather than carbon. The metal is heated in contact with ammonia or some other suitable nitrogenous material. Nitriding makes steel more resistant to wear and to certain types of corrosion and enables it to retain hardness at high temperatures.

8. *Tool Steel Hardening.* Tool steels generally are steels with high carbon content which have been alloyed with such elements as manganese, nickel, molybdenum, or chromium. Although scientific metallurgical procedures must be followed, the know-how of the heat treater is also vital. Experience gives the heat treater a knowing eye and a touch and feel for the tongs.[20]

9. *Nitriding of High-Speed Steels.* The surface of high-speed steels is hardened by the process of nitriding, which gives additional wear resistance to the surface and prolongs the useful life of the tool. The steel is immersed in a nitrogen-rich salt bath for a specified period at a predetermined temperature below the melting point of the steel.

10. *Annealing.* In annealing the metal is softened through heating in a special furnace and thus prepared for various types of machining operations. Both the physical structure and the hardness of the metal can be controlled.

11. *Austempering.* Austempering is an exacting method in which the quenching operation is interrupted and the metal is held at a constant temperature for a sufficient time to change the internal structure. This process results in a tougher steel surface than the older quenching techniques.

12. *Martempering.* In martempering the quenching process is also interrupted at a specified temperature to produce certain desired changes in the internal structure of the steel. The process reduces stresses and results in uniform internal hardness.

13. *Selective Hardening.* Selective hardening processes rely largely on the skill, ingenuity, and know-how of the heat treater. Many ingenious methods have been developed to treat a specific section, but not the entire piece of steel.

14. *Cold Treating of Steel.* The cold treatment of steel has been developed by the steel industry and heat treaters in recent decades. The steel is heated to a predetermined temperature and then exposed to sub-zero temperatures. This exposure results in certain metallurgical changes in the internal structure that makes the steel more resistant to wear. The process has been found to be very useful in treating steel to be used in gauges, tools, and precision instruments. Considerable research is currently being done by metallurgists on the potentialities of cold treatment of steel, and refinements are being developed continually.

15. *Treatment of Nonferrous Metals.* The 14 heat treatment methods noted above apply largely to steel. It is frequently necessary, however, to harden nonferrous metals; such as copper, beryllium, aluminum, and magnesium. For example, brazing, required for joining metals with alloys of copper and zinc, may be accomplished by (a) heating in a furnace; (b) dipping the

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[19] A detailed discussion of liquid carburizing is contained in a pamphlet by E. N. Case, *Salt Bath Carburizing,* published by the American Cyanamid Company, 1955.

[20] A further description of the problems involved in the hardening of tool steels is contained in *Tool Steel Topics,* a pamphlet published by the Bethlehem Steel Company.

metal to be treated into a molten bath containing the brazing alloy; (c) heating the metal in an electrical resistance heating unit; or (d) heating the metal with torches.[21] In recent years heat treaters have developed a special process, known as Sanfordizing, for hardening aluminum. Research work is also being done on the problems involved in heat treating titanium alloys.[22]

## APPENDIX II

### QUESTIONNAIRE SENT TO MEMBERS OF THE METAL TREATING INSTITUTE

*Patent Process Survey*

1. Have you developed and patented any process in recent years?
   If so, what?
2. Do you use any patented process?
   Pay any royalty?
   If so, what?
3. Have you developed any process or technique that you have not patented?
   If so, what?
4. How much do you alter equipment—a furnace, for example—after purchasing it?
5. To what extent do you use "know-how" in your operations?

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[21] An extensive discussion of the technical aspects of heat treating is contained in a publication of the Metal Treating Institute, *Manual for Heat Treating Services,* 1946. The Institute also publishes a bi-monthly magazine, *Metal Treating,* which contains material on the metallurgical aspects of heat treatment. See also "Heat Treating—The Present," and "Heat Treating—The Future," *Iron Age,* June, 1955, pp. C7-C14.

[22] C. R. Cook, "Titanium Alloys Are Heat Treatable," *Metal Treating,* July-August, 1955, pp. 2 ff.

# The Patent Utilization Study*

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## Summary and Conclusion

THE PATENT UTILIZATION STUDY is a trial attempt to apply present-day statistical methods to patents in force to determine empirically the number of patents that are actually used in production and the extent of such use.

The present report sets the stage for the pilot study, describes the general procedures followed, indicates the returns that might be expected from the mail questionnaires, and gives a preview of the preliminary findings with respect to the proportion of patents used commercially and reasons for current non-use of patents.

Present indications, from a pre-pilot sub-sample, are that some information through mail questionnaires can be expected from 70, and at most 80 per cent of the assigned patents in terms of completed assignee and/or inventor questionnaires. Of the unassigned patents, returns might be expected from 35 to possibly 45 per cent. With such incomplete returns, it will not be possible to arrive at any firm conclusions on patent utilization and other characteristics of patents studied because of the possibility of bias in the returns. It is planned, therefore, to remedy this situation at least partially by interviewing a sub-sample of non-responding inventors and assignees to ascertain to what extent the characteristics studied of the patents of such inventors and assignees are different from the patents of those assignees and inventors who have returned completed questionnaires. Other methods might also be found useful to supplement personal interviews, so as to be able to test the extent, if any, that the patents of inventors and assignees who could not be reached by mail or personal interviews are different with respect to utilization and other significant characteristics from those for which questionnaires have been returned or interviews have been made.

The analyses of completed questionnaires received so far indicate a somewhat higher utilization rate of patents reported by inventors of assigned patents in comparison with unassigned patents. Comparison of inventor replies with respect to utilization of assigned patents with assignee replies shows a tendency for inventors to over-report the current use of patents. In terms of assignee replies, it would seem that of the sampled patents about 50 per cent were in current use or had been used in the past. These are divided roughly as follows: about 30 per cent in current use and 20 per cent used in the past. An additional 10 to 15 per cent are patents with prospects for use in the near future. This would suggest that, by the time assigned

* This is a research interim report on *Project 1a,* **Patent Utilization.** Dr. Sanders in large part prepared this report. Mr. Robert L. Carter and Mr. Robert E. Grindle are assisting on this project.

patents expire, 55 to 65 per cent have been used in production to some extent and at some time. For sampled unassigned patents, the proportion used is closer to 40 per cent, including current and past use. If patents with prospects for future use are also included, this percentage will approach 50. It would appear, therefore, that between 40 and 50 per cent of unassigned patents are used to some extent at some time before expiration.

In the preliminary findings the most frequent reasons given for current non-use of the patent by inventors of assigned patents are, in the order of relative frequency: (1) lack of market demand; (2) development of the art has taken a different course; (3) competitively at a disadvantage. The most frequent reasons for non-use reported by assignees are: (1) lack of market demand; (2) competitively at a disadvantage; and (3) other, reasons different from those listed specifically in the questionnaire. The most frequent reasons for non-use given by the inventors of unassigned patents are: (1) shortage or lack of venture capital; (2) patent does not provide sufficient protection; and (3) lack of market demand.

When the pilot study is completed and the findings are mechanically tabulated, it will be possible to establish many more tests of internal consistency and reliability of the returns. To generalize the findings, however, and to determine their range of variability in time and in response to various economic and social forces, it is essential to extend studies of this type over the entire life of the patent to isolate and measure the impact of various forces on utilization and related characteristics of patents.

## THE PROBLEM

CONSIDERABLE SPECULATIVE LITERATURE has been published by social scientists, engineers, industrialists, and others regarding the role of inventions in our economy. However, few of the conclusions are based on objective, factual data derived from a firsthand appraisal of the effects of inventions on our economy. We believe that such a factual appraisal is feasible with respect to the use of patented inventions provided the term *use* is given a functionally narrow definition.[1]

Such a study would attempt to determine the proportion of patents issued in a particular year, which are used in actual production before the expiration of the

[1] The term "patent" is used in place of the more formal term "Letters Patent." The patent statute defines a patent as the legal right to exclude others from making, using, or selling the patented invention. In this sense a patent is an intangible property right which gives the owner the right to bring suit against an infringer in order to restrain the unauthorized use of the patented invention. The invention itself exists separate and distinct from the patent. The term "invention" thus refers to the subject-matter covered by the patent and is often used interchangeably with the term "patent." However, in this article, the term "patent" will be used generally as referring to the invention covered by the patent since the study is restricted to the universe of patented inventions. Occasionally the term "patent" will be used to refer to the exclusive legal rights inherent in Letters Patent and such usage will be apparent from the context.

patent. It would determine how soon patents used in production were put to use after the filing of the patent application, how many of these were put to use prior to the issuance of the patent, for what periods, the length of time patents are generally used, and the extent of such use. One measure of the extent of use would be the monetary income inventors derive from patented inventions and the monetary returns of assignees from assigned patents. The study would yield information on the economic or competitive value of patents which are not used in actual production. Information would be obtained on specific social, economic, or technological factors which stimulate or inhibit the industrial utilization of different patents and the extent to which these effects are uniform or different for the various classes of patents. Many other relationships between utilization and other attributes such as the classification of the patent, the year of issue, the characteristics of inventors, etc., could be studied.

It would be necessary to interview a sufficiently large number of inventors and assignees conforming to the statistical requirements of a probability sample to obtain the kind of information referred to above. The results derived from such a sample could then be applied, with a relatively narrow margin of error, to all patents to determine the extent of patent utilization. If the results thus obtained over a period of years yield consistent patterns of patent utilization, it should then be possible to evolve a patent utilization index which could be projected into the future.[2] We hope it will be possible to predict the number of patents that will come into commercial use in a given year and thereby evaluate to some extent the impact that the use of these patents will have on our economy.

To do this, sampling is necessary in view of the nearly 600,000 patents in force in the United States. It would be impractical to attempt a study of all of these patents. Before such a study could be completed an appreciable number of these patents would have expired, and others would have taken their place. Moreover, in any study of patent utilization, the necessary emphasis is not on the patents that have been issued, but on the dynamic phenomena that may occur in the future. Unless it can be demonstrated that characteristics of utilization observed in one period are useful in forecasting similar utilization in another period, any empirical approach to the study of this problem would be futile for practical purposes. In this respect, therefore, this pilot study of patent utilization is an experiment to determine the extent to which patent characteristics remain constant from year to year, so that future events may be forecast. Ideally this would require interviewing thousands of inventors and assignees in different parts of the country to obtain a representative sample of all the patents in force over a representative period of time. However, it would be foolhardy to embark on such a costly project before we have explored its potentialities and practicalities beyond reasonable doubt. It was therefore proposed to conduct this pilot study of patent utilization, and the present article is a preliminary presentation of the approach and findings that have resulted from this effort to date.

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[2] Such a projection would have to take into consideration changes in economic and social environment, to the extent that these can be anticipated and would affect patent utilization.

## THE SCOPE OF THE PILOT STUDY

In this pilot study the term *use* means that prior to the expiration of the sampled patent the patent is being produced for sale or is being used in the manufacture of articles for sale. It is believed that with this limitation it should be possible to arrive at an operationally useful differentiation of patents which have proved of immediate and direct economic significance from those that have not as yet done so.

The Patent Utilization Study does not merely differentiate patents utilized from those not utilized; it goes beyond this basic distinction. It differentiates used patents *inter se* in terms of the extent and the nature of such use. It further seeks information on the effect that the use of the patent has had on sales and production costs of assignees or inventors. Furthermore, an effort is made to obtain the net monetary results from the use of the sampled patent as of the time of the preparation of the questionnaire.[3]

The study also seeks information as to interrelationships between the above characteristics of use and other attributes of the patent, such as the year of application, the year of issue, the lapsed time in the Patent Office between the date of application and the date of issue, the classification of the patent, the number of claims made by the patentee, the assignment status, etc. It will provide information regarding certain personal characteristics of the inventors and the extent that these are associated with use.

In the case of assigned patents, certain correlations will be sought among various characteristics of patents, the extent and nature of their utilization, and assignee characteristics. Assignee characteristics may include the type of industry, amount of capitalization, annual expenditures for research, etc.

## THE METHOD

A 2 per cent sample from all the patents issued in 1938, 1948, and 1952 was selected for this pilot study. Ideally the sample would have included some patents from each of the 17 years covering the term of a patent.[4] The three years were selected because it was felt more could be learned from a study where the sample represents the two extremes and roughly the mid-point of the 17-year period. The sample is what in statistics is regarded as a probability sample; that is, initially every patent in these three years had a known probability (in this case the same probability) of being included in the sample. The method used in selecting the sample was systematic sampling, using the patent numbers as the basis for sampling.[5]

Instead of interviewing the inventors and assignees, it was felt that many of

[3] For the scope and content of the inventor and assignee questionnaires see Appendix B.

[4] The statutory period of a patent is 17 years, after which the invention becomes public property.

[5] To select the sample, from a table of random numbers, two sets of two-digit numbers were drawn. These turned out to be 10 and 59. Thus all patents with numbers having terminal digits of 10 or 59, issued in 1938, 1948, and 1952 were selected as the sample. This gave a 2 per cent sample for each of the years selected. This assumes, of course, that (1) in assigning numbers to patents all numbers are used; there is no pattern or design in assigning numbers to patents by the Patent Office; and (2) one type of patent has the same probability of being assigned a particular number as any other type. The second prerequisite is fully met; with respect to the

these could be reached by mail questionnaires. However, initial interviews were conducted with a limited number of inventors and assignees in order to develop and pre-test mail questionnaires. It is assumed that the bulk of the study can be carried out by means of mail questionnaires. To determine whether refusal to respond to the questionnaire introduces a bias in the returns, and if so, the extent of such bias, it is planned to follow up, by personal solicitation and interview, a sub-sample of inventors and assignees who fail to respond to the mail questionnaire. It is possible that in addition a number of substitute means might be found, some of them reflected in this interim report, to test the representative nature of the working sample.

## THE PURPOSE AND SCOPE OF THIS REPORT

The present report is not a report of the completed study. Many of the inventor and assignee questionnaires have not yet been received. Furthermore, for efficient analysis of the entire body of data collected, and their interrelationships, it will be advisable and economical to use statistical data processing machines. The study has not advanced far enough for such processing.

The present report, aside from describing briefly in the preceding pages the purpose and method of the pilot Patent Utilization Study, aims to deal with the following:

1. Present the gross characteristics of the 2 per cent sample, showing the number from each of the years sampled and their distribution according to the residence of the inventor and the assignment status of the patents, and the homogeneity of the patents in terms of these characteristics for the individual years sampled.

2. Compare a few patent characteristics derived from the present sample with the characteristics of the population sampled in terms of a complete count or other samples.

3. Present the phases or stages in which questionnaires were mailed to inventors. The division of the 2 per cent sample into sub-samples[6] provides a basis to test the reliability of the findings in terms of the internal consistency of these sub-samples.

4. Present an analysis of the returns from the pre-pilot phase of the sample. This was the first phase in which mail questionnaires were used. Therefore, the percent-

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first prerequisite the requirements are closely approximated. Thus in "Distribution of Patents Issued to Corporations (1939-55)" Study of the Subcommittee on Patents, Trademarks, and Copyrights of the Committee on the Judiciary, U.S. Senate, 84th Congress, 2nd session, Pursuant to S. Res. 167, Study No. 3, it is stated, p. 3, footnote 2: "If the number of the first patent issued in 1939 (2,142,080) is subtracted from the number of the first patent issued in 1956 (2,728,913) the result would be slightly higher than the total given here. This is due to the fact that some patent numbers were not used: an application might be in process of issue with the patent number assigned and then be withdrawn for some reason and the patent not issued (or issued later with another number), in such event the assigned patent number could not be used for some other case. These withdrawals averaged 26 per year during the period involved here."

Accordingly, the use of a table of random numbers was not a necessary condition to the selection of a random sample from the patent population. For an explanation of the use of a table of random numbers to prevent possible bias in sampling see G. W. Snedecor, *Statistical Methods* (Ames: The Iowa State College Press, 5th ed., 1956), p. 9 *et. seq.*

[6] See Appendix A.

age of returns will give an indication of the returns of completed questionnaires that might be expected from the completed pilot study mailings.

5. Present some preliminary findings with respect to the percentage of patents utilized and the reasons given by inventors and assignees for current non-use of patents. Of course, these findings are based on completed questionnaires received thus far; therefore, their reliability is still open to question if applied to the populations sampled.

Much of the work in preparing this interim report has involved extensive statistical testing of the early returns from the different phases of the 2 per cent sample to check their consistency and to ferret out any evidence of possible selectivity in the early returns in comparison to later returns—some of these in response to repeated requests to inventors and assignees. In this report only the general conclusions will be considered. Because this is the first systematic study of patent characteristics by modern statistical methods, the detailed analysis and the detailed methodological implications will be presented in a subsequent report.

## CERTAIN GROSS CHARACTERISTICS OF THE SAMPLE

Table 1 presents certain characteristics of the 2 per cent sample selected for the pilot Patent Utilization Study.

### TABLE 1

NUMBER OF PATENTS ACCORDING TO THE YEAR IN WHICH ISSUED AND THE PERCENTAGE DISTRIBUTION ACCORDING TO RESIDENCE OF THE INVENTOR AND THE ASSIGNMENT STATUS OF THE SAMPLED PATENT.

PRELIMINARY

| Assignment Status of Patents and Residence of Inventors | Year of Issue of Sampled Patents 1938 | | 1948 | | 1952 | | All Three Years | |
|---|---|---|---|---|---|---|---|---|
| | No. | Per Cent | No. | Per Cent | No. | Per Cent | No. | Per Cent |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Total | 762 | 100.0 | 479 | 100.0 | 873 | 100.0 | 2,114 | 100.0 |
| Total assigned: | 502 | 65.9 | 317 | 66.2 | 552 | 63.2 | 1,371 | 64.9 |
| Initially | 462 | 60.0 | 307 | 64.1 | 539 | 61.7 | 1,308 | 61.9 |
| Subsequently* | 40 | 5.2 | 10 | 2.1 | 13 | 1.5 | 63 | 3.0 |
| Unassigned | 260 | 34.1 | 162 | 33.8 | 321 | 36.8 | 743 | 35.1 |
| United States residents | 645 | 84.6 | 436 | 91.0 | 768 | 88.0 | 1,849 | 87.5 |
| Foreign residents | 117 | 15.4 | 43 | 9.0 | 105 | 12.0 | 265 | 12.5 |
| United States residents: | | | | | | | | |
| Total assigned | 437 | 57.3 | 288 | 60.1 | 485 | 55.6 | 1,210 | 57.2 |
| Initially | 397 | 52.1 | 278 | 58.0 | 472 | 54.1 | 1,147 | 54.3 |
| Subsequently | 40 | 5.2 | 10 | 2.1 | 13 | 1.5 | 63 | 3.0 |
| Unassigned | 208 | 27.3 | 148 | 30.9 | 283 | 32.4 | 639 | 30.2 |
| Foreign residents: | | | | | | | | |
| Assigned initially† | 65 | 8.5 | 29 | 6.1 | 67 | 7.7 | 161 | 7.6 |
| Unassigned | 52 | 6.8 | 14 | 2.9 | 38 | 4.4 | 104 | 4.9 |

* Based on assignment records of the United States Patent Office checked in the spring of 1955 to ascertain the number of patents assigned subsequent to the time the patent was issued.
† Subsequent assignments by foreign inventors were not determined.

Table 1 shows the distribution of the 2 per cent sample of patents according to the year in which issued, and the residence of the inventor (whether residing in the United States or elsewhere) and according to the assignment status. Column 9, for instance, indicates that of the total number of patents included in this sample, nearly 65 per cent were assigned. About 62 per cent were initially assigned, 3 per cent were subsequently assigned, and 35 per cent were unassigned. For the three years, nearly 88 per cent of the patents were issued to residents of the United States. It further shows the percentage of patents issued to residents of the United States according to assignment status, and the corresponding percentages with respect to patents of non-residents. It will be noted that the proportion of the initially assigned patents does not vary widely from year to year in the three years studied. The proportion of subsequently assigned patents does vary as one would expect. The number as well as the proportion of such patents is highest in 1938;[7] this number and percentage is considerably lower in 1948, and lowest of all in 1952.

In 1938 about 5 per cent of the patents not assigned initially were assigned subsequently. This figure, however, is in terms of subsequent assignments of patents issued to residents divided by all the patents issued. For inventors residing in the United States these percentages of subsequent assignments are 6 (6.2) for all the patents and 16 (16.1) for patents unassigned at the time of issue. Of course, the constancy of this percentage of patents assigned subsequently would have to be tested by further parallel studies, using different terminal years.

The percentage of 1948 patents not assigned initially, but assigned subsequently, is only 2 and for 1952 patents it is less than 2 (1.5).[8] It is apparent that, during the life term of the patent, the number of patents that become subsequently assigned increases. If 1938 patents are typical in this respect, for inventors residing in the United States, of all the patents issued about 6 per cent, and of the initially unassigned patents about 16 per cent became assigned subsequent to issue.[9]

The proportion of patents issued to residents of foreign countries was highest in 1938 and lowest in 1948. This is understandable in the light of circumstances during World War II which prevented many foreign residents from taking out patents in the United States, and economic and other differentials since the war that would affect the decision of foreign inventors to apply for United States patents.

Regarding the percentage of patents initially assigned, statistical tests applied to the proportion of patents assigned in the three years indicate that there are no significant differences between these years. If these three years are typical of other years, it would seem that the proportion of patents initially assigned does not change markedly from year to year. In this connection, a recent study (U.S. Senate Study No. 3) prepared by the Patent Office for the Senate Subcommittee on Patents,

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[7] When this study began 1938 patents were still in force. When the search was made for assignment of patents subsequent to issue some of the 1938 patents had expired. This was by design, so that the prospects for future assignments would be nil (as it probably was for patents of 1938).

[8] In terms of patents issued to resident inventors, these percentages are 2.3 and 1.7 respectively.

[9] The subsequent assignment rate of patents in 1938 might deviate from the average of such rate because of the impact of World War II. This is another matter requiring additional studies.

Trademarks, and Copyrights[10] shows that the percentage of patents issued in these three years to corporations does not differ markedly from the average percentage of all patents in force as of December 31, 1955. The percentage of patents assigned to corporations (domestic or foreign) for the three years, derived from the Patent Office study, is 56.6, which does not differ materially from the average for the 17-year period, given as 58.5. It may be inferred, therefore, that it is probable that many of these percentages remain reasonably constant over a protracted number of years, or fluctuate within relatively narrow ranges. This inference is borne out by Figure 4, page 15, and Table 7 on page 12 of the U.S. Senate Study No. 3. The percentage range over the entire period is 54.5 to 64.5 and much of the deviation from the norm was concentrated in the war years when the proportion of patents issued to corporations was the highest. The figure indicates that, in the 20-year period, 1936-1955 inclusive, the percentage of patents issued to corporations has not changed materially. On the other hand, the proportion of patents issued to foreign residents, like subsequently assigned patents, shows statistically significant variation from year to year, in the war and postwar period.

## TESTING OF THE SAMPLE

The nature of the sample readily provides two equivalent sub-samples, patented inventions ending with the number 10 and those ending with the number 59. In the second methodological report to be published these two sub-samples will be presented separately so that the internal consistency of the entire sample may be tested.

A different kind of test may be obtained by multiplying the sample for the individual years shown in Table 1 by 50, to estimate the total number of patents issued in each of these years.[11] These yield the numbers of 38,100; 23,950; and 43,650 for 1938, 1948, and 1952, respectively. The United States Senate Study No. 3 gives the total number of patents issued in these three years as 38,060; 23,963; and 43,616, respectively. It is apparent that the estimates very closely approximate the actual number of patents issued in these years. The total number of patents issued in these three years was 105,639 and the estimate for this from the 2 per cent sample is 105,700.[12]

Another type of comparison may be made with respect to estimates of the proportion of patents initially assigned, derived from this study with percentages obtained by the Patent Office from a much larger sample. The Patent Office sample, however, is not a *probability* sample. This comparison is shown by Table 2.

[10] "Distribution of Patents Issued to Corporations (1939-55)" Study of Subcommittee on Patents, Trademarks, and Copyrights of the Committee on the Judiciary, U.S. Senate, 84th Congress, 2nd Session, Pursuant to Res. 167, Study No. 3. See Committee print 1957, p. 3, Table I, and see also footnote 4.

[11] Of course to derive any other estimate of patents of a certain type for any one year or all three years, the number of such patents found in the sample would be multiplied by 50—for instance, if we wished to estimate the number of patents issued to a particular corporation in these three years, or the number of chemical patents, etc., we would have to multiply the number of such patents in our sample by 50.

[12] We have ignored adjusting for the fact that certain numbers have no assigned patents—see footnote 5. Nevertheless, the estimates check very closely with the actual count of the total patent population.

TABLE 2

COMPARISON OF ESTIMATES OF THE PERCENTAGE OF PATENTS INITIALLY ASSIGNED BASED ON THE PATENT UTILIZATION STUDY, WITH ESTIMATES PREPARED BY THE PATENT OFFICE, FOR EACH OF THE YEARS SAMPLED AND FOR THE THREE YEARS.

PRELIMINARY

| Year | Per Cent of Patents Initially Assigned | | |
|---|---|---|---|
| | From the Patent Utilization Study | From the Patent Office* | Percentage Difference |
| (1) | (2) | (3) | (4) |
| 1938 | 60.6 | 63.1 | −2.5 |
| 1948 | 64.1 | 63.4 | +0.7 |
| 1952 | 61.7 | 61.6 | +0.1 |
| Three Years | 61.9 | 62.5 | −0.6 |

* Supplied by the Patent Office.

The comparison indicates very close agreement. If the sampling variation of the percentages derived from the Patent Utilization Study are taken into consideration, in no case are the differences between the percentages derived from this study and those obtained by the Patent Office statistically significant. The largest difference found is in 1938 when the Patent Office estimate was 2.5 per cent higher. The smallest difference is for 1952 when the percentage obtained from the Patent Utilization Study was 0.1 per cent higher. For the three-year period the difference between the two sets of estimates is approximately 0.6 per cent, well within the margin of sampling variation.

Table 3 presents another comparison between the estimates derived from the Patent Utilization Study and estimates obtained by the Patent Office.

TABLE 3

COMPARISON OF ESTIMATES OF THE PERCENTAGE OF PATENTS ISSUED TO FOREIGN RESIDENTS, FROM THE PATENT UTILIZATION STUDY, WITH ESTIMATES PREPARED BY THE PATENT OFFICE, FOR EACH YEAR AND FOR THE THREE YEARS COMBINED.

PRELIMINARY

| Year | Per Cent of Patents Issued to Foreign Residents | | |
|---|---|---|---|
| | From the Patent Utilization Study | From the Patent Office* | Percentage Difference |
| (1) | (2) | (3) | (4) |
| 1938 | 15.4 | 15.2 | +0.2 |
| 1948 | 9.0 | 8.3 | +0.7 |
| 1952 | 12.0 | 12.9 | —0.9 |
| Three Years | 12.5 | 12.7 | −0.4 |

* Supplied by the Patent Office.

This table compares the estimates derived from the Patent Utilization Study showing the percentage of patents issued to residents of foreign countries with similar estimates obtained by the Patent Office.

It should again be noted that the differences are small. When the sampling variations are taken into consideration, none of the differences is statistically significant.

A fourth comparison is available in terms of the duration of time elapsed between the date when the patent was applied for and the date when it was granted. This comparison is presented in Table 4.

TABLE 4

COMPARISON OF ESTIMATED MEAN DURATION OF TIME IN MONTHS ELAPSED BETWEEN THE APPLICATION FOR A PATENT AND THE GRANTING OF THE PATENT, FOR PATENTS ISSUED IN SPECIFIED YEARS, BASED ON THE PATENT UTILIZATION STUDY AND THE PATENT OFFICE DATA.

PRELIMINARY

| Year | Mean Duration of Time Elapsed in Months | | |
|---|---|---|---|
| | From the Patent Utilization Study | From the Patent Office* | Difference in Months |
| (1) | (2) | (3) | (4) |
| 1938 | 29.9 | 29.41 | +0.49 |
| 1948 | 39.5 | 40.51 | −1.01 |
| 1952 | 44.2 | 43.65 | +0.55 |
| Three Years | 38.0 | 37.81 | +0.19 |

* Supplied by the Patent Office.

It is to be noted again that the differences between the estimates derived from the 2 per cent sample of this study and those obtained by the Patent Office are small and statistically not significant.

These various comparisons indicate the essential statistical soundness of the 2 per cent sample. It is not possible to determine from these comparisons of parallel estimates whether the Patent Office estimates or those derived from this study are closer to the true values of the population from which the samples were taken. As already indicated, the distinction between the two estimates is that the Patent Office samples were commonly larger, but they were not *probability* samples. Therefore, it is not possible to derive any measure of sampling error for the Patent Office estimates. Measures of sampling errors for this study will be presented in the forthcoming second report.

PERCENTAGE OF RETURNS TO BE EXPECTED FROM MAILINGS AND ITS IMPLICATIONS

In the pre-pilot sub-sample extensive effort was made to follow all possible leads to obtain a current address for the inventor.[13] Once an address was found, efforts

[13] See Appendix A.

were made to persuade the inventor to return a completed questionnaire. While telephone contact has been used occasionally, there is no indication that this will increase completed questionnaires substantially where efforts through the mails have failed, although telephone calls may materially reduce the number of inventors classed as non-respondent.[14] The percentage of completed questionnaires, with respect to the patents in the pre-pilot sub-sample, might be used as an indication of the proportion of completed mail questionnaires that we are likely to get from the more recent mailings.

Table 5 shows the distribution of inventors in the pre-pilot sub-sample by response status, as of January 10, 1957, separately for inventors of assigned and those of unassigned patents, and for the two groups combined.

TABLE 5

NUMBER AND PERCENTAGE DISTRIBUTION OF INVENTORS IN THE PRE-PILOT SUB-SAMPLE BY RESPONSE STATUS SEPARATELY AND COMBINED FOR ASSIGNED AND UNASSIGNED PATENTS—RETURNS AS OF 1/10/57.

PRELIMINARY

| Response Status | Assigned | | Unassigned | | Assigned and Unassigned | |
|---|---|---|---|---|---|---|
| | No. | Per Cent | No. | Per Cent | No. | Per Cent |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Inventors in the sample | 152 | 100.0 | 59 | 100.0 | 211 | 100.0 |
| Completed questionnaires: | 91 | 59.9 | 21 | 35.6 | 112 | 53.1 |
| Inventor living | 89 | 58.6 | 20 | 33.9 | 109 | 51.6 |
| Inventor deceased | 2 | 1.3 | 1 | 1.7 | 3 | 1.4 |
| No questionnaire: | 61 | 40.1 | 38 | 64.4 | 99 | 46.9 |
| Inventor deceased | 19 | 12.5 | 6 | 10.2 | 25 | 11.8 |
| Inventor incapacitated | 2 | 1.3 | .. | ..... | 2 | .9 |
| No current address | 10 | 6.6 | 8 | 13.6 | 18 | 8.5 |
| No response | 26 | 17.1 | 23 | 39.0 | 49 | 23.2 |
| Refusal to answer | 4 | 2.6 | 1 | 1.7 | 5 | 2.4 |

Of the 211 inventors in the sub-sample, questionnaires were received from 112 or 53 per cent of the total. Three of these were questionnaires completed for deceased inventors.[15] Of the 99 inventors from whom no questionnaires had been received as of January 10, 1957, 25 were deceased and two others were seriously incapacitated. Eighteen inventors have not been reached because of the lack of a current address. Perhaps many of these are deceased. Forty-nine inventors have presumably received the questionnaires but for one reason or another have failed to respond; and finally, five indicated that they did not care to complete the questionnaire. There is reason to believe that a number of these 49 cases are not in any

[14] See footnote 2 of Appendix A.

[15] Relatives of deceased inventors were not solicited to complete the questionnaires. However, these three completed questionnaires were returned without solicitation.

real sense non-response, but at this stage we could not estimate what proportion of these cases classified as non-respondent in Table 5 should be reclassified.[16]

It should be noted that an appreciably smaller proportion of inventors of unassigned patents in the sample have returned completed questionnaires in comparison with inventors of assigned patents, 36 per cent and 60 per cent, respectively—a difference which is statistically significant. A larger proportion of inventors with unassigned patents are among those whose current address is unknown to us, nearly 14 per cent as compared with less than 7 per cent for inventors with assigned patents.[17] Similarly, in the group who apparently have received questionnaires, non-respondents are proportionately greater among inventors of unassigned patents, 39 per cent as compared with 17 per cent. It is probable that a substantially higher proportion of inventors with unassigned patents, about whom we have no specific information, are deceased, compared with inventors of assigned patents.

Table 5 has dealt with the number of inventors who have returned completed questionnaires and the further classification of others who have not returned ques-

TABLE 6

NUMBER AND PERCENTAGE DISTRIBUTION OF PATENTED INVENTIONS IN THE PRE-PILOT SUB-SAMPLE, BY WHETHER OR NOT AT LEAST ONE COMPLETED QUESTIONNAIRE WAS RECEIVED FROM THE INVENTOR, SEPARATELY AND COMBINED FOR ASSIGNED AND UNASSIGNED PATENTS—RETURNS AS OF 1/10/57.

PRELIMINARY

| Receipt of Questionnaire | Assigned | | Unassigned | | Assigned and Unassigned | |
|---|---|---|---|---|---|---|
| | No. | Per Cent | No. | Per Cent | No. | Per Cent |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Patents in the sample.......... | 124 | 100.0 | 54 | 100.0 | 178 | 100.0 |
| One or more questionnaires received.................... | 76 | 61.3 | 21 | 38.9 | 97 | 54.5 |
| No questionnaire*............. | 48 | 38.7 | 33 | 61.1 | 81 | 45.5 |

* Since joint inventors could have had different reasons for failure to return a questionnaire, no attempt was made at this stage to indicate the apparent reason for failure to have received a completed questionnaire.

[16] From our attempts to telephone non-respondents, we have learned that some of these inventors are deceased, though the mail was not returned to us by the Post Office. In other instances the letter was mailed to a person bearing the same name, who was not the inventor. In the latter cases the true inventor might be deceased, or, if living, his current address is not available to us.

[17] According to a preliminary analysis of the age, as of January 1, 1957, of inventors of assigned and unassigned patents, the age distribution of inventors of unassigned patents indicates this group has many more inventors of advanced age, yet the proportion of deceased and incapacitated inventors known in this group is actually smaller in comparison to inventors with assigned sampled patents. This would tend to strengthen the belief that an appreciable number of inventors with unassigned sampled patents, who have not been heard from, are deceased. This is probably true also for inventors of assigned sampled patents, but to a much lesser extent proportionately. A detailed analysis of the age data of inventors and the implications based thereon will be given in the forthcoming methodological article.

tionnaires. Table 6 shows the number and percentage of patents with respect to which inventor questionnaires were received.

Table 6 indicates that completed questionnaires received from inventors in the pre-pilot sample by January 10, 1957, constitute less than 55 per cent of the patented inventions in that sub-sample. It is problematic whether with further effort this percentage for the pre-pilot group could be raised to 60. Table 6 confirms what was observed in Table 5, that is, a higher response rate from inventors with assigned sampled patents. Thus, for assigned patents in the sub-sample, inventors have supplied information with respect to 61 per cent of the patents, while the corresponding percentage for the unassigned group is 39. This percentage difference is statistically significant.

Questionnaires were mailed to most of the assignees of patents in the pre-pilot sub-sample. These mailings were made initially in the spring of 1956.[18] The 124 assigned patents have 116 different assignees. One-hundred four of these assignees are companies and 12 are individuals. The latter, very often, is either the wife or some other close relative of the inventor. The number and percentage of patented inventions with respect to which questionnaires have been received from assignees are shown in Table 7.

TABLE 7

NUMBER AND PERCENTAGE DISTRIBUTION OF ASSIGNED PATENTS IN THE PRE-PILOT SUB-SAMPLE BY THE RESPONSE STATUS OF THE ASSIGNEES—RETURNS AS OF 1/10/57.

PRELIMINARY

| Response Status | No. | Per Cent |
|---|---|---|
| Assigned inventions in the sample | 124 | 100.0 |
| Assignee questionnaire received* | 60 | 48.4 |
| No questionnaire | 64 | 51.6 |
| No current address† | 13 | 10.5 |
| No response‡ | 51 | 41.1 |

* These are all corporate assignees.
† Of these, six are individual assignees.
‡ Of these, six are individual assignees.

Although the assignee questionnaires for the pre-pilot sub-sample had been mailed initially early the previous spring, less than 50 per cent of the assignees had responded by January 10, 1957. While some increase in this percentage is still expected, again it is improbable that the percentage of assignees returning completed questionnaires will exceed 60. The probability of receiving a completed questionnaire from an individual assignee appears to be very small. Of the 12 such assignees in the pre-pilot sub-sample, for six, no current addresses could be found, and with respect to the remaining six, for whom presumably there were current addresses when the questionnaires were mailed, none has responded.

[18] Assignees who fail to return a completed questionnaire are sent a first follow-up letter; if this proves ineffective after an interim, a second follow-up letter is sent requesting the return of completed questionnaires.

Of course, as expected, many of the questionnaires completed by assignees are for the same patents for which questionnaires were also received from one or more inventors. This is reflected in Table 8.

TABLE 8

NUMBER AND PERCENTAGE DISTRIBUTION OF PATENTS IN THE PRE-PILOT SUB-SAMPLE BY RESPONSE STATUS FROM INVENTORS AND/OR ASSIGNEES FOR ASSIGNED PATENTS, AND INVENTOR RESPONSE FOR UNASSIGNED PATENTS—RETURNS AS OF 1/10/57.

PRELIMINARY

| Response Status | Assigned | | Unassigned | | Assigned and Unassigned | |
|---|---|---|---|---|---|---|
| | No. | Per Cent | No. | Per Cent | No. | Per Cent |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Number of inventions.......... | 124 | 100.0 | 54 | 100.00 | 178 | 100.0 |
| One or more questionnaires:.... | 92 | 74.2 | 21 | 38.9 | 113 | 63.5 |
| Inventor questionnaire only.. | 32 | 25.8 | 21 | 38.9 | 53 | 29.8 |
| Inventor and assignee questionnaires (all inventors)... | 41 | 33.1 | ... | ..... | 41 | 23.0 |
| Inventor and assignee questionnaires (some inventors) | 3 | 2.4 | ... | ..... | 3 | 1.7 |
| Assignee questionnaire only... | 16 | 12.9 | ... | ..... | 16 | 9.0 |
| No questionnaire.............. | 32 | 25.8 | 33 | 61.1 | 65 | 36.5 |

The over-all results are given by the percentages in the last line of Table 8. It will be seen that inventors and assignees have not returned completed questionnaires for nearly 26 per cent of the assigned patents in the pre-pilot sub-sample; no questionnaires have been returned with respect to 61 per cent of the unassigned patents; these give a combined group of between 36 per cent and 37 per cent of the patents for which there are no completed questionnaires. Without knowing something about the characteristics of this 36 per cent to 37 per cent of inventions in the sub-sample, no firm prediction can be made with respect to the characteristics of all the patents from which the sub-sample was derived. Before such a partial sample can be used as a probability sample, it must be demonstrated that the characteristics of patents under study, for which no questionnaires have been returned, are no different from those for which questionnaires have been returned.

It is evident that information in the sub-sample is particularly deficient with respect to unassigned patents. Questionnaires have been received in the pre-pilot sub-sample for less than 40 per cent of the unassigned patents included. For assigned patents, this percentage is 74. It is improbable that the response rate for unassigned patents could be raised to as high as 50 per cent or that the over-all response rate for the combined group, assigned and unassigned, could be raised to 70 per cent from the less than 64 per cent shown in Table 8.

The conclusion, therefore, which may be derived on the basis of the pre-pilot phase of the study is that when the work on the mailings for the study is concluded, the percentage of patents with one or more completed questionnaires will range between 35 and 45 for the unassigned, and between 70 and 80 for the assigned patents.

The implication of incomplete returns is the possibility that patents for which no questionnaires are returned may be different in certain respects, particularly with respect to utilization, from those for which questionnaires have been returned. The most effective way to test this possibility would be, as planned, to interview a sub-sample of inventors and assignees who failed to respond. If this non-response group is not significantly different from the group responding, it would indicate, in effect, that the mail questionnaire approach is sufficient, by itself, to produce a reasonably representative sample, at least for those characteristics used in this study. Information for all the patents in the entire sample cannot be obtained, even through the use of personal interviews as a follow-up method. A significant proportion of inventors, especially those of unassigned patents, are deceased; other inventors and some assignees cannot be located; and some inventors and assignees will not cooperate. For these groups, other methods should be devised to assure that the characteristics of the patents of interest to us in this study are not different from those for which information has been obtained or will be obtained through personal interviews.[19]

One possible approach for testing the adequacy of the working sample (the sample for which information has been obtained) is in terms of internal analyses. These include comparison of the different sub-samples with one another. This has been done intensively in terms of the inter-comparison against one another of different phases of the interviews and mailings. We have compared the characteristics of assigned patents from questionnaires completed only by assignees with those of patents for which both the inventor and assignee have completed questionnaires. We also have compared the converse, the characteristics of patents with inventor replies only with those patents with both inventor and assignee replies. We have also compared replies of assignees with replies of inventors for identical patents. Characteristics of assigned and unassigned patents with two or more inventors have also been compared; contrasting the utilization patterns of patents in which all the inventors have replied against those in which only some of the inventors have replied. We have compared characteristics of patents for which replies were received as a result of the initial mailing with those for which completed questionnaires were received after one or more follow-up requests. The internal checks and comparisons available at this stage have been used in appraising the findings presented in this article. Their detailed presentation and discussion, however, will be given in the forthcoming methodological report.

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[19] It should be stressed, of course, that if through conventional means it is not possible to reach 100 per cent, but information is available for, let us say, 90 or 95 per cent of the patents in the sample—and that either specifically, or as a group, they do not differ from the ones for which specific information is unavailable—the study would still be an overwhelming success as a fact-finding study in utilization. It will give for the first time firm figures of the proportion of patents used with a margin of uncertainty far below anything that has been available to date.

When the pilot study is ready for mechanical processing, there will be many more internal checks and correlations which, although not conclusive in themselves, will give an inferential basis for determining whether the working sample is appreciably different from a truly random sample with which the study began. These tests should also aid in appraising the level of reliability of information supplied. These internal tests will also include comparisons of the patents for which questionnaires have been completed with those patents for which no questionnaires have been completed with respect to known characteristics, such as the year of patenting. This information may indicate the extent that non-response reflects old age, death of the inventor, or other differential characteristics which might influence the prospect of response but which may have little, if any, association with patent utilization. Similarly, comparisons will be made to determine whether there are differences in these two groups of patents (those with questionnaires and those without) in terms of class of patent, length of time pending in the Patent Office, geographic location of the inventor, number of claims, and other factors for which information is available for the entire 2 per cent sample.

## THE FINDINGS

It has already been indicated that at this time the pilot study is incomplete. Only a few of the tentative findings are available, subject to the cautions already stressed and the possible errors in the information reported by inventors and assignees. Errors and inconsistencies in reported information is another limitation characteristic of studies of this type. Only repeated studies and intensive analysis of the returns supplemented by special inquiries can reveal the presence and the magnitude of such errors.

### *Percentage of Patents Utilized*

Since the determination of the proportion of patents utilized by industry is the capstone of the current study, it is natural that this ratio has been a key item of information looked for as soon as the completed questionnaires began to come in. Information with respect to patent utilization was obtained independently from inventors, and for assigned patents, from assignees. Table 9 summarizes these returns from inventors separately for assigned and unassigned patents and for the combined group.

Table 9 summarizes all the information obtained so far from inventor questionnaires with respect to utilization of the sampled patent. The questions were designed to obtain information as to whether or not the patent has been used at any time and, except in the personal interview questionnaire, separate information was obtained as to whether the patent was still in use or had been used only in the past. If the patent was not in either of these classes, information was sought as to whether there was a prospect for use in the near future. Other replies provided for were: "Never used and no prospect of use" and "Don't know whether used or not." So far seven inventors of assigned patents and four inventors of unassigned patents have failed to answer this question. Column 2 shows the frequency distribution of the assigned patents according to these replies. The sub-items "In current use" and "Used in the past" do not add up to the total of patents used at any time, because the latter are based, as indicated in Table 9, on all the questionnaires,

TABLE 9

NUMBER AND PERCENTAGE DISTRIBUTION OF PATENTS IN THE 2 PER CENT SAMPLE ACCORDING TO UTILIZATION STATUS, BASED ON ALL RESPONSES RECEIVED FROM INVENTORS FOR ASSIGNED AND UNASSIGNED PATENTS, SEPARATELY AND COMBINED AFTER WEIGHTING.

PRELIMINARY

| Utilization Status | Assigned | | Unassigned | | Assigned and Unassigned (weighted)* |
|---|---|---|---|---|---|
| | No. | Per Cent | No. | Per Cent | Per Cent |
| (1) | (2) | (3) | (4) | (5) | (6) |
| Total number of patents represented by one or more completed questionnaires........ | 457 | 100.0 | 152 | 100.0 | 100.0 |
| Patents used at any time:...... | 267 | 58.4 | 64 | 42.1 | 53.9 |
| In current use†............ | 178 | 41.1 | 46 | 33.3 | 39.1 |
| Used in the past†........... | 76 | 17.6 | 12 | 8.7 | 14.8 |
| Expected use in the near future | 11 | 2.4 | 9 | 5.9 | 3.7 |
| Don't know whether in use..... | 76 | 16.6 | 12 | 7.9 | 13.8 |
| Never used and no prospect of use...................... | 96 | 21.0 | 63 | 41.4 | 28.6 |
| Unanswered................. | 7 | 1.5 | 4 | 2.6 | ..... |

* This column is derived by weighting the percentages in columns 3 and 5 by the relative proportion of assigned and unassigned patents granted to residents of the United States in the three years under consideration (1,218 assigned and 631 unassigned—see Table in Appendix A). The questionnaires in which the inventor failed to indicate utilization were not taken into consideration.

† Since for the personal interview cases the information regarding current or past use was not differentiated, the figures, for "current use" and "used in the past," as separate categories, are based on mail questionnaire responses only, which constitute 433 assigned, and 138 unassigned patents.

while the two sub-items are based on questionnaires exclusive of those completed by personal interviews. The percentage distribution of these is shown in column 3. The tentative findings indicate, according to the replies received from inventors, approximately 58 per cent of the patents were used, about 41 per cent being in current use and about 18 per cent used in the past. Between 2 per cent and 3 per cent of the inventor replies for assigned patents indicate that there is a prospect for use of the sampled patent in the near future. Twenty-one per cent indicate that the patent was not used, and there is no prospect for its use; about 17 per cent said that they did not know whether the patent was used. The majority of these, as indicated from the assignee replies for these same patents, were never used.

With respect to unassigned patents, column 4 shows the distribution according to utilization status based on inventor questionnaires. In all, 152 inventors of unassigned patents have replied. The percentage distribution for these patents indicates that some 43 per cent are used currently or were used in the past. About one-third of the unassigned patents are used currently and about 9 per cent were used in the past. Nearly 6 per cent of the inventors of unassigned sampled patents indicated that the patent is to be used in the near future. Forty-one per cent indicated that the patent had never been used and there is no prospect for use, and about 8 per cent said that they did not know whether the patent was used or not. Since the proportion of completed questionnaires is quite different for assigned and unassigned patents, it would be misleading to combine columns 2 and 4 to obtain combined utilization rates. Therefore, column 6 percentages have been derived by weighting each group according to its proportionate representation in the original 2 per cent sample shown in Table 1 in Appendix A. In doing this, we have assumed that these assigned patents with replies on utilization are representative of all the assigned patents in the 2 per cent sample, and the unassigned patents likewise are representative of the unassigned patents in the sample.

Comparisons of columns 2 and 3 with columns 4 and 5 indicate marked differences between assigned and unassigned patents as to utilization based on inventor replies. These differences have been tested and found to be statistically significant. There is no basis to assume that these differences in the utilization patterns for assigned patents will vanish with more complete returns. There is a possibility, however, that the reliability of the information with respect to utilization reported by inventors of assigned patents is of a different quality from those reported by inventors of unassigned patents. Therefore, the replies on utilization received from the inventors of assigned patents are checked against the corresponding replies of assignees on identical patents. This is shown in Table 10.

TABLE 10

COMPARATIVE UTILIZATION REPORTED BY INVENTORS AND ASSIGNEES WITH RESPECT TO THE SAME PATENTS OBTAINED TO DATE THROUGH MAIL QUESTIONNAIRES.

PRELIMINARY

| Inventor Replies | Total | Assignee Replies | | | |
|---|---|---|---|---|---|
| | | Current Use | Past Use | Expected Use | Never Used |
| (1) | (2) | (3) | (4) | (5) | (6) |
| Total | 136 | 46 | 21 | 20 | 49 |
| Current use | 62 | 43 | 9 | 5 | 5 |
| Past use | 12 | 1 | 9 | 1 | 1 |
| Expected use | 3 | .. | .. | 2 | 1 |
| Don't know | 30 | 2 | 1 | 3 | 24 |
| Never used | 28 | .. | 2 | 8 | 18 |
| Unanswered | 1 | .. | .. | 1 | .. |

The marginal total of Table 10 based on 136 patents in which concurrent replies with respect to utilization were available through mail questionnaires received from the inventors and assignees indicates that, while inventors reported 62 patents to have been in current use, the corresponding number reported by the assignee is 46. In only 43 patents did both the assignees and the inventors agree that the patent had been used in the past. Of the inventors, 12 reported that the patent had been used in the past. The corresponding total reported by assignees is 21. On 9 patents inventors and assignees agree that the patent had been used in the past. Only 3 inventors indicate that there is a prospect for future use of the patent. The corresponding number reported by assignees is 20. There is agreement between inventors and assignees for 2 patents that will be used in the near future. For 30 patents inventors reported they did not know whether the patent is in use; for 24 of these patents the assignees report the patent was never used. None of the assignees reports that it is not known whether the patent was used. Inventors report 28 patents as never used; the total number of never used patents reported by assignees is 49. With respect to 18 patents, both the inventor and the assignee agree on the identical patents that were never used. Further details of cross-distribution of these patents, according to utilization reported by inventors and assignees, may be observed in Table 10.

We may conclude from Table 10 that there is a tendency for the inventors to over-report the number of patents in current use, assuming that the assignee reply in this respect is a reliable criterion. This exaggeration, however, may not be due to intentional falsification, but rather a lack of correct information. On the other hand, with respect to over-all per cent of patents utilized, if one takes into consideration future use as well, assignee replies do not give results materially different from those of inventor replies—this may be true particularly near the end of the 17-year term.

The unreliability of replies with respect to utilization from inventors of assigned patents, however, cannot be the basis of judging the reliability of replies of inventors of unassigned patents, since inventors of unassigned patents are in a better position to know the utilization status of their patents. However, a glance back to Table 9 indicates that nearly 8 per cent of the inventors of unassigned patents stated that they did not know whether the patent was used or not. This may suggest that there is a degree of uncertainty in the replies of inventors of unassigned patents as well—though not to the same extent as is true with respect to inventors of assigned patents.

Since the assignee is in a better position to know the utilization status of the sampled patent, subject to further exploration and inquiry, we believe that greater reliance should be placed on returns based on assignees' replies. In Table 11 are shown the assignee replies as to whether or not the patent was being used or had been used, etc., in terms paralleling those employed in the inventor questionnaires.

Table 11 shows the assignee replies, and compares replies in terms of two sub-samples, summarizing all the assignee questionnaires received as of February 18, 1957. Columns 2 and 3 are based on assignee replies with respect to patents in the pre-pilot sub-sample and those included in the initial personal interviews. The figures showing patents in current use, and those patents used in the past, however, are based on the pre-pilot sub-sample only. In the initial interviews current use was not distinguished from past use only. In columns 4 and 5 are shown assignee returns from the December 1956 mailings. The frequency distribution of these patents according to utilization agrees closely with the frequency distribution of patents in the pre-pilot sub-sample and in the personal interview cases. The use of various statistical tests for possible significance of the differences indicates none of these percentages is statistically significantly different from one another; therefore, the two sets of returns can be regarded as different samples from the same universe and can be combined to give a larger sample, with a higher degree of reliability and stability. This has been done in columns 6 and 7.

TABLE 11

NUMBER AND PERCENTAGE DISTRIBUTION OF ASSIGNED PATENTS BY UTILIZATION STATUS, BASED ON ASSIGNEE RESPONSES, SEPARATELY AND COMBINED FOR THE PRE-PILOT SUB-SAMPLE RETURNS AND INITIAL INTERVIEWS, COMPARED WITH THE RETURNS FROM THE DECEMBER MAILINGS.*

PRELIMINARY

| Utilization Status | Pre-Pilot and Personal Interviews | | December Mailing | | Combined | |
|---|---|---|---|---|---|---|
| | No. | Per Cent | No. | Per Cent | No. | Per Cent |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Patents represented by completed assignee questionnaires | 78 | 100.0 | 183 | 100.0 | 261 | 100.0 |
| Patents used at any time: | 38 | 48.7 | 92 | 50.3 | 130 | 49.8 |
| In current use | 17† | 28.8† | 61 | 33.3 | 78† | 32.2† |
| Used in the past | 11† | 18.6† | 31 | 16.9 | 42† | 17.4† |
| Expected use in the near future | 8 | 10.3 | 16 | 8.7 | 24 | 9.2 |
| Don't know whether in use | 1 | 1.3 | ... | .... | 1 | .4 |
| Never used and no prospect of use | 31 | 39.7 | 74 | 40.4 | 105 | 40.2 |
| Unanswered | ... | .... | 1 | 0.5 | 1 | .4 |

* See Appendix A.
† Since for the personal interview cases the information regarding "current use" and "past use" was not differentiated, the figures showing current use and those showing past use are based on the responses from the mail questionnaires only. This represents 59 patents in column 2 and 242 in column 6.

On the basis of Table 11, if it can be assumed that the assignees from whom questionnaires have been received are not significantly different from those who have not responded, it may be concluded that about half of the assigned patents in the sample are being used or were used in the past.[20] Almost another 10 per cent of patents are expected to be used in the near future. The over-all conclusion, therefore, seems to be that if these statistics are not biased, by the time assigned patents expire, about 60 per cent of them will have been used in production at one time or another. Stated in these terms the conclusions derived from the assignee replies would not be materially different from the conclusions that could be derived from

20 This is far greater than the percentage of patents believed to be used in commercial production in terms of estimates which have been found in the literature. For example, L. J. Carr, in an article "The Patenting Performance of 1,000 Inventors During Ten Years," *Amer. J. of Sociology,* Vol. 37, 1932, pp. 569-580, refers to estimates of 1 per cent of the patents issued as having any practical utility. Edward Thomas, "Are Patents Worthwhile?" *Journal of the Patent Office Society,* Vol. 13, 1931, pp. 232-235, refers to estimates of 5 per cent of patents being used. His own estimates are 10.8 per cent to 18 per cent of patents are actually put to use. A number of our correspondents have written that it is commonly believed that about 5 per cent of the patents are used—some have indicated more specifically that a quarter or a third of their company patents are in current use.

the inventor replies. In other words, much of the difference apparent between inventors and assignees is with respect to the time axes; as far as over-all percentages of used patents are concerned, inventors tend to report all patents used in the past or to be used, as being in current use.

Table 11 shows that there is no significant difference between two sub-samples of assignee replies, in one of which every effort has been made to maximize the returns, while in the other there has not been time for a similar effort as yet.[21]

In Table 12 all the direct and indirect evidence available at present regarding the utilization patterns of assigned patents in terms of assignee replies has been summarized.

TABLE 12

PROBABLE REPLIES OF ASSIGNEES AS TO THE UTILIZATION OF PATENTS BASED ON INVENTOR REPLIES—PATENTS WITH RESPECT TO WHICH ONLY INVENTOR QUESTIONNAIRES HAVE BEEN RECEIVED, COMPARED WITH ASSIGNEE RESPONSES ON UTILIZATION.

PRELIMINARY

| Utilization Status | Inferred Assignee Replies | | Assignee Responses | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Assignee Questionnaire Only | | Assignee and Inventor Questionnaires | | Combined | |
| | No. | Per Cent | No. | Per Cent | No. | Per Cent | No. | Per Cent |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Patents represented by completed questionnaires by inventor or assignee | 304 | 100.0 | 120 | 100.0 | 136 | 100.0 | 560 | 100.0 |
| Patents used at any time: | 162 | 53.3 | 60 | 50.0 | 67 | 49.3 | 289 | 51.6 |
| In current use | 90 | 29.6 | 36 | 30.0 | 47 | 34.6 | 173 | 30.9 |
| In past use | 72 | 23.7 | 24 | 20.0 | 20 | 14.7 | 116 | 20.7 |
| Expected use in the near future | 45 | 14.8 | 5 | 4.2 | 20 | 14.7 | 70 | 12.5 |
| Don't know whether in use | ... | .... | 1 | .8 | ... | .... | 1 | .2 |
| Never used and no prospect of use | 97 | 31.9 | 53 | 44.2 | 49 | 36.0 | 199 | 35.5 |
| Unanswered | ... | .... | 1 | .8 | ... | .... | 1 | .2 |

Columns 2 and 3 of Table 12 are derived from the relationship shown in Table 10 between inventor and assignee replies on patent utilization. Using that relationship, we have estimated for the 304 patents, for which there were inventor replies but no assignee replies, what the probable assignee replies would have been. These estimates have been compared with columns 4 and 5 where the distribution of patent

[21] In the pre-pilot sub-sample and initial interviews, questionnaires were available for 78 out of 150 assigned patents, 52 per cent of the total; in the remaining segment of the 2 per cent sample there are 1,048 assigned patents with only 183 replies to date or about 17 per cent of the total.

utilization is shown in terms of 120 patents with respect to which no inventor has replied, and columns 6 and 7, showing the distribution of 136 patents with respect to which there were both assignee and inventor replies—the distribution as to utilization being based on assignee replies. Examination of these columns indicates that with respect to over-all patent utilization the percentages are quite close across the board, the maximum being 53 and the minimum 49, a variation that one may well expect in samples of this size. The same may be said of the percentage of patents in current use. The range among these percentages across the board is from almost 30 to less than 35. There is considerable difference regarding past use between the group of 120 assignees of patents the inventors of which had not replied and the 136 assignees of patents with respect to which both inventors and assignees had replied (see columns 5 and 7 as well as 3 and 7). The test of significance shows that in random samples drawn from the same population, differences as large as this could occur with less than 5 per cent frequency. It is to be noted that this difference is between two groups of assignee replies—differences between columns 3 and 5 are not significant. The 120 assignees who replied without the inventor having replied reported a much lower expectancy of use in comparison to parallel percentages in columns 2 and 7 respectively. Again this difference is statistically significant. This might suggest that for this group of patents with respect to which the assignees only replied, the inventors may have been of more advanced age so that more of them were deceased or were incapacitated and therefore unable to reply to the inventor questionnaire. For such a group of patents—heavily weighted with patents issued in 1938—there will be a concentration of those used in the past and a corresponding deficit of patents used in the future. But this, of course, is purely conjectural at this time, though subject to checking. In any event, even though some of these differences are large enough to be statistically significant, the over-all pattern shown in the three columns is nevertheless reasonably consistent and therefore columns 8 and 9 may be said to give us, as of this stage of our study, the best approximation of the proportion of patents utilized, from the patents granted in these three years.

The percentage of assigned patents utilized, based on assignee replies, is not significantly higher than the percentage of unassigned patents utilized. This may be seen by comparing the percentages given in column 5 of Table 9, with column 7 of Table 11 and column 9 of Table 12. We believe, nevertheless, that the percentage of unassigned patents used is probably somewhat lower, and there is also some reason to believe that the period over which the unassigned patents come into use is much more restricted.

### *Tentative Conclusions on Utilization*

Because utilization is the central theme of this study, despite its preliminary and incomplete state, the returns to date have been subjected to intensive analysis, subject to the limitation that the information has not been mechanically processed as yet. It would not have been economical to attempt many cross-classifications, even by the year in which the patent was granted which, it appears, exerts marked influence on the selective factors which differentiate patents for which information has been received from those for which no information is as yet at hand. Subject to these limitations, the analysis, much of which will be embodied in the methodological article, seems to suggest that at a given time, from one-quarter to one-third of the assigned patents in force are likely to be in current use. For unassigned patents it is probable that this proportion would be somewhat lower. Between one-sixth and one-quarter of the assigned patents are likely to have been used, but are no longer in current use. Therefore, at any given time, of all the assigned patents in force, approximately one-half would be in current use or would have been used at some time. The corresponding percentage for unassigned patents may range between one-quarter and two-fifths, that is, one-quarter and two-fifths of such patents would be in current use or have been used in the past. The percentage for patents expected to be used in the near future may range from one out of 12 to one out of 6 for assigned patents. In this respect, the reported information for unassigned patents is likely to be less reliable and shows a somewhat higher percentage than that for assigned patents.

The above indicated ranges will depend, in part, on the composition of what is sometimes called the "mix" of patents, that is, the relative proportion of patents that are in their first, second . . . to 17th year; partly on the times in relation to the economic cycle; partly on the time lapse in the Patent Office, between the filing and the granting of the patent; and probably many other factors.

The tentative findings of this study suggest that at the time of expiration of the patents from 45 per cent to 65 per cent of the assigned patents have had some commercial use, however limited. The probable comparable percentage for unassigned patents may range from 30 to 45.

There are indications that by the time patents are granted some 20 per cent to 30 per cent of those assigned have been used. Some of these would be already obsolete. In this respect the pattern of use for unassigned patents is likely to be quite different—a far smaller proportion of unassigned patents are probably in use at the time the patent is granted. The majority of patents will probably be used close to the time of granting. In other words, the period for "usability" as defined in this study is probably much more restricted, comparatively speaking, for unassigned than for assigned patents. Even with respect to assigned patents the chances for utilization probably decline rather rapidly after the patent is granted. In all probability for both groups of patents a very small percentage would come into commercial use toward the end of the 17-year period.

We assume that as the study progresses it will be possible to narrow the ranges of some of these guestimated percentages. We also hope to be able to trace more sharply the utilization curve in relation to the 17-year term for assigned and unassigned patents, since there is every indication that the patterns of utilization for the two groups will be markedly different. Another related matter that has hardly been touched upon, though present inferentially in these statistics, is the time span over which patents are used. The completed study should shed considerable light on this area in which it is also probable that the patterns will differ markedly for assigned and unassigned patents.

While our findings are tentative, the internal consistency of the data leads us to believe that the over-all results regarding the high proportion of patents used are reasonably firm.

## *Reasons for the Non-Use of Patents*

An important aspect of the utilization project is to ascertain the reasons for the current non-use of the patent. Question 32 in the inventor questionnaire and question 12 in the assignee questionnaire, which is similar, provide the bases for such analyses.[22] Table 13 shows the distribution of replies to question 32 from inventors, for inventors of assigned patents and those of unassigned patents with respect to reasons for current non-use of the patent.

TABLE 13

NUMBER AND PERCENTAGE DISTRIBUTION OF PATENTED INVENTIONS ACCORDING TO THE REASON FOR CURRENT NON-USE OF THE PATENT, BASED ON INVENTOR REPLIES SEPARATELY FOR ASSIGNED AND UNASSIGNED PATENTS.

PRELIMINARY

| Reasons for Current Non-use or Very Little Use | Assigned | | Unassigned | |
|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) |
| Replies to question 32 | 289 | 100.0 | 85 | 100.0 |
| a. Lack of market demand | 72 | 24.9 | 16 | 18.8 |
| b. Rapid obsolescence | 36 | 12.5 | 2 | 2.4 |
| c. Competitively at a disadvantage | 41 | 14.2 | 3 | 3.5 |
| d. Shortage or lack of venture capital | 7 | 2.4 | 27 | 31.7 |
| e. Development of the art has taken a different course | 54 | 18.7 | 5 | 5.9 |
| f. Foreign competition | ... | .... | .... | .... |
| g. Supporting arts have not developed sufficiently | 7 | 2.4 | 2 | 2.4 |
| h. Patent does not provide sufficient protection | 3 | 1.0 | ... | ... |
| i. Neglect to exploit it | 10 | 3.5 | 20 | 23.5 |
| j. Do not know the reason | 31 | 10.7 | 4 | 4.7 |
| k. Other | 28 | 9.7 | 6 | 7.1 |

Columns 2 and 3 indicate that of the 289 replies, 25 per cent indicated lack of market demand as the reason for current non-use of the patent. Nearly 19 per cent gave as the reason the fact that the development of the art had taken a different course. About 14 per cent indicated that competitively the patent was at a disadvantage. Over 12 per cent gave rapid obsolescence as the reason for current non-use. Another 11 per cent replied they did not know the reasons for current non-use. Nearly 10 per cent wrote in different reasons for current non-use instead of checking one of the choices given in the questionnaire. Finally, 4 per cent indicated neglect to exploit the patent. These written-in replies have not been studied or analyzed as yet. A few inventors gave reasons such as "patent does not provide sufficient protection," "supporting arts have not developed sufficiently," and "shortage or lack of venture capital."

In order of their importance, as determined by the relative frequencies of the replies, the reasons for current non-use are: (1) lack of market demand; (2) development of the art has taken a different course; (3) the patent is competitively at

[22] See questionnaire in Appendix B.

a disadvantage; (4) rapid obsolescence; (5) reason for current non-use unknown; and (6) other.[23]

The distribution of replies from inventors of unassigned patents regarding the reasons for current non-use of the sampled patent is distinctly different. For these, the highest freqeuncy, almost one third, gave as the reason for current non-use, shortage or lack of venture capital. The next largest category, nearly 24 per cent, is the group that gave neglect to exploit the patent as the reason. Another 19 per cent gave lack of market demand as the reason. Seven per cent stated they did not know the reason. Smaller percentages gave other reasons. It is reasonable to assume that the reasons for non-use would be quite different for assigned and unassigned patents, so there is no justification to combine these two groups.

The assignee replies to the reasons for current non-use of the sampled patent are given in Table 14.

Column 3 in Table 14 shows the percentage distribution of all the replies, including those in current use and those who failed to reply to question 12. Column 4 shows the percentage distribution of those who specifically replied to the question

TABLE 14

NUMBER AND PERCENTAGE DISTRIBUTION OF PATENTED INVENTIONS ACCORDING TO THE REASON FOR THE CURRENT NON-USE OF THE PATENT, BASED ON ASSIGNEE REPLIES RETURNED BY 2/18/57.

PRELIMINARY

| Reasons for Current Non-use or Very Little Use of the Sampled Patent | Number | Per Cent | |
|---|---|---|---|
| | | All Replies | Specific Replies |
| (1) | (2) | (3) | (4) |
| Total replies | 320 | 100.0 | .... |
| Replies to question 12, assignee questionnaire | 202 | 63.2 | 100.0 |
| a. Lack of market demand | 81 | 25.3 | 40.1 |
| b. Rapid obsolescence | 18 | 5.6 | 8.9 |
| c. Competitively at a disadvantage | 51 | 15.9 | 25.3 |
| d. Shortage or lack of venture capital | 1 | .3 | .5 |
| e. Foreign competition | .. | .... | .... |
| f. Patent does not provide sufficient protection | 1 | .3 | .5 |
| g. Neglect to exploit it | .. | .... | .... |
| h. Other | 50 | 15.6 | 24.8 |
| Question does not apply | 106 | 33.1 | .... |
| Unanswered | 12 | 3.8 | .... |

[23] In question 32 it was deemed possible that there might be more than one reason why the patent was not in current use. Therefore, respondents were not instructed to check only one specific reason, but more than one if applicable. A number have given multiple reasons for current non-use of the sampled patent. For the sake of simplicity, in this preliminary analysis only one reply has been used, the first reason listed in the questionnaire. There is no information about the relative importance if an inventor indicated two or more reasons.

requesting reasons for current non-use of the patent.[24] Two-fifths of the assignees gave as the reason for current non-use of the sampled patent, lack of market demand. One-fourth gave as the reason that the patent was competitively at a disadvantage; another quarter listed reasons other than those specifically given in the questionnaire, using the category "other." These reasons have not been specifically analyzed at this time though they will be eventually.[25] Nearly 9 per cent gave as a reason, "rapid obsolescence." "Shortage of capital" and "patent does not provide sufficient protection" each had only one assignee respondent.

To determine what insights and meaning these replies might have on questions such as non-use or suppression of patents, more intensive and detailed analysis is needed of these returns in relation to other information regarding the patent, as well as possibly the cross-analysis of inventor and assignee replies with respect to the same patent. More light will be shed on these and many other basic questions in the months to come in analyzing and interpreting the returns and relating them to other bodies of data where available and appropriate.

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[24] Some assignees also checked more than one reason for non-use, but at this time only the first reason checked has been used.

[25] Two items listed in the inventor questionnaires specifically, "Development of the art has taken a different course" and "Supporting arts have not developed sufficiently," were excluded from the list of specific reasons in the assignee questionnaire. Although this makes the comparison of reasons for current non-use by inventors and assignees a little more difficult, it may provide evidence on how specific the reasons given are if these missing reasons are reflected in the "written-in" answers under "Other." It might be noted that in Table 13 fewer than 10 per cent of the inventors of assigned patents gave reasons under "Other." In Table 14, for assignees, 25 per cent wrote in reasons other than those listed in the questionnaire.

# APPENDIX A

## PHASES OF THE PILOT STUDY

This study has been conducted in certain phases. The number of patents included in each of these phases and the number of the inventors to whom these patents were issued are shown in Table I of this Appendix. The patents studied as to utilization were confined to those inventors who, at the time when the patent was granted, were residents of the United States.

### TABLE 1

NUMBER OF PATENTS AND INVENTORS ACCORDING TO THE ASSIGNMENT STATUS OF THE SAMPLED PATENTS, BY SUB-GROUPS DEVELOPED IN THE COURSE OF THE STUDY—LIMITED TO INVENTORS RESIDING IN THE UNITED STATES* WHEN THE PATENT WAS ISSUED.

PRELIMINARY

| Category† | Sampled Patents | | | Inventors of Sampled Patents | | |
|---|---|---|---|---|---|---|
| | Combined No. | Assigned No. | Unassigned No. | Combined No. | Assigned No. | Unassigned No. |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Total | 1,849 | 1,218 | 631 | 2,150 | 1,460 | 690 |
| Initial interviews | 40 | 26 | 14 | 45 | 28 | 17 |
| Pre-pilot Sub-sample | 178 | 124 | 54 | 211 | 152 | 59 |
| October mailing | 1,428 | 936 | 492 | 1,663 | 1,126 | 537 |
| January mailing | 168 | 112 | 56 | 195 | 133 | 62 |
| All others‡ | 35 | 20 | 15 | 36 | 21 | 15 |

* The study of utilization was restricted to inventors residing in the United States.
† The inventor questionnaires were mailed in three groups; the assignee questionnaires were mailed in two groups, one in the spring of 1956, for the pre-pilot sub-sample and the balance in December 1956.
‡ This category represents deceased inventors and those for whom no addresses could be found, as well as assignees for whom no addresses could be found.

The first phase of the study consisted of initial interviews conducted with inventors and assignees in greater Washington, D. C.; Maryland; Delaware; and greater Philadelphia. All the inventors who could be contacted cooperated in the study. However, these interviews with inventors and assignees are, at best, suggestive since there were only 40 patents involved in this phase, of which 26 were assigned. There were 45 inventors involved.

The second phase, the pre-pilot sub-sample, consisted of a sub-sample of 10 per cent, taken randomly from the 2 per cent sample; limited, of course, to inventors who had not already been interviewed. The purpose of the pre-pilot phase was to test the mail questionnaires and the mailing procedures before launching the larger study involving some 1,850 patents and more than 2,000 inventors. This 10 per cent sub-sample represented 178 patented inventions and 211 individual inventors. In this phase, one of the aspects explored was the effectiveness of the use of certified mail in comparison to regular mail.[1] Furthermore, this sub-sample was used to ascertain which avenues are useful in finding current addresses for inventors, and ways of inducing inventors and assignees to respond. The pre-pilot mailing to inventors was made in the fall of 1955. We are still attempting to maximize the number of returns by using all avenues

1 In the pre-pilot mailing questionnaires to inventors of odd numbered patents were sent certified. Questionnaires covering even numbered patents were sent by regular mail. In subsequent phases where questionnaires were sent to inventors for the first time certified mail was used exclusively. In all phases, the first follow-up letter was sent by regular mail. With respect to assignee questionnaires, regular mail was used exclusively.

available to us. Assignees of patents in the pre-pilot sub-sample were sent questionnaires in the spring of 1956. Efforts are being continued to maximize these returns.

The addresses used for mailing questionnaires to inventors were the latest available in the Patent Office files of patents granted. In the pre-pilot phase of this study about 41 per cent of the initial mailings were returned by the Post Office because the address obtained was not current. For many of these inventors current addresses were obtained eventually by writing to assignees, if the patent was assigned, and/or to attorneys. Where these means proved unproductive, we resorted to others, such as writing to co-inventors and searching various directories. The same procedures are being followed in subsequent phases of mailing of questionnaires to inventors. Various standard manufacturers' indexes and registers have been used in securing current addresses of assignees. Few difficulties have been encountered, except in cases where the assignee is an individual.

In this report the pre-pilot sub-sample is used to indicate the proportion of returns that may be expected from the subsequent mailings to inventors and assignees.

The largest group of questionnaires was sent by certified mail to inventors in October 1956. These questionnaires included over 1,400 patents, and nearly 1,700 inventors. Enclosed with the questionnaires was an explanatory covering letter and instructions.[2]

Finally, the last phase of the study consisted of mailing the remaining questionnaires to inventors in January 1957. This mailing included some 168 patents representing 195 different inventors. There was a residue of 35 patents for which the inventor, and in some instances the assignees, could not be identified, or from other sources it was known that the inventor was deceased.

All assignee questionnaires not included in the initial or the pre-pilot sub-sample were mailed in December 1956. The number of assigned patents shown in Table 5 is slightly larger than the number shown in Table 1. This results from the fact that communication with the inventors has indicated that the patent had been assigned even though the Patent Office files failed to reveal an assignment as of the spring of 1955. However, it should be noted that the differences between the two are relatively slight.

2 Two months after the initial mailing, a follow-up letter was sent to those who presumably received the initial mailing but had returned no completed questionnaire. This is now being followed by a second follow-up letter urging the return of a completed questionnaire. If this brings no result, then the individual will be considered as a non-respondent. Recently, attempts have been made, where convenient, to telephone non-responding inventors. This experience has indicated that in some instances the inventor is deceased even though the letters, including certified letters, were delivered to the address by the Post Office. In other instances the inventors, presumably identified through a telephone directory, turn out to be someone other than the inventor but with the same name. Therefore, some of the non-responses more correctly should have been listed as deaths or inventors without current address rather than non-response.

## APPENDIX B

### INSTRUCTIONS FOR FILLING OUT THE QUESTIONNAIRE ON THE PATENT UTILIZATION STUDY

*(For the Inventor)*

All the information supplied by the inventor in this questionnaire will be treated as confidential.

To save the respondent's time, the questionnaire is so designed that the replies can be made by a check mark in most instances. In questions calling for numbers and amounts, where the number or amount is zero enter "0."

*Part I.* The information in Part I was abstracted from the official records of the U.S. Patent Office. Please check this information for accuracy and completeness and enter necessary corrections or additions.

*Part II.* Most questions in Part II are self explanatory.

3. This question is to obtain information on the number of years of full-time or equivalent part-time school attendance. As a rule, a person who has only completed grade school will circle "8"; one who has attended high school for two years should encircle "10" or "11" depending on the highest grade completed. A high school graduate should encircle "12," a college graduate with no further graduate work should encircle "16," and so on for graduate work, depending on the number of full years (or equivalent) of graduate work.

6. Major occupation refers to the occupation in which you have the greatest skill; as a rule it is the occupation which you have pursued the longest. "Sampled invention" or "sampled patent" is your patent indicated on page 1.

10. The position to be recorded here should be the current position with the company. If you are no longer with that company, please record the last position you held with the company.

11. What was the impetus, "trigger," as it were, that gave you the idea for the sampled patent?

13. The answer desired is, as accurately as possible, the lapse of time (in months) between the time when you had the initial idea and the development of this idea to a stage at which a patent application could be filed. For instance, if you conceived the idea in May, 1951, and did enough work on it so that you could have filed for a patent in September, 1951, but you actually did nothing about it until January, 1952, when you filed for a patent—the time interval desired is that between May and September, 1951.

14. This includes laboratory tests, construction of a model and any other concrete means of testing the workability of the machine, process or product. If certain phases were tested but others not, indicate the extent of testing in the space provided for "Other."

16. Include in your replies patents issued to you jointly with other inventors. Patents in force are those for which the 17 years has not elapsed since the date of their issuance. A patent is considered "used commercially" if it is produced for sale. Production, merely to test the workability, or the cost, or the method of production is not to be regarded as "used commercially."

18. The purpose of this question is to see whether most inventors work in a limited field of technology and what these fields are. Therefore, please describe the field as specifically as possible.

19. Include only inventions which you believe could have been patented.

20. "Out-of-pocket" expenses means payments from your own personal funds. (a) Refers to any expenditures in developing the idea; (b) any expenditures to have a search made, prepare the patent application, file for a patent, etc., and pay all the necessary fees to obtain the patent; (c) refers to trying to sell the patented invention (there may have been costs of attempts to sell the idea even before the patent was applied for or granted—if so, these should be included in *c,* also the initial costs incidental to producing the patented invention for the market).

22. "Assigned to your employer by special agreement" means that there was no standing contract to assign it to your employer at the time the invention was made. "A company" in c, d, or e refers to a firm other than the one in which you are employed or were employed at the time of the invention.

23. Difficulties would include obstacles in seeing the responsible officials of various companies you felt would be interested in your sampled invention, or difficulties encountered in securing needed capital to produce the patented article, process or product yourself, etc.

25. Do not count as income from your sampled patent any promotion which you received from your employer or increase in salary, though the invention was the direct or contributory cause. Income in reply to the question means payment for your sampled patent—such as a monetary award. Sometimes an award is made to the employee at the time of disclosure and a subsequent payment is made if the disclosure is patented; both of these are to be included. Where the employer pays you *pro forma* $1.00 in consideration of your assigning the patent to him, count it as income, and any other direct income from any sources whatsoever paid to you for the use of the patent or its product. Of course, if you have produced the patented item yourself, then the income which you have had from the sale of it, less the production cost, should be included. If the patent rights were sold outright report the amount received from such sale.

26. This refers to costs incurred in developing special machinery or other preparation necessary to produce and market your invention—not, however, the routine cost of production for the market.

29. Interference means there was at least one other application filed in the Patent Office which duplicated one or more of the claims made by you, so that you were required to submit evidence to show that your invention preceded in time this other inventions(s) on file in the Patent Office.

30. Have you or your assignee(s) sued or threatened to sue any individual or corporation for infringing your sampled patent or has anyone sued or threatened to sue you or your assignee(s) or licensee(s) in connection with the use of your sampled patent?

34. Means one or more foreign patents were taken out on the same invention as the sampled patent. The reply to this question should be affirmative whether the foreign patent has expired or lapsed—the question is: was there a foreign patent granted at any time on this invention? If the answers for (b) are different, that is, the invention was patented, let us say, in England by you; in Sweden by an assignee; and in France by a licensee—indicate these by adding subnumbers after each country (1) to indicate you, (2) the assignee, and (3) a licensee. If the relationships are more involved, explain under "Remarks" at the end of Part II.

*Note:* If the space provided for any question proves insufficient, use the space provided for "Remarks" at the end of Part II. In all such instances, however, be sure you give the number of the question. If the space allowed for "Remarks" proves insufficient, use additional sheets and attach these to your questionnaire. The space under "Remarks" is otherwise left for you to make any observations explanatory or otherwise that you may wish.

THE PATENT UTILIZATION STUDY

Order number.................... Sample number.................... Date Mailed.................... Received....................

PART I—Basic information on sampled patent (Derived primarily from the Official Gazette)

1. Patent number.................... 2. Number of claims.................... 3. Class....................

4. Title....................

5. Name(s) of inventor(s)....................

6. Address....................

7. Application date (earlier priority date if any)....................

8. Date patent granted.................... 9 Date of assignment....................

10. Date of subsequent assignment (from file or other source)....................

11. Name(s) and address(es) of assignee(s). Give names and addresses of *all* assignees and indicate whether all or a part of the interest was assigned)

12. Never assigned (check)

REMARKS:

QUESTIONNAIRE FOR INVENTOR

Strictly CONFIDENTIAL

PART II—All references to invention or patent in this section are with respect to the sampled patented invention, unless indicated otherwise.

1. When were you born?....................
(day) (month) (year)

2. Give the state or country of your birth....................

3. Encircle the highest grade of schooling completed

| 1 2 3 4 5 6 7 8 | 9 10 11 12 | 13 14 15 16 | 17 18 19 20+ |
|---|---|---|---|
| Grade School | High School | College | Graduate and post-graduate work |

4. Did you show early interest in inventions—before age 20? (check) Yes.......... No..........
Do not recall..........

5. How old were you when you received your first patent?..........

6. What do you consider your major occupation?....................
What was your occupation at the time of your sampled invention?....................

7. What industry have you been in primarily?....................
What industry were you in at the time of your sampled invention?....................
....................

8. Are you: (check) (a) Self-employed.......... (b) Employee..........
(c) Other (specify)..........

9. At the time when you made your sampled invention were you: (check)
(a) Self-employed.......... (b) Employee.......... (c) Other (specify)..........

10. If you are, or were an employee of a company to which the sampled patent was assigned, please indicate your official position with such company

..........

(President, Vice-President, Research Director, etc.)

11. What stimulated or gave rise to your sampled invention? (check one or more)
(a) The demands of your job.......... (b) Financial problems.......... (c) Studies you were engaged in.......... (d) No known stimulus.......... (e) Accidental..........
(f) Other (specify)..........

12. Was your sampled invention associated with your: (check one or more)
(a) Business.......... (b) Training.......... (c) Hobbies.......... (d) Other (specify)..........

13. How many months elapsed between the initial conception of the idea of your sampled invention and your development of it to a stage ready to apply for a patent?..........

14. Was your sampled invention actually produced (in the laboratory or otherwise) to test its feasibility? (check) Yes.......... No.......... Other (specify)..........

15. What led you to seek patent protection for your sampled invention?..........

16. What is the total number of your patented inventions? (a) All the patents issued to you to-date.......... (b) All the patents issued to you that are still in force.......... (c) All the patents issued to you which are assigned.......... (d) All the patents issued to you that were or are being used commercially.......... (e) All the patents issued to you before the sampled patent..........

17. What is the number of your patent applications which are pending?.......... Number of these pending applications that are assigned.......... Number that are not assigned but will be assigned before issue..........

18. Are your patented inventions in a specified field of technology? (check) (a) One patent only.......... (b) All of them.......... (c) Most of them.......... (d) They are in different fields.......... (e) Other (specify)..........
If your answer is other than (a) please indicate the specific field or fields:

..........

19. Have you made patentable inventions which were not patented? (check) Yes.......... No.......... If "yes," why were these not patented?..........

20. In developing your sampled invention did you have any out-of-pocket expenses for the following? (If yes, give the amounts; if no, enter zero) (a) In developing your idea so as to be able to apply for a patent $.......... (b) In applying and obtaining the patent $.......... (c) In trying to interest others to purchase or use your patent or to develop means for producing and marketing it yourself $..........

21. Are the amounts shown in 20 based on: (a) Expense accounts.......... (b) Recollection.......... (c) Estimates.......... (d) Other (specify)..........

22. Is your sampled patent assigned? (check) Yes.......... No.......... If "yes" (a) Was it assigned to your employer by prior agreement to assign.......... (b) Was it assigned to your employer by special agreement.......... (c) Was it assigned to a company through the assistance of an agent.......... (d) Was it assigned to a company through your own negotiation.......... (e) Was it assigned to a company which approached you for purchasing.......... or licensing it.......... (f) Other (specify)..........

23. What, if any, difficulties did you experience in trying to market your sampled invention?
..........

24. Is your sampled patent licensed?: (check) Yes.......... No.......... Do not know.......... If "yes," how many licensees does it have..........? If "no," were efforts made to license it? Yes.......... No.......... Do not know..........

25. What is the net income from your sampled patent to you (enter the amounts; if none, enter zero)? (a) Realized to date $..........

26.* Do you know the amount that the assignee(s) or licensee(s) had to spend to put your sampled invention or its product on the market? (check) Yes.......... No.......... If "yes," give the amount (including zero) $..........

27.* Do you know the total net amount that the assignee(s) or licensee(s) have realized from the use of your sampled invention? Yes.......... No.......... If "yes," give the amount (including zero) $..........

28.* Are the amounts given in Questions 26 and 27 based on: (check) (a) Belief.......... (b) Records (royalties, etc.).......... (c) Other (specify)..........

29. Was your sampled patent involved in interference? (check) Yes.......... No.......... If "yes," (a) What out-of-pocket costs did you incur as a result $.......... (b) What costs did the assignee(s) or licensee(s) incur $.......... (c) What was the outcome (describe)
..........

30. Has there been any litigation or threat of litigation with respect to your sampled patent? (check) Yes.......... No.......... Do not know.......... If "yes," what was the outcome (describe)..........

31. What, if any, use has been made of your sampled invention? (check) (a) Is the sampled invention presently being used? Yes.......... No.......... Do not know.......... If "yes," check whether slightly.......... moderately.......... extensively.......... (b) If it is not presently being used, was it ever used? Yes.......... No.......... Do not know.......... If "yes," check whether slightly.......... moderately.......... extensively.......... (c) If it has not been used to date, is it expected that it will be used in the near future? Yes.......... No.......... Do not know..........

32. If your sampled invention is not being used in production at this time, or it is being used only slightly, is it because of: (check) (a) Lack of market demand.......... (b) Rapid obsolescence..........(c) Competitively at a disadvantage.......... (d) Shortage or lack of venture capital..........(e) Development of the art has taken a different course.......... (f) Foreign competition.......... (g) Supporting arts have not developed sufficiently.......... (h) Patent does not provide sufficient protection..........(i) Neglect to exploit it..........(j) Do not know the reason.......... (k) Other (specify)..........

33.* Do you feel that the assignee(s) or licensee(s) of your sampled patent have done all that could be done to make the maximum use of your patent? (check) Yes.......... No.......... Do not know.......... If "no," what do you believe is the reason for their failure to do so? (describe)..........

<u>34.</u> Is your sampled invention patented in other countries? (check) Yes.......... No..........
Do not know.......... If "yes," (a) List all the foreign countries in which it was patented
..........................................................................................................................

35. In your opinion: (a) Does the present patent system in the United States encourage invention? (comment) ..........................................................................................
(b) Does it encourage utilization of patents by industry? (comment)..............................
(c) Are inventors sufficiently protected? (comment)..........................................................

36. On the basis of your experience, would you say that large corporations are receptive to outside inventions, such as inventions by free-lance inventors? (comment)...........................

37. In terms of your own experience have you found the 17-year period: (check) (a) Too long.......... (b) Just about right.......... (c) Too short..........(d) Other (specify)..........
If your answer is other than (b), please indicate what period you consider most appropriate and why?..........................................................................

38. Do you believe that on the average the large corporations have a stimulating or a retarding influence on: (a) Number of patented inventions (comment)...............................................
(b) On the use of patents in industry (comment)..................................................

39. What questions would you add to a questionnaire on the utilization of patented inventions which you deem appropriate, but have been overlooked in this questionnaire? (use additional sheets if necessary)..........................................................................

40. Which questions in this questionnaire do you deem inappropriate or worthless for one reason or another? (indicate the questions by numbers)..................................................

REMARKS: (use additional sheets if necessary)

*Note:* For underscored question numbers read the Instructions.
* To be answered only in cases in which the sampled patent is assigned.

## INSTRUCTIONS FOR FILLING OUT THE ASSIGNEE QUESTIONNAIRE ON THE PATENT UTILIZATION STUDY

*(For the Assignee)*

The first page of the questionnaire provides basic information with respect to the sampled patent, abstracted from the Official Gazette. Please check this information and enter any corrections or additions in the space for remarks on this page. If the space is insufficient, please attach extra sheets.

There are 31 questions. A number of these questions will be inapplicable to you. For instance, Question 2, dealing with a purchased patent, will not concern an assignee who did not acquire the patent by purchase. Conversely, the assignee who acquired the sampled patent by purchase will not be concerned with Question 3. There are a number of other questions that are used alternatively so that *any particular assignee has considerably fewer than 31 questions to answer.*

Most questions can be answered by a check mark or a number.

In most questions there is a sub-item "other" in the event your reply does not fit in the specific category provided. If you find it necessary to use "other," please do not check but write out the appropriate answer.

Please base your replies on records where possible. Where records are not available please give your best estimate. Please answer *all* applicable questions.

*Question 3.* This question seeks to determine the expenditures in connection with the sampled invention from its conception to the time at which a patent application was or could have been filed. It should *exclude* expenditures looking toward the sale, the manufacture, or in general, the commercial use of the invention. Where separate cost records have not been kept, please give your best estimate. Include the actual cost, fees, etc., incidental to obtaining the patent (and foreign patents, if any).

*Question 5.* This is the period in which the costs reported in Question 3 were incurred.

*Question 6.* The costs sought in Question 6 are those incurred in addition to the costs reported in Question 3. Such costs should be included whether or not the patent was actually commercially exploited. These are costs looking toward commercial exploitation of the patent whether they were incurred before applying for the patent or afterwards. Please note that all costs incidental to patenting are included in Question 3 and should not be duplicated in Question 6.

*Question 7.* Please answer regardless of the extent of use.

*Questions 10 and 11.* Please give actual dates.

*Question 26.* Net loss means all expenses incurred in inventing, patenting, and/or developing the sampled invention for commercial exploitation, plus actual production costs, less the total income realized to-date from sales, royalties, inventory, etc., derived from the sampled patent. Net gain represents the excess of income from sales, royalties, inventories, etc., above all the expenses incurred in inventing, patenting, and/or developing the sampled invention for commercial exploitation plus actual production costs.

The "expenses incurred in inventing and patenting" is the amount you reported in Question 3. The expenses for "developing the sampled invention for commercial exploitation" is the amount you reported in Question 6.

If accounting figures are not available please give your best estimate.

*Question 27.* This question is primarily intended to ascertain the current practice in patent cost accounting.

*Questions 28 and 29* relate to a phase of the study contemplating an intensive examination of sampled patents involved in litigation or interference.

*Questions 30 and 31.* If you are an assignee with two or more questionnaires, please record your responses with respect to Questions 30 and 31 on only one of these questionnaires.

*Definition of Words and Phrases Used:*

*Commercial exploitation. (used commercially):* Making or selling the patented invention, or using the patented invention in the production of goods or services, or making financial arrangement(s) with a third party(s) for the production, use, or sale of the patented invention.

*Use (used) in production:* Making or selling the patented invention, or using the patented invention in the production of goods or services.

*Unexpired:* This was underlined for emphasis.

*"Know-how":* Factual knowledge not suitable for precise, separate description but which, when used in an accumulated form, after being acquired as the result of trial and error, gives to the one acquiring it an ability to produce something which otherwise he would not have known how to produce with the same accuracy or precision found necessary for commercial success.

## THE PATENT UTILIZATION STUDY

Order number.................................... Sample number.................................... Date....................................

PART I—Basic information on the sampled patent (Derived primarily from the Official Gazette)

1. Patent number.................... 2. Number of claims.................... 3. Class....................

4. Title....................................................................

5. Name(s) of inventor(s)....................................................................

6. Application date (earlier priority date if any)....................................................................

7. Date patent granted.................................... 8. Date of assignment....................................

9. Name(s) and address(es) of assignee(s). (If more than one assignee, give names and addresses of all, and indicate whether all or a part of the interest was assigned to each)

........................................................................................................................................

10. Legal status of the assignee....................................................................
(Corporation, Partnership, or Individual)

REMARKS:

## QUESTIONNAIRE FOR ASSIGNEE

All replies will be kept strictly CONFIDENTIAL

PART II—Information concerning the sampled patent

All references to invention or patent are with respect to the sampled patent under consideration unless indicated otherwise.

1. How did you acquire your right(s) in the sampled patent? (check) (a) Purchased.......... (b) Developed by own employe(s): (1) Under contract to assign.......... (2) Not under contract to assign.......... (c) Other (specify)....................................................................

2. If purchased, what was the amount paid? (Give the amount if lump sum payment; otherwise, indicate both the method of payment and the amounts involved)....................................................................

3.* If the invention was produced by your employe(s), give the actual or estimated costs incidental to the conception, research and all other expenditures incurred including the cost of patenting (exclusive of any separate costs for commercial exploitation) $..........

4. If purchased, when was it purchased? (month and year)....................................................................

5.* How many months elapsed between the initial conception of the idea of the sampled invention and the development of it to a stage ready to apply for a patent?....................................

6.* What expense (in addition to those given in Question 2 or 3) did you incur to develop the sampled invention to the stage where it was ready for commercial exploitation (production for sale or use in production)? $..........

7.* Is the sampled patent used in production now? (check) Yes.......... No..........
Other (specify)..........

8. If not used in production now, has it ever been used in production? (check) Yes..........
No.......... Other (specify)..........

9. If it has never been used in production, are there indications that it will be used in the foreseeable future? (check) (a) Definite indication it will be used.......... (b) Some indication it might be used.......... (c) No indication that it will be used..........
(d) Other (specify)..........

10.* If the sampled invention is or was ever used in production, what is the date when it was first used? (month and year)..........

11.* If the sampled invention was in use but is no longer in use, what is the date when it was last used? (month and year)..........

12. If the sampled invention is not being used now in production, check the reason why it is not being used: (a) Lack of market demand.......... (b) Rapid obsolescence..........
(c) Competitively at a disadvantage.......... (d) Shortage of venture capital..........
(e) Foreign competition.......... (f) Patent does not provide sufficient protection..........
(g) Outright neglect to develop.......... (h) Other (specify)..........

13. If the sampled patent is or was used in production, indicate if it is or was used: (check)
(a) Extensively.......... (b) Moderately.......... (c) To a limited extent..........
(d) Other (specify)..........

14. Can the sampled invention be used commercially by itself (with or without expired patents) or must it be used in conjunction with other unexpired patented inventions? (check)
(a) Can be used by itself, but that is not the way it is being used.......... (b) Is being used by itself.......... (c) Cannot be used to advantage by itself.......... (d) Would have to be used in conjunction with others.......... (e) Other (specify)..........

15. If the sampled invention is or was used in production in conjunction with one or more other patented inventions, is or was the sampled invention a major or minor item? (check)
(a) Major.......... (b) Equally important.......... (c) Minor..........
(d) Other (specify)..........

16. If the sampled patent is or was used in production, is or was the "know-how" an essential element in that production? (check) (a) Yes.......... (b) No..........
(c) Other (specify)..........

17. Did you devote your attention to the development and perfection of the "know-how" because of the patent protection on the sampled invention? (comment)..........

18. Has the sampled invention increased your sales? (check) (a) Markedly..........
(b) Moderately.......... (c) Slightly.......... (d) Not at all..........
(e) Other (specify)..........

19. Has the sampled invention resulted in the reduction of your production costs? (check)
(a) Markedly.......... (b) Moderately.......... (c) Slightly (d) Not at all..........
(e) Other (specify)..........

20. Describe any other benefits which you have derived or expect to derive from your right(s) in the sampled invention__________

21. Have licenses been issued by you to others for the sampled patent? (a) Yes____ (b) No____ If "no," would you be willing to license it? (1) Yes____ (2) No____ (3) Other (specify)__________ If "yes," did the license contain provisions relating to: (check) (a) Quantity____ (b) Territory____ (c) Price____ (d) Other (specify)__________

22. If it has been licensed, what were the reasons for licensing it? (comment)__________

23. Would you have manufactured, used, or sold the sampled invention if you did not have the patent protection? (check) (a) Yes____ (b) No____ (c) Other (specify)__________

24. What relationship or dealings did you have with the inventor prior to the assignment of the sampled patent? (describe)__________

25. Do you own or are you licensed to use other patents issued to the inventor of the sampled patent? (a) Total number of such patents owned____ (b) Total number of such patents licensed to you____ (c) Total number of such patents which have not expired____

26.* What would you estimate as the net loss or gain that you have had to-date from the sampled invention? (give the estimated amount) (a) Net loss $____ (b) Net gain $____ (c) Other (specify)__________

27.* Is the amount in 26: (a) a recorded figure____ (b) an informed guess____ (c) Other (specify)__________

28.* Was the sampled patent involved in interference? (check) No____ Yes____ If "yes," what was the outcome? (indicate)__________

29.* Has the sampled patent been involved in litigation? (check) No____ Yes____ If "yes," what was the outcome? (indicate)__________

30.* What questions would you add to a questionnaire on the utilization of patented inventions which you deem appropriate, but which have been overlooked in this questionnaire? (use additional sheets if necessary)__________

31.* Which questions in this questionnaire do you deem inappropriate or worthless for one reason or other? (indicate the questions by numbers)__________

REMARKS:

*Note:* For definition of words or phrases underlined see instructions.
* Asterisked question numbers are explained in the instructions.

# Patent and Other Factors in the Future Organization of the Steel Industry*

ROBERT M. WEIDENHAMMER, Research Associate
IRVING H. SIEGEL, Principal Consultant

SUMMARY

THIS STUDY SEEKS to appraise the economic feasibility of the growth of small-scale, financially independent iron and steel companies or establishments upon a new foundation of "capital-saving" technology. Such a prospect has often been conjectured, anticipated, or ardently desired. It has excited the fancy of the engineer as well as the partisan of economic decentralization. At least two well-known government reports that refer to the possible emergence of a new steel technology compatible with the concept of "small business" immediately come to mind: the Federal Trade Commission report on *The Control of Iron Ore,* prepared for the Antitrust Subcommittee of the House Committee on the Judiciary, December 24, 1952, pp. 136-37; and the report of the President's Materials Policy Commission, *Resources for Freedom,* June 1952, II, p. 17, and IV, p. 35.

Professor Weidenhammer has been assigned the task of evaluating the numerous novel iron and steel processes that have recently been described with enthusiasm in the trade journals and the technical literature. These developments come opportunely because some of the traditional constants of the industry have also been softening. For example, the supply of coking coal has been dwindling, and the high-grade Mesabi ores must be supplemented with low-grade taconites and with imports. Do the many technical innovations provide a realistic basis for expecting financial and geographic decentralization of the industry? Do they mean that small integrated facilities will be able to operate profitably in the neighborhood of limited ore deposits and secondary population centers? Will the future geographic and size distributions of firms be significantly affected by the ownership and accessibility of patents on the new technology?

Briefly, Professor Weidenhammer's researches suggest that the traditional patterns of the iron and steel industry will not alter drastically as the new technology is assimilated. Costs of entry will remain high, and economic considerations will continue to favor technical integration of facilities. Patent ownership will apparently not be a controlling factor in the gradual reshaping of the industry's technology. The new opportunities for small business will apparently arise in satellite industries, rather than in iron and steel production proper.

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* Dr. Weidenhammer prepared this research interim report. This is a report on one of three case studies designed, carried out, and written up under the general direction of Dr. Siegel for *Project 3a,* **Effect of Patents on the Creation and Growth of Small Industrial Units.**

LOOKING BACKWARD

FROM 1644, WHEN JOHN WINTHROP, JR., son of the first governor of Massachusetts, started an iron furnace near Lynn on the Saugus River, to 1847, when William Kelly in Suwanee, Kentucky, made the first commercial-grade steel, this country used wood and iron as its major industrial raw materials. Kelly did not file a patent application on his invention before Henry Bessemer in 1856 announced his similar process at the Cheltenham meeting of the British Association for the Advancement of Science. When Kelly heard that Bessemer had filed a patent application in Washington, he fully substantiated his own claim to priority and received the original patent. Bessemer thereupon filed patents on details of the actual installations used, thus preventing any American company from using the process without being licensed by himself as well as Kelly. This awkward situation retarded construction of a commercial-size steel plant until Alexander L. Holley pooled the Kelly, the Bessemer, and the Mushet patents and in 1865 began operating the Albany Iron Works at Troy, New York.

Incidentally, Sir Henry fared better than his American rival. He was knighted, had his name given to the process, and collected more than $10 million from the combined patents. Kelly's own reward was a small fraction of the sum, and his name is generally remembered only by historians of American invention.[1]

The time was evidently ripe for steelmaking. In 1856 Dr. Karl W. Siemens (later Sir William Siemens) of Hanover, Germany, patented another process known today in this country as the open hearth and in Europe as the Siemens-Martin. As early as 1868 Peter Hewitt arranged for his Trenton Iron Company to become a licensee under the Siemens-Martin patents. The royalty on these patents was $3 per ton of steel made from two furnaces; but, if additional furnaces were built, their output would have to be licensed at the higher rate of $5 a ton. Hewitt then made arrangements with the Martin Brothers of Sireuil, France, to take out U.S. patents for their process at his own expense and to reserve for his Trenton Works the exclusive use of these patents for gun barrels and railroad tires. Interested U.S. producers were licensed by Hewitt to make other steel products, with the Trenton Iron Works sharing in the receipts on a 50:50 basis with the Martin brothers, once the cost of establishing the U.S. patents had been recovered by Hewitt. The original open hearth furnace at Trenton proved to be a high-cost operation and was replaced. The first low-cost operations were in Boston and Nashua in 1870 and in Pittsburgh, in 1871.

The development of the iron, and later of the steel, industry in this country during the 19th century was fostered by rapid capital formation from high retained profits. In the forties, when larger-scale output of iron had reduced its price to $35-40 a ton, costs at the Trenton Iron Works are reported as follows:

| | |
|---|---|
| Iron ore, 2 1/5 tons at $1.50 | $3.30 |
| Coal, 2 tons at $3 | 6.00 |
| Limestone, 1/4 ton at 25¢ | 0.06 |
| Labor and "incidentals" | 4.00 |
| | $13.36 |

[1] Allan Nevins, *Abram S. Hewitt* (New York: Columbia University Press, 1935), p. 131; J. N. Boucher, *William Kelly*, 1924 (Greensburg, Pa.: Privately printed, 1924), p. 242.

The large gap between price and costs justified the substantial fees paid for the use of patents and stimulated competition from new companies, such as Jones & Laughlin in Pittsburgh (1853), Cambria Iron Works (now Bethlehem Steel) at Johnstown (1853), and the Bethlehem Iron Company at Bethlehem (1860).

### NEWER DIRECTIONS

On January 1, 1957, the ingot capacity of the U.S. steel industry stood at 133.5 million net tons, of which 117 million net tons was open hearth, 12 million net tons electric furnace, and only 4.5 million net tons Bessemer capacity. These capacity data reflect, first of all, the fact that open hearth capacity, which in 1900 was only one-half of Bessemer capacity, had outdistanced it in 1910 by two to one, and in 1920 by four to one.

A trend toward a modified Bessemer, a truly significant innovation, now seems imminent. In 1957 one of the major producers, the Jones & Laughlin Steel Corporation, will start to operate such a new type Bessemer, known as the oxygen-blown converter. The McLouth Steel Corporation, a small producer, has been operating this type for several years in Detroit. Perhaps significantly, a substantial part of the funds for the McLouth installation was obtained from the General Motors Corporation. The patents for this process, which was developed in Austria and first used at Linz-Donawitz, are held in this country by Kaiser Engineers. The first North American installation was at the Dominion Iron and Steel Company in Canada.

The first commercially successful electric furnace was operated by Heroult in France in 1899 and introduced into this country in 1906 at the Halcomb Steel Company of Syracuse (today Crucible Steel) and at the Firth-Sterling Steel Company in Pittsburgh. Electric furnace capacity in 1940 amounted to only 2 million net tons, but it has since risen to the 12 million figure cited above and it is expected to rise to 25 million net tons in another decade. This trend toward more electric furnace capacity reflects the ever-growing need for high-grade alloy steels and the attainment of a level of operating costs competitive with those of the open hearth even for making carbon steel. A restraining factor, however, is the shortage of purchasable scrap (the major charge for electric furnaces), a shortage which appears to be headed for further world-wide aggravation.[2]

Steelmakers expanded facilities with reluctance in the thirties and forties, but a new mentality has now taken hold. In the decade 1930-39, the steel industry in this country had been able to use its capacity at an average rate of only 48 per cent. In five of those ten years the industry operated at a loss. After World War II most steel men looked upon the 1946-48 boom with skepticism. Ingot capacity on January 1, 1945, stood at 95.5 million net tons; by January 1, 1947, it had been reduced by dismantlements to 91.2 million net tons. Not until mid-1950 did capacity for the first time exceed the mark of 100 million net tons. But, in the next 6½ years the capacity increase totaled 33.5 million net tons. Further expansion at a rate of 3-4 million tons a year is being projected for the next 15 years.

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[2] *Report on Iron and Steel Scrap,* prepared by the Department of Commerce House Committee on Banking and Currency, February 1, 1957.

It is not our concern to decide how much of the recent expansion has been attributable to Government urging in the face of the threat of a possible World War III, or how much to the availability of rapid amortization (between January 1, 1951, and January 1, 1957), or how much to long-term projections of rising peacetime demands. What matters is that this new spirit of expansionism has provided a favorable climate for significant innovations in steel technology. The high and rising rate of research outlays, supported in part by the "new look" policy of national defense, has accelerated innovation and patent activity in the field of ferrous metallurgy. The urgent military need for steels that are stronger and more resistant to heat and corrosion has also made new materials available for civilian markets. On the other hand, the depletion of high-grade mineral deposits, especially of iron ore and coking coal, has created the need for beneficiation processes. An indicated shortage of scrap has provided an incentive for the development of synthetic scrap.

For the first time in a century we shall in the foreseeable future make steel by methods fundamentally different from those in use since steel first became a commercial mass product. No single complete new process is in prospect. Rather, we shall witness the use of a combination of new steps: say, the direct reduction of iron ore through hydrogen, then steelmaking in the oxygen-blown converter, and finally continuous casting. This combination should reduce the investment costs per ton of annual capacity by one-half, and direct operating costs per ton by at least 5 per cent. The oxygen-blown converter can melt steel every 45 minutes instead of the 10 hours as in the most modern open hearth furnace. In short, steel production will come closer to being a continuous, rather than a batch, process.

Gases, especially oxygen and to a lesser extent hydrogen and argon, are finding important uses in the newer ferrous metallurgy. Thus, the prospect of new small firms arising around the steel industry should also be recognized. For example, Air Products, Inc., of Allentown, Pennsylvania, started in 1940 with a capital of less than $100,000. It now does a business of $40 million a year manufacturing oxygen-generators for steel plants, chemical plants, and guided-missile firing installations.

While the importance of gases in ferrous metallurgical processes has long been realized, widespread use was not commercially feasible so long as oxygen was sold at relatively high "retail" prices in steel vessels. With oxygen generators now an integral part of the user's plant, the cost of oxygen to the steel industry has been reduced to only a fraction of the cost of a decade ago. The reorientation of steelmaking is thus being facilitated by "small business."

## REVOLUTION OR EVOLUTION?

The steel industry has often been accused of technological sluggishness. It has been blamed for not encouraging research as much as other key industries, such as chemicals, electronic equipment, or petroleum refining. It has been criticized for slowness in adoption of new techniques, for fear of obsolescence of existing facilities. The observation is often made that, since the Duquesne blast furnace was built near Pittsburgh in 1895, the process of melting iron has not been changed except for improvements in capacity, refractories, the blast, materials handling, and pressurizing. The open hearth furnace too has not changed *in principle* since 1868.

Extenuating factors may, of course, be cited. Steel engineers have stated, for example, that the size and cost of the installations (a blast furnace producing 2,000 tons of hot metal a day costs some $30 million to build) themselves discourage unpredictable experiments. Even if the danger of blowouts is discounted, the hard fact remains that in good times a furnace cannot be spared for "laboratory tests" because customers are waiting in line. In times of recession when a furnace is idle, management may have neither the will nor the wherewithal to gamble. Lest the "capitalist system" be wrongly charged with a special antagonism to the research spirit, examples of frustration in the Soviet Union's steel industry could also be cited.[3]

The attitude of the steel industry toward research, patents, and innovation seems to be undergoing change. Some of the major steel producers are now making substantial outlays for research.[4] Although they will continue to rely on know-how, they may be expected also to give increasing weight to patents in their competition with others.

Nevertheless, the economic impact of foreseeable technological change on the industry will be gradual and will not reverse the trend toward integration and concentration. It is quite true that the continuous rolling mill not only produces a better product in less time and requires fewer workers but that it also represents a smaller capital investment per ton of steel rolled than the old-fashioned hand rolling mill. It is the considered opinion of competent steel engineers interviewed by the writer that such new processes as H-iron, the L-D oxygen steelmaking process, and continuous casting will some day be widely adopted, with significant savings in capital outlays per ton of capacity over new but conventional-type installations.

But it would be entirely erroneous to conclude that we are at the threshold of an era of decentralization for the iron and steel industry, with perhaps small steelworks serving local markets. Even if this were a plausible prospect—and it appears not—the impact on the industry of such new steelmaking techniques would be insignificant for many years to come. After all, in an industry with a capacity of 133.5 million net tons, the installation of say, 1-2 million net tons of unconventional capacity per year could not for a generation reshape the plant-size and ownership patterns of the industry. Furthermore, most of the actually reported increases each year are achieved by improvements of, or additions to, existing installations. One sound economic reason is that new "grass roots" plants cost four times as much to build today per ton of annual capacity than did over one-half of the total existing capacity cost when installed in the years before World War II. Thus, even if the new processes could achieve savings of as high as 50 per cent in investment outlays per ton of annual capacity as compared to the present cost of conventional installations, they would still call for capital expenditures of twice the investment in plants of prewar vintage that are still giving satisfactory service today. Even if all engineering aspects of the new processes were satisfactorily solved—and they are not—

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[3] M. Gardner Clark, *The Economics of Soviet Steel* (Harvard University Press, 1956), p. 264.

[4] For example, large new research laboratories were opened in 1956 by U. S. Steel, Bethlehem, Republic, Jones & Laughlin, and Crucible Steel.

neither the funds are available nor does the profit incentive exist for scrapping all conventional type plants in the next 30 years.

Finally, it cannot be emphasized enough that the whole trend toward making better, quality-controlled steels at lowest cost is still directed toward further technical integration rather than decentralization of processes. A perusal of the official Directory of the Iron and Steel Works of the United States and Canada for 1930, 1938, and 1954 (the latest available) will reveal the nearly complete demise of the established small merchant blast furnaces and hand rolling mills.

Factors making for large-scale, fully integrated operations from raw materials to finished products seem compelling. Benefits of flexibility in operation, product uniformity, and reasonable cost accrue from access to assured and quality-controlled supplies of iron ore, coking coal, limestone, and home scrap; the location of by-product coke ovens in the vicinity of the blast furnaces; the construction of blast furnaces in pairs; the usability of hot metal and of home scrap rather than of purchased cold pig iron and market scrap; the availability of more and larger open hearths in one shop; the usability of furnace-blast gas in subsequent stages of production; the retention of heat in the metal from the blast furnace to the steel furnace and to the continuous rolling mill. It is noteworthy that the West European steel industries are now moving strongly toward large, integrated facilities in order to regain, if possible, a competitive position in the world market. In the USSR, where traditionalism, Veblenian "vested interests," and private ownership are not supposed to be entrenched, the same trend has been evident.

A few words are necessary on the past role of patents as a guide to the future. The past development of the steel industry obviously cannot be adequately recounted or interpreted without reference to thousands of foreign and domestic patents. As we have seen, crucial patent issues arose in the very beginning of modern steel production in the United States. Numerous subsequent innovations in materials, processes, and products—for example, continuous rolling mills, materials handling equipment, control instruments, refractories, heat-and-corrosion-resistant alloys, and processes for pickling, heat treating, electroplating, and galvanizing—originated within the steel industry, with suppliers, or with consulting and engineering firms, under the protection of the patent system. In general, it appears that:

1. The benefits of patented improvements have been widely shared, either through the licensing of competitors or the conduct of counter-research designed to undermine entrenched patent positions.

2. Patents have been vital to the establishment and growth of new firms supplying equipment to the steel industry, but they have apparently not been decisive in the establishment of new steel companies.

3. The recent growth of formal research programs has fortified interests in a strong patent system on the part of the present steel industry and its suppliers.

## CONCLUSION

Even if we assume that fundamentally new processes (such as H-iron, the oxygen converter, and continuous casting) are so promising that 50 years hence most steel will be made by such (or other) unconventional methods, there is no technical or commercial reason for a reversal of the historical trend toward larger integrated steel companies. A merger of Bethlehem and Youngstown may be frowned upon by antitrust officials, but there is no criticism of a U. S. Steel's building at Morrisville, Pennsylvania, and perhaps eyeing a location in Texas or California. The pending acquisition of Rotary Electric in Detroit by Jones & Laughlin, its plans for a mill in Texas, and Bethlehem's plan for a mill in the Chicago district tend to be regarded as sound management decisions.

Few new enterprisers will be able to raise the risk money needed for the high threshold investment to challenge these large fully integrated units backed by nationwide or even world-wide sales organizations. True, Kaiser Steel, Lone Star Steel, and McLouth Steel are newcomers who successfully serve primarily a local market, but the first two were started with government loans, and the expansion of the last was financed by General Motors and American Metal Products at a time of steel shortage. Small local steel plants may occasionally be favored by raw materials or markets; but, to become commercially successful, they usually must provide a variety of shapes, and the needed minimum-size finishing facilities will tend to exceed the local market.

Another possible economic barrier to new competition that has recently been cited,[5] the limited unavailability of iron ore, does not seem important. Although all fully integrated producers strive to assure their own ore supplies through the development of their own mines or at least through long-range supply contracts, perhaps no blast furnace in this country has ever been idled because of inability to buy ore in the open market.[6] With the development of many large new iron ore deposits in Canada and elsewhere, the ultimate exhaustion of the more closely held Mesabi deposits should not reduce free access to market ore.

In the light of the foregoing, it is plausible to assume that the recent trend toward fewer and larger fully integrated companies will continue. Due to the large capital investment in serviceable plants built years ago at a fraction of existing costs, existing companies will introduce radically new processes only very gradually. New competition will be inhibited by the still high threshold investment required for a fully integrated plant offering a wide variety of finished products. The investment barrier seems more real than any patent or raw material monopoly.

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5 Joe S. Bain, *Barriers to New Competition* (Harvard University Press, 1956), p. 153.

6 A rapidly growing and fully integrated steel company, Granite City Steel Corporation, buys all its ore in the open market. In February 1957, however, the company announced that its geological crews were looking for iron ore in the Tri-State district (Southwest Missouri, Oklahoma, and Kansas).

# Patent and Other Factors in the Growth of the Electronics Industry in the Boston Area*

WELDON WELFLING, Research Associate
IRVING H. SIEGEL, Principal Consultant

## SUMMARY

THE POSSESSION OF "INTELLECTUAL CAPITAL" is vital to the establishment by scientist-entrepreneurs of small consulting or manufacturing businesses on the technological frontier; but this is only one of the requisites to the survival and eventual success of such businesses. A study of small electronics and related firms in the Boston area has been undertaken to ascertain the role of other factors, including patents.

Since this study has not yet been completed, the note published here must be regarded as provisional. The study thus far indicates that many factors may enter significantly into the organization and development of the small electronics firms: university contacts, government employment experience, military contracts, family capital, assistance from venture capital companies, patents, etc.

Boston industry leaders have divergent views on the importance of patents. Basic electronics patents are generally accessible to all comers on reasonable licensing terms. Although the ownership of patents has often served as the basis for establishment of new firms, other factors have greatly influenced their subsequent history. Smaller companies, especially those working on government contracts, tend to be less interested in patents than larger firms. Firms filing patent applications often do so defensively—for trading purposes in cross-licensing agreements and for the reduction of net royalty costs.

## NATURE OF THE INDUSTRY

THE WORD "ELECTRONICS" originally referred to vacuum tubes and to the devices of which they are part. However, the development of myriad new applications in communications, controls, computers, and radiation has blurred its original meaning.

The industry, however defined, is a new and major factor in the American economy, but it promises to be particularly significant in New England (especially Massachusetts), which has experienced the decline of other industries such as

* Dr. Welfling prepared this research interim report. This is a report on one of three case studies designed, carried out, and written up under the general direction of Dr. Siegel for *Project 3a*, **Effect of Patents on the Creation and Growth of Small Industrial Units.**

textiles and shoes. Thus Boston may, because of its "head start" and certain other advantages, remain a principal center of electronic research and manufacture. The Federal Reserve Bank of Boston found in 1953 that "this young industry has been growing so rapidly that it would not stand still long enough to be measured accurately." In a survey of 123 New England firms in the industry in 1955, 60 per cent were found to have commenced business since the end of World War II.

The following figures, compiled by the Federal Reserve Bank of Boston, are incomplete but they give a fair idea of the relative importance of different types of electronics firms in the Boston area:

| PRODUCT GROUPS | PLANTS | EMPLOYMENT JULY 1955 | SALES 1955 (000) |
|---|---|---|---|
| Communications Equipment | 29 | 22,259 | $235,187 |
| Industrial Electrical Apparatus | 13 | 3,685 | 44,358 |
| Instruments | 5 | 1,025 | 13,275 |
| Non-Electrical Machinery | 8 | 405 | 4,752 |
| Insulated Wire Cable | 2 | 152 | 1,733 |
| Other | 12 | 1,893 | 26,662 |
| | 69 | 29,419 | $325,967 |

The industry includes research and development laboratories as well as manufacturing firms. Some of the latter produce components; some produce end products. The larger firms produce radio and television sets, telephone and sound reproducing and recording equipment. General Electric, Westinghouse, Sylvania, Columbia, Bell Laboratories, Raytheon, and other large organizations are equipped to produce tubes, transistors, resistors, semiconductors, transformers, and other components on a mass production basis.

Smaller firms tend to specialize in military and civilian devices requiring a high degree of know-how and development skills. In the military field, fire control, radar, communications, navigational aids and controls predominate. (An Arthur D. Little Company survey in 1952 found that the electronic equipment in a military plane approximates in cost the airframe and engines, and that the total annual military expenditure for electronics was about $2 billion.) Small firms are also active in the production of computing and office equipment and specialized measuring and control equipment. These items generally require considerable design and development work, and their value per unit is high.

Many firms are engaged primarily in independent and contract research. Some of these do not confine their activity to electronics. A principal source of business is government contracts, some of which go to firms that also manufacture. Newer firms often do most of their work for government, while others concentrate largely on civilian business.

## LOCATIONAL FACTORS

The importance of research and development in the growth of products and markets is indicated by the fact that electronics firms in the Boston area spend, on the average, about 10 per cent of sales for research and development. This proportion is much greater than the average found for all industry in broader inquiries, say those conducted by the U.S. Bureau of Labor Statistics for the National Science Foundation. The Federal Reserve Bank of Boston ascertained that 78 of 123 New England electronics firms had research and development programs in 1954, compared with 51 companies in 1950.

Most of 44 firms reporting why they located plants in the Boston area gave primacy to three reasons: availability of workers, management preference, and proximity to research organizations. Compared to other reasons these three overshadow all others. The 44 firms listed availability of workers 24 times, personal reasons of management 22 times, and proximity to research organizations 14 times. Next in line is availability of financing, with 4 listings.

In the rapid growth of electronic and nuclear research and operations in the Greater Boston area, the presence of Harvard and the Massachusetts Institute of Technology (like the presence of the California Institute of Technology in the case of the West Coast development) must have served as a catalyst. These centers of training and research have certainly helped create an environment particularly conducive to the exploitation of nuclear and electronic science. For one thing, consulting services were immediately available in the faculty and staff of these institutions, although this factor could easily be exaggerated. Furthermore, the direct participation of teachers in new enterprises as partners or owners was possible; some professors even left their teaching posts. Schools also imply a geographic concentration of young men, who make local contacts as students and for one reason or another may later become residents. Whether a young man comes from a distance to Cambridge (Harvard or M.I.T.) to study science or engineering or is already a resident of the area, he finds himself upon graduation already in the center of electronics and nuclear developments on "Research Row."[1] His first employment may well be near where he got his education; and if, a few years later, he strikes out on his own, he will already be cognizant of the advantages of that area. Of special importance was the establishment of wartime research centers under the direction of these educational institutions in the Boston area.

A connection probably also exists between the research accomplishments of the area and the availability of capital. For example, wealthy friends of the schools tend to be aware of the industrial opportunities being created and may prove amenable when approached for capital. All of these factors inter-mesh to form a favorable environment, and they are reinforced by others, such as labor supply, markets, and transportation.

### SCHOLAR-ENTREPRENEURS

A 1952 study by Arthur D. Little Company covering 40 research-based firms (not restricted to nuclear or electronic research) found that the most often mentioned motives of those founding such enterprises were:

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[1] Research Row is the name applied to Memorial Drive, and its contiguous area, in Cambridge, because on it are Massachusetts Institute of Technology, National Research Corporation, Electronics Corporation of America, and several other scientific companies.

1. A preference for carrying a few developments through to final stages over making a limited contribution to each of many projects.

2. A desire to exploit a new product or process. (Sometimes an employer encourages an employee to do so if the new idea does not fit the framework of the existing concern.)

3. A desire for broader responsibilities.

4. Prestige and recognition attainable by successful development and marketing of a new product.

5. Profit prospects (for example, anticipation of building an equity in a successful enterprise).

A pioneer firm in electronics, now well established and listed on the American Exchange, was begun by an assistant professor of mathematical physics at Boston University. His motive was to exploit the development of control devices based upon light beams. Other corporations were later established by him to develop other products, and a few years ago they were merged. This entrepreneur rates highly the opportunity to carry out basic and applied research projects of major interest to him, rather than those permitted by a university's contracts. His company had sales in excess of $10 million in 1955, divided approximately equally between commercial and military, as against $6 million in 1954. Commercial sales are made to the aircraft, atomic energy, beverage, chemical, food, metal fabricating, paper, plastics, textile, and other industries.

Another firm, established in 1945, had sales of $6 million in fiscal year 1955, nearly all military, but in this decade of operations it had not yet reached consistently profitable operations. The founders were three young scientists who had been at the Radiation Laboratory at M.I.T. during the war. They established a consulting partnership and, a few months later with financial backing from New York, established a corporation for research and development in electronics. It was the intention of the founders to capitalize on their inventiveness and wartime experience. One of the original three left the firm for a larger research company. The firm has been able to expand its product sales to over half its revenue, the remainder being derived from research contracts. Nearly all of its business is with the government, but a considerable part of its research and development costs are assignable to civilian products it hopes to exploit. In the opinion of management, this firm was established in Boston primarily because it was the founders' home. However, it is apparent that technology influenced the choice of residence; and it is considered that proximity of M.I.T. and Harvard has been helpful in the growth of the firm, as four consultants from those institutions are employed.

A few other examples confirm the general impression of the new entrepreneur in this field. While in general most new businesses may be started by men in their late 40's,[2] many of the electronics firms established in the last decade or so have been started by men in their 30's. These men as a rule have college degrees in engineering

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[2] Alfred Oxenfeldt, *New Firms and Free Enterprise* (American Council on Public Affairs, Washington, D. C.), p. 79.

or science and have had up to 10 years' experience in the fields of research or technical work.

The co-founder and president of a firm employing 200 was educated in science at a small Pennsylvania college of high rank. After six years of technical work he served in the Navy as an engineering specialist. Following the war he came to Greater Boston as a senior engineer for one of the larger electronics firms. In 1948 he formed a new company to design and manufacture precision instruments and controls.

A Harvard graduate of 1935 worked in the research department of a large electronics firm until he joined the Office of Scientific Research and Development. After the war he became a half-time consultant to his previous employer and spent the rest of his time developing an electronic analogue computer. In 1946 he established his own company to design, produce, and market this computer, "getting in on the ground floor."

Another inventor-founder went to high school abroad and then turned to radio engineering. Prior to the war he worked in testing and calibration for one of the larger radio firms in New England. After the war he was employed by the Croft Laboratory at Harvard and subsequently enrolled as an undergraduate. He ran out of funds shortly before graduation, but he had developed several promising electronic products, particularly a wide-band distributive amplifier. His co-worker, a Ph.D. candidate, chose to license the use of his share. He himself continued the design and development work, establishing a company in 1948 that successfully marketed the amplifier as well as a succeeding line of products.

High Voltage Engineering Corporation illustrates the formation of a successful company by faculty members utilizing the results of basic research. Professor Robert Van de Graaff was brought to M.I.T. as a result of his research with static generators, where he collaborated with Professor John Trump, who was primarily interested in applications of theoretical work (e.g., to cancer therapy). After the war it appeared that there was a definite market for the type of product they were developing. Since the administration of M.I.T. thought it desirable to separate the commercial operations from the Institute, a company was formed. Since both men wished to continue their academic work, a third scientist was brought from England to head the newly established company. This company has progressed with the application of high voltage generators to sterilization of foods and drugs and to other fields.

## CAPITAL SOURCES

The sources of capital for the young electronics firms are, in general, what might be expected. Illustrative cases of new firms show personal and family savings, private stock offerings, and estates as sources of funds. Venture capital organizations have on occasion played important roles. The more successful new companies reach the point where they can place common stock with the public or debt securities with financial institutions. Older firms that were not originally in nuclear or electronic research and development have entered the field in a normal process of expansion and diversification.

Personal and family resources have proved sufficient to finance the initial operations of a large number of the smaller electronics firms. In such instances, development work by the founders contributed a key investment; or the assembly of purchased components was accomplishable by skilled labor with a minimum of investment in costly equipment.

There also are instances of originators selling stock to a circle of friends who, perhaps remembering the story of Ford Motor Company, have been willing to invest on the strength of their confidence in the founders. Investors in some cases are estates. One of the companies already mentioned drew its original capital from Rockefeller and Stillman funds and from an investment by Pennroad Corporation. Some other small companies are really subsidiaries of established firms; for example, Datamatic, owned jointly by Minneapolis-Honeywell and Raytheon.

The American Research and Development Corporation deserves special mention. It was founded in 1946 as a means of diversifying public investment of venture capital. The Corporation's stock is publicly held and widely traded over the counter. It makes investments in firms developing new products or technological processes. Its management works closely with that of the new company; and when the latter has reached the point of financial independence, the Corporation sells out, using the proceeds to repeat the process.

The majority of firms in which the Corporation has invested are in New England; and, because of the nature of the industry, there are several representatives of electronics. One of the better known is Tracerlab, Incorporated. This company, established in 1946 by a group of scientists and engineers operating in nuclear physics and radioactive isotopes (tracers), has become a leader in the field of radioactivity applications. The original capital was limited to the savings of the founders. In its first year Tracerlab received $150,000 from American Research and Development; and two years later, another $100,000. The following year, 1949, Tracerlab was able to net $1,300,000 from a public offering of common stock. The tremendous value of the Development Corporation as a source of equity prior to the time a public offering is justified is well illustrated.

Another type of venture capital organization is New Enterprises, Incorporated. This firm, also started in 1946, has a small capitalization and a small staff to screen new ventures brought to the firm's attention. The ventures selected are brought before the individual investors associated with the firm. The investors themselves then decide whether or not to invest for long-term capital gains. New Enterprises itself invests little.

## ROLE OF PATENTS

Widely different opinions are held by Boston industry leaders concerning the role of patents in the establishment or growth of new electronics or related firms. Furthermore, this divergence does not seem to correlate well with size of firm or type of activity. Some firms have virtual monopolies which are covered by patents but which may also be ascribed to non-patent factors. Small firms generally do not enter into the manufacture of basic products made by large firms; but such factors as capital requirements and marketing organizations seem to be as important reasons as patent ownership.

In the case of High Voltage Engineering, most of whose work is in the field of accelerators, both General Electric and Westinghouse turned down the Van de Graaff patents in 1946. The basic patents expired in 1952. The main factors in the position of High Voltage seem to be its experience and know-how, plus the fact that capital requirements are high while the market is not extensive enough to attract the larger firms. Although new firms could enter the field so far as patents are concerned, they would have to compete with an established leader in a limited market.

Nevertheless, in the opinion of the management of High Voltage, the existence and validity of the patents were essential in the establishment of the company. Without the patents, the original capital investment would probably not have been forthcoming from American Research and Development Company and Rosenwald funds. The same is true of several other highly successful growth companies of the last two decades or so. Raytheon was established largely to utilize patents on gas rectifier tubes. Electronics Corporation of America and some other companies were founded because the existence of patents interested investors of risk capital.

It is probably a general rule that the larger the company, the more patent applications it files. Raytheon is an example of a large company that actively seeks to obtain patent protection. Smaller companies, especially those working mostly on government contracts, seem less interested in patents for reasons mentioned below.

Among those firms filing patent applications, the reasons for doing so appear to be largely defensive. Patents can be traded in cross-licensing agreements, and the ability to cross-license thus reduces the net cost of royalties.

Access to patents on reasonable terms appears to be easy for basic patents of wide applicability. R.C.A., Bell Laboratories, and some other large firms are engaged in licensing on a broad scale.[3]

The large proportion of government work affects the significance of patents. In supply contracts for what are known as "standard commercial items," a patent holder may not sue a contractor for infringement; instead he may sue the govern-

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[3] A significant step in the licensing arrangement in this country was the establishment of R.C.A., with government blessing after World War I, to combat British Marconi. This company represented a pooling of General Electric, Westinghouse, and Bell patents. Bell's main interest was telephonic communication, and General Electric and Westinghouse were not at that time primarily interested in wireless communication. Hence an exclusive cross-licensing arrangement was made: wireless communication to R.C.A., telephone to Bell, and industrial patents to General Electric and Westinghouse. As a result of the agreement, each had exclusive right to sub-license.

The government's position later changed, and in the early 1930's a suit resulted in the elimination of the exclusive feature. However, by the use of the license royalty, each company was continued in its field. In later years this arrangement broke down; any of the four companies now grants licenses and cross-licenses.

The industry seems to have arrived at fairly standard rates and terms upon which licenses are available. While other factors in agreements may differ slightly, standard rates appear to be available to all for, say, radio and television receivers, radio tubes, and transistors and semiconductor rectifiers.

ment in the Court of Claims. This arrangement apparently is designed to prevent delay in production. The contractor in such cases may be obliged to indemnify the government. On other than standard commercial items the government waives the right to indemnity, apparently to eliminate contingency factors from cost estimates.

Of course, a single contract may involve numerous patents, raising questions as to who owes whom how much. Where such question exists, potential contractors usually obtain government approval to submit specifications to others to check for possible infringement.

When products are first created or applied on government contracts, the company can patent, but the government enjoys royalty-free use in the future. Consequently, some small companies working largely on government contracts expect little advantage in obtaining patents. (Some larger firms, furthermore, claim to avoid government work for this reason.) The know-how and past experience of these small companies, rather than their patents, keep them in specific lines of work. Government contracts may provide that, if the company does not patent, the government will, with the company retaining patent-free use.

In general, the ownership of patents apparently has often served as the basis for the establishment of new firms, but these companies tend subsequently to develop in directions determined by the aptitudes of management and requirements of capital or availability of skills. If the companies survive for a five- or ten-year period, they are usually "over the hump." However, reasons for selling out or merging may still exist. For example, an established company developing a new field may find it more economical to absorb a small company than to establish a new division. Absorption is also a means to enter a new market; and merger may remedy a lack of managerial skill. But the reverse process also takes place: employees of a large firm may break off to set up their own companies. Transonic Corporation, Microwave Associates, and Tracerlab are examples of this reverse process.

# Compulsory Licensing and Patent Dedication Provisions of Antitrust Decrees--A Foundation for Detailed Factual Case Studies*

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SUMMARY

DECREE PROVISIONS providing for compulsory licenses have become a standard form of relief sought in antitrust cases involving patents. Most of the provisions are consent decree provisions providing for licenses at reasonable royalties. Some, including one litigated decree, require royalty-free licensing or dedication of patents. The decrees have been entered on the theories that the provisions are necessary to restore competition, that they are required to deprive antitrust violators of the "fruits" of the illegal activity and, to some extent, as punishment.

The present interim report is directed to an analysis of the legal background of the compulsory licensing and patent dedication decree provisions. It points to some of the respects in which experience to date shows that the assumptions made at the time of entering the decrees are not supported by subsequent experience.

This project, devoted to a factual study of the effects of some of the compulsory licensing and patent dedication provisions of decrees entered under Section 4 of the Sherman Act, is now in the pilot stage with the first report under preparation. The present interim report is directed to the foundation material upon which the case-by-case factual study of the project is based. Detailed studies respecting the cases of *United States v. Besser* and *United States v. Vehicular Parking* are in progress. The final report on the *Besser* case is scheduled to be presented at the First Public Conference of the Foundation in June. Further studies should lead to more generally applicable conclusions as to the place of compulsory licensing and dedication decree provisions and to the formulation of criteria that should guide their entry.

COMPULSORY LICENSING DECREE PROVISIONS have emerged as a major form of relief in cases brought by the Attorney General under Section 4 of the Sherman Act. As was recently pointed out, in such cases "the Department of Justice

* Mr. Frost prepared this research interim report on *Project 4a*, **Effect of Certain Antitrust Decrees Involving Patents as a Major Factor.**

will almost certainly insist upon compulsory licensing of some sort."[1] This emphasis in the antitrust cases stands in sharp contrast to the normal rule that the owner of United States Letters Patent is entitled to license or not to license as he sees fit, and to fix such royalty terms as his own judgment and economic interest dictate.

In substituting the rules of conduct set forth in the decree for the normal rules governing the patentee, the decree provisions relating to compulsory licensing (at reasonable royalties or royalty free) and patent dedication[2] provide a most promising field for study. Unlike the limited areas wherein compulsory licensing has applied in the past, the antitrust decree provisions operate in a variety of areas of business activity and afford an opportunity to evaluate the effect of compulsory licensing in many of the normal environments of patent system operation. Experience with the decrees should accordingly shed light on the operation of the patent system itself. Of equal importance, the decrees have been entered in cases where the government has proven—or at least alleged—that patents have been a significant source of the economic power by which a restraint of trade or monopolization has been effective and the emergence of competition forestalled. In these cases the courts have acted upon the premise that by opening the patents to use by all upon the basis of reasonable royalties, or even no royalties, the prospects of restoring a competitive order are significantly increased. A study of what has actually happened under the decree provisions affords an opportunity to determine both the significance of the charges that patent rights in fact formed the source of the economic power and the extent the premises under which the decrees have been entered have been justified by subsequent events. Finally, a study of the effects of the decree provisions offers an opportunity to formulate the criteria that should govern the entry of similar decrees in the future.

No study of this kind can be based on legal or economic theory alone. Nor can it be confined to statistical analysis, a review of the trade journals, the decided cases, or other readily accessible sources of information. To the contrary, a detailed case-by-case factual study of specific decree provisions is essential. Such study demands discussion with industry personnel, an evaluation of the patent history of the industry and the sources of technical progress, a study of the industry conditions that preceded entry of the decree, the considerations that motivated entry of the decree, and an evaluation of events since the entry of the decree. Only in the light of this necessarily slow and laborious procedure can meaningful conclusions be drawn as to the effect of the decree provisions under study. When a significant number of such studies has been completed, it is likely that reasonably broad and meaningful conclusions can be drawn as to the effects of compulsory licensing and patent dedi-

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[1] Antitrust Problems in the Exploitation of Patents, Staff Report to Subcommittee No. 5 of the Committee on the Judiciary, House of Representatives, October 15, 1956, p. 23.

[2] Patent dedication results in a complete ending of all the patent rights. Royalty-free compulsory licensing may leave some residuum of value to the patent owner. It may, for example, be conditioned upon the grant of reciprocal license by the licensee, or apply only to certain applications of the inventions. See United States v. General Electric, 115 F. Supp. 835, 844 (D.N.J. 1953). During the course of the factual studies contemplated in the present project, an examination will be made of the differences between royalty-free licensing and patent dedication. For purposes of this foundation study, however, no distinction need be drawn between these two forms of relief.

cation generally, the relationship of such provisions to normal patent system operation evaluated, and criteria laid down for the entry of such decrees in the future.

The factual studies, however, must rest on a firm foundation of analysis, coupled with an evaluation of the readily available information respecting compulsory licensing and patent dedication decree provisions. This initial analysis not only provides a necessary historical and analytical perspective, but also serves to define some of the industry patterns that demand study and some of the variations likely to be encountered during the course of detailed factual studies. It is the purpose of the present research project interim report to discuss the foundation for such factual study.

COMPULSORY LICENSING AND THE PATENT SYSTEM

The first patent act was passed in 1790.[3] During the 167-year period since that date the American patent system has been based on the proposition that the patent owner should normally be free to grant licenses or not as he sees fit. Congress has consistently acted on the premise that freedom of choice in granting patent licenses—exercised in accordance with the judgment of the patent owner and economic interest—best serves the patent system objective of promoting "the progress of science and useful arts."[4] Since at least 1877, proposals have been made to enact compulsory patent licensing statutes in one form or another, but such bills—with the limited exceptions discussed below—have not been passed.[5]

A number of statutes, however, define limited areas within which compulsory licensing is effective. One such area is that of the use of patented inventions by the government, or in manufacture for sale to the government. Statutes enacted in 1910 and 1918[6] confine the patent owner in such instances to suit for reasonable compensation in the Court of Claims and thus preclude the injunctive relief that is the essence of the right to refuse licenses. Another such area is found in the Atomic Energy Act, which includes provisions for compulsory licensing to the Atomic Energy Commission and to private business enterprise with respect to certain types of inventions.[7]

In a limited class of cases the courts—upon the basis of the principles of public policy and equity jurisprudence—have refused to grant relief for patent infringement and have thus in effect provided compulsory licensing. Thus, where injunction for patent infringement would arrest operation of a sewage disposal system and endanger the public health, the Court of Appeals for the Seventh Circuit denied injunctive relief and remitted the patent owner to its remedy by way of damages.[8]

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3 1 STAT. 109.

4 U.S. CONST., art. I, § 8, cl. 8.

5 See, e.g., Hartford-Empire Co. v. United States, 323 U.S. 386, 417 (1945).

6 36 STAT. 851, 40 STAT. 705 (both now incorporated in 28 U.S.C. 1948). See note 54 HARV. L. REV. 1,051 (1941).

7 68 STAT. 919, 945.

8 City of Milwaukee v. Activated Sludge, 69 F(2d) 577 (cert. den. 293 U.S. 576). For a more complete discussion of the compulsory licensing that has in effect resulted from application of principles of equity to patent infringement suits see Frost, *The Patent System and the Modern Economy, Study No. 2, Subcommittee on Patents, Trade-marks, and Copyrights, United States Senate* (1956), pp. 28-33.

The patent misuse cases[9] have in effect provided temporary royalty-free licenses because the courts have refused all relief for patent infringement. Here the touchstone of the judicial refusal has been the conclusion that the patentee "is using the right asserted contrary to the public interest."[10] In some of the misuse cases the misuse has been found in refusal to grant patent licenses.[11]

In view of the above statutes and judicial decisions, compulsory licensing cannot be regarded as wholly foreign to the American patent system. In each instance, however, the effect of the compulsory licensing has been confined to an atypical area of business activity—such as government purchases or the field of atomic energy; is limited to a few very unusual cases; or—as in the misuse cases—is frequently subject to action of the patentee itself in revising its commercial practices.[12] It has remained for the compulsory licensing and patent dedication provisions of antitrust decrees to define more general areas where patent owners have been denied the right to exercise their own judgment as to the granting of patent licenses.

## COMPULSORY LICENSING AND PATENT DEDICATION AS ANTITRUST RELIEF MEASURES

The Sherman Act was passed in 1890.[13] In Sections 1 and 2, contracts, combinations, and conspiracies in restraint of trade, combinations and conspiracies to monopolize, attempts to monopolize, and monopolization are declared illegal and made the subject of criminal penalties. The statutory scheme also contemplates enforcement of the Act by the government through decrees in equity. Section 4 of the Act accordingly provides for action by the Attorney General for a decree in equity to "prevent and restrain" violations of the Act.[14]

It has long been settled that in Section 4 cases the government is entitled to relief of sufficient scope both to prevent further conduct in violation of the Act and to create an atmosphere in which competition will be restored. As stated in the *Standard Oil* case:[15]

> It may be conceded that ordinarily where it was found that acts had been done in violation of the statute, adequate measure of relief would result from restraining the doing of such acts in the future. . . . But in a case like this, where the condition which has been brought about in the violation of the statute, in and of itself is not

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[9] For a collection of the principal misuse cases see Oppenheim, *Cases on Federal Antitrust Laws* (1948), pp. 637-692.

[10] Morton Salt v. Suppiger, 314 U.S. 488, 492 (1942).

[11] E.g., Leitch Mfg. Co. v. Barber Asphalt Co., 302 U.S. 458 (1938); Vitamin Technologists v. Wisconsin Alumni Research Foundation, 146 F(2d) 941 (9th Cir. 1945) (cert. den. 325 U.S. 867).

[12] ". . . Equity may rightly withhold its assistance from such a use of the patent by declining to entertain a suit for infringement, and should do so at least until it is made to appear that the improper practice has been abandoned and that the consequences of the misuse of the patent have been dissipated." Morton Salt v. Suppiger, *supra* note 10 at 493. And see with respect to abandonment of conduct violating the Sherman Act, United States Gypsum Company v. National Gypsum Company, No. 11, October Term 1956, Supreme Court of the United States, 25 U.S.L. WEEK 4, 132.

[13] 26 STAT. 209.

[14] *Ibid.*

[15] Standard Oil Company v. United States, 221 U.S. 1, 77 (1911).

> only a continued attempt to monopolize, but also a monopolization, the duty to enforce the statute requires the application of broader and more controlling remedies. As penalties which are not authorized by law may not be inflicted by judicial authority, it follows that to meet the situation with which we are confronted the application of remedies two-fold in character becomes essential; 1st—To forbid the doing in the future of acts like those which we have found to have been done in the past which would be violative of the statute. 2nd—The exertion of such measure of relief as will effectually dissolve the combination found to exist in violation of the statute, and thus neutralize the extension and continually operating force which the possession of the power unlawfully obtained has brought and will continue to bring about.

More recently, the Court has reiterated what has been termed the "fruits" doctrine[16] to enlarge further upon the scope of relief available to the government in Section 4 cases. As stated by the Court:[17]

> In this type of case we start from the premise that an injunction against future violations is not adequate to protect the public interest. If all that was done was to forbid a repetition of the illegal conduct, those who had unlawfully built their empires could preserve them intact. They could retain the full dividends of their monopolistic practices and profit from the unlawful restraints of trade which they had inflicted on competitors. Such a course would make enforcement of the Act a futile thing unless perchance the United States moved in at the incipient stages of the unlawful project. For these reasons divestiture or dissolution is an essential feature of these decrees. . . .
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> Divestiture or dissolution must take into account of the present and future conditions in the particular industry as well as past violations. It serves several functions: (1) It puts an end to the combination or conspiracy when that is itself the violation. (2) It deprives the antitrust defendants of the benefits of their conspiracy. (3) It is designed to break up or render impotent the monopoly power which violates the Act. . . .

For 50 years after passage of the Sherman Act the relief sought by the government and granted by the courts in the patent-antitrust cases was confined to injunctions against repetition of the acts found to have violated the Act, general injunctions against violating the Act, and to relief unrelated to patents. The *Standard Sanitary* decree[18] will serve as an illustration. There one Wayman had purchased several patents to "dredgers" or sieves used for the purpose of distributing glass frit over iron castings in preparation for the firing operation required to make a vitreous enamel coating on the castings. One of the patents was obtained from the Standard Sanitary Manufacturing Company, a leading vitreous enamelware manufacturer, in contemplation of the scheme of patent licensing that was followed. Wayman thereupon licensed the producers of about 85 per cent of the vitreous enamel-

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[16] The Supreme Court decisions relating to the "fruits" doctrine are summarized and analyzed in United States v. Aluminum Co. of America, 91 F. Supp. 333, 343-4 (S.D.N.Y. 1950).

[17] Schine Chain Theatres Inc. v. United States, 334 U.S. 110, 128 (1948).

[18] United States v. Standard Sanitary Mfg. Co., Eq. G-17 (D. Md. 1911). The decree appears at 1 Decrees and Judgments in Antitrust Cases 263. The district court decision is reported at 191 Fed. 172 (1911) and the Supreme Court opinion at 226 U.S. 20 (1912).

ware made in the United States to use the patented dredgers in the manufacture of ware. Each license, however, forbade the marketing of second-grade ware and fixed a minimum price below which the ware could not be sold. The record included considerable evidence that the licenses were issued under a plan of eliminating the "seconds" and preventing price competition, as distinguished from maximizing the return to Wayman for the use of the patented dredgers. Compliance with the terms of the licenses was secured by a royalty rebate arrangement under which a percentage of the royalties was returned to the respective licensees so long as the license provisions—including those relating to "seconds" and prices—were adhered to.

The District Court in the *Standard Sanitary* case found that the defendants had violated the Sherman Act. The Supreme Court affirmed that decision on appeal. The decree as entered by the District Court and affirmed by the Supreme Court contained only a general injunction against the enforcement of contracts fixing prices of the ware made by the "patented process" and a general injunction against "restraining trade." The decree also specifically provided that:[19]

> . . . this decree shall not be construed to prevent whoever may be the owner or owners of the Arrott patent and other dredger patents relating to the manufacture of sanitary enameled ironware, from granting lawful licenses to any of the defendants or others to use such patents, or to prevent the defendants or others from taking lawful licenses to use any of such patents.

While the above provision is not without ambiguity, it seems to contemplate the same general freedom as to patent licensing under the patents involved—and by the defendants in the action—as would have existed in the absence of the antitrust litigation.[20]

By 1941, however, a number of factors had combined to focus attention upon patent practices in relation to the antitrust law and to move the antitrust division to seek more extensive relief in patent cases. The presentation by the Department of Justice of patent practices in the glass container industry before the T.N.E.C. in 1938[21] and the sharply critical report of the T.N.E.C. in 1941[22] contributed to this emphasis. Additionally, the period was characterized by well-publicized charges of general abuse of patent rights and contentions that the practices of American business enterprise in connection with patent rights had strengthened the military potential of the axis powers, had retarded the military efforts of the allies, and had impeded the defense effort of the United States.[23] Finally, there was a general increased tempo of activity by the Department of Justice with respect to the antitrust laws and a broad-scale effort to enforce the antitrust laws more vigorously.

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19 Decree, paragraph 7.

20 For discussion of the decrees entered in patent-antitrust cases prior to the compulsory licensing decrees see *Compulsory Patent Licensing by Antitrust Decree,* 56 YALE L.J. 77, 91 (1946).

21 Part 2, T.N.E.C. Hearings, pp. 381-657.

22 Final Report and Recommendations of the T.N.E.C., Document No. 35, 77th Cong. 1st Sess., pp. 36-7.

23 See, e.g., Arnold, "The Abuse of Patents," and Langner, "We Depend on Invention," both printed in *Atlantic Monthly,* July, 1942.

It was in this atmosphere that the first compulsory licensing decree of current importance was entered in the *Kearney and Trecker* case on August 22, 1941.[24] There, patent 1,794,361 had issued to three competitors—Kearney and Trecker, Browne & Sharpe, and the Cincinnati Milling Machine Company—as assignees of the inventor. The complaint charged that by refusing to issue licenses under the patent the defendants had been able to fix prices and restrict production and distribution of milling machine arbors covered by the patent. The decree—entered by consent—required dedication of the patent, stating:[25]

> The defendants . . . , and each of them, their officers, managers, directors, agents and employees, and all persons acting under, through, or for them or any of them, be and they are hereby ordered to divest themselves of all right, title and interest in and to said United States Letters Patent 1,794,361, and forthwith to take such steps as may be necessary to dedicate, transfer, and assign said Letters Patent and all rights thereunder to the public (including said defendants), without the payment of royalties or other compensation whatever therefor.

In early 1942 the second compulsory licensing decree was entered in the *Whitehead Brothers* case.[26] This was a consent decree, providing for the licensing of the patent involved at the "standard royalty."

The first compulsory licensing decree in a litigated case was entered in the *Hartford-Empire* case[27] on October 8, 1942. The focus of this case was directed to the same practices that formed the subject matter of the Department of Justice presentation before the T.N.E.C. some four years earlier. In a lengthy opinion entered on August 25, 1942,[28] Judge Kloeb, condemning in extreme terms the practices he found to have taken place and with respect to the relief to be granted, stated:[29]

> The court believes that no half-way measures will suffice. There has been a deliberate violation of the law, and it is the duty of the court to do what he can to make certain that these violations of the law will cease and will not be resumed in the future and that competition will be restored in the industry. The record discloses that some of the individual defendants anticipated legal action by the Government, and went ahead in spite of that and violated the law. They also tried to anticipate the remedies that might be applied and did what they could to forestall the effect of such remedies and retain the benefits of their unlawful actions. The court intends to make certain that this does not occur. The Government has requested the dissolution of Hartford. The court, however, is first going to make an attempt to avoid that, if it is possible to do so and at the same time restore competition to the industry. If this cannot be worked out to the satisfaction of the court, dissolution will be ordered.
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24 United States v. Kearney & Trecker, Civil 3337 (N.D. Ill.) C.C.H. Trade Cases 1940-1943, p. 571.

25 *Id.*, para. III.

26 United States v. Whitehead Brothers, Civil 17-99 (S.D.N.Y.) C.C.H. Trade Cases 1940-1943, p. 665.

27 United States v. Hartford-Empire Co., 46 F. Supp. 541 (N.D. Ohio); Hartford-Empire Co. v. United States, *supra* note 5.

28 46 F. Supp. 541.

29 *Id.* at 621.

> Any future system for the distribution of automatic machinery must be put on a basis of outright sale at reasonable prices. This is to include machines made under all of the patents and applications for patents owned or controlled by all the defendants herein and involved in this suit. In addition, all the defendants shall be required to license anyone, royalty free, in the manufacture of machines embodying these patent rights. This will include all patent rights relating to the suction machine, feeders, forming machines, and lehrs.
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> . . . . . . . . . . . . . . . .
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> The defendants will be enjoined from engaging in interstate commerce unless they (a) comply with the orders of the court, (b) agree to license anyone, royalty free, on all present patents and pending applications for patents for the life of the patents, and (c) make available to anyone who desires them copies of drawings and patterns relating to suction devices, feeders, forming machines (except Lynch), and lehrs.

On appeal the Supreme Court affirmed the *Hartford-Empire* judgment with respect to the presence of a violation of the antitrust laws.[30] However, with respect to relief in general and compulsory licensing in particular, the majority of the Court stated:[31]

> The applicable principles are not doubtful. The Sherman Act provides criminal penalties for its violation, and authorizes the recovery of a penal sum in addition to damages in a civil suit by one injured by violation. It also authorizes an injunction to prevent continuing violations by those acting contrary to its proscriptions. The present suit is in the last named category and we may not impose penalties in the guise of preventing future violations. This is not to say that a decree need deal only with the exact type of acts found to have been committed or that the court should not, in framing its decree, resolve all doubts in favor of the Government, or may not prohibit acts which in another setting would be unobjectionable. But, even so, the court may not create, as to the defendants, new duties, prescription of which is the function of Congress, or place the defendants, for the future, "in a different class than other people" as the Government has suggested. The decree must not be "so vague as to put the whole conduct of the defendants' business at the peril of a summons for contempt"; enjoin "all possible breaches of the law"; or cause the defendants hereafter not "to be under the protection of the law of the land." With these principles in mind we proceed to examine the terms of the decree entered. . . .
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> Paragraph 24 enjoins each of the corporate and individual appellants from engaging in the distribution of machinery used in glass manufacture or in the distribution of glassware in interstate commerce unless each files with the court an agreement (a) to license, without royalty or charge of any kind, and for the life of all patents, any applicant to make, to have made for it, and to use any number of machines and methods embodied in inventions covered by any patent or patent application now owned or controlled by such defendant; (b) to license, at a reasonable royalty (to be fixed by the court, in case of dispute) any applicant to make, have made for it, and to use any number of machines and methods in the manufacture of glassware embodying inventions covered by patents hereafter applied for or owned or controlled by any defendant . . .

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[30] *Supra* note 5.
[31] *Id.* at 409-17.

Since the provisions of paragraphs 21 to 24 inclusive, in effect confiscate considerable portions of the appellant's property, we think they go beyond what is required to dissolve the combination and prevent future combinations of like character. It is to be borne in mind that the Government has not, in this litigation, attacked the validity of any patent or the priority ascribed to any by the patent office, nor has it attacked, as excessive or unreasonable, the standard royalties heretofore exacted by Hartford. . . .

. . . . . . . . . . . . . . .

Paragraph 24(a) of the decree should be modified to permit the reservation of reasonable royalties and its provisions should be restricted to feeders, formers, stackers and lehrs and patents covering these or improvements of them, or methods or processes used in connection with them.

On remand from the Supreme Court, the District Court thereupon entered a decree on October 31, 1945, providing for compulsory licensing of the patents at reasonable royalties. This judgment was amended in 1947 pursuant to a settlement arrangement between the government and the various defendants.

Following the success in obtaining the early consent and litigated decrees requiring compulsory licensing and dedication, the Department of Justice has followed a policy of seeking relief of this kind in essentially all cases involving patents. The current policy has been summarized as follows:[32]

The ordinary type of relief in cases of patent misuse is in most instances the imposition of a duty on the patentee to license his patents in the field of the antitrust violation. In the majority of cases, the patentee is allowed to charge and receive reasonable royalties. The compulsory licenses are non-exclusive and cancellable by the licensee, but only under exceptional circumstances (most notably because of nonpayment of royalties) by the licensor. The way of ascertaining the reasonableness of the royalties due in case of controversy is necessarily somewhat complicated, the consent judgment court being vested with ultimate authority in that respect; experience has shown, however, that the parties, familiar with their own businesses, have no difficulties in reaching agreement as to the amount of reasonable royalties. Compulsory licenses may extend to future patents as well.

While the propriety of compulsory reasonable royalty-bearing patent licenses has become quite generally accepted, the same is not true with regard to royalty-free licensing. It has been the practice of the Antitrust Division to demand relief by royalty-free licensing or dedication of patents (though being quite different in theory, the financial effects of both are the same on the patentee) if the facts of the case call for it. No doubt, this drastic type of relief is not justified and is not requested in each and every instance of patent misuse; however, if the situation, antitrust-wise, is serious enough, availability of the patent invention to the public without any consideration may be the only effective remedy. In a considerable number of cases, defendants have felt that they should consent to royalty-free licenses or dedication of their patents which had been misused in the past.

In the period since 1941 over 100 judgments have provided for compulsory licensing or the dedication of patents. Over 300 antitrust defendants are subject to these

[32] Kilgore, Antitrust Judgments and Their Enforcement, ABA Antitrust Section Report, Volume IV, 102, 115 (1954).

decrees. The great majority of these have been consent judgments with provisions for compulsory licenses at reasonable royalties. A relatively small number have provided for royalty-free compulsory licensing or dedication of patents, one of these being a litigated decree.[33] The total number of patents affected by compulsory licensing decree provisions has been estimated at no more than 30,000 to 35,000.[34] In terms of subject matter the decrees encompass a wide range of industries and products, and in some instances—such as the *Hartford-Empire* case—the decrees have extended to virtually all the business concerns in the industry.

Since most of the compulsory licensing and patent dedication decree provisions appear in consent decrees, and in many litigated cases the courts have been silent as to the specific reasons for the decree provisions, the number of judicial statements of the rationale behind the decrees is small. The Supreme Court has spoken on this subject in the *Hartford Empire,*[35] *National Lead,*[36] and *Gypsum*[37] cases. However, in the latter case the Court did not discuss the rationale of the compulsory licensing in other than general terms directed to the remedial purpose of the decree as a whole. In the *Hartford-Empire* case the majority of the justices sitting overturned the royalty-free licensing provisions of the decree below. The majority opinion reflects a considerable concern with the confiscatory character of the royalty-free licensing provisions as compared with the remedial purposes of the decree. However, the opinion gives no specific reasons for the royalty-bearing license provision that was substituted as compared with other possible decree provisions directed to the same end. In the *National Lead* case the government sought by appeal to obtain a royalty-free licensing provision or its equivalent in the decree in lieu of the reasonable royalty licensing ordered by the court below. The majority of the Supreme Court affirmed the decision below, again pointing to the remedial rather than punitive purpose of the decree, but noting also that the district court had justifiably concluded from the evidence that the payment of royalties would not retard the growth of competition.[38] In each of these two Supreme Court decisions, however, a minority of the Court insisted that royalty-free compulsory licenses should be required in view of the past conduct of the defendants. The following statement from Mr. Justice Rutledge's dissent in the *Hartford-Empire* case brings out the point:[39]

> The requirement of licensing of existing patents, royalty free, would present greater difficulty if the violation had not been so gross and so long continued. But because it was both, and because the evidence shows a long course of using patents and patent position illegally to acquire other patents and consolidate still stronger positions, it is impossible now to determine what patents members of the combination may have acquired illegally. The certainty is however that many were so acquired. Since the pool and its members are not required to dispose of the patents, any

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[33] United States v. General Electric Co., 115 F. Supp. 835 (D.N.J. 1953).
[34] Hollabaugh, Patent and Know-How Relief in Antitrust Cases, 13 (Lecture delivered April 19, 1956, before the National Industrial Conference Board, Inc.).
[35] *Supra* note 5.
[36] United States v. National Lead Co., 332 U.S. 319 (1947).
[37] United States v. United States Gypsum Co., 339 U.S. 959 (1950).
[38] *Id.* at 347-8.
[39] *Supra* note 5 at 450.

> revenues now received by them from the existing patents are the result, and inevitably will continue to be the result, of the owners' violation of the law. To permit the continued collection of royalties would be to perpetuate, for the lives of the patents, the illegal consequences of the violations. That the court is bound, in equity, and by the statute, not to do.

In dissenting in the *National Lead* case, Mr. Justice Douglas more specifically pointed to the effect of royalty collections in retarding the growth of competition because "each dollar of royalty adds a dollar to the costs of the new competitor and gives the established licensor another dollar with which to fight that competition."[40]

The lower courts have for the most part stressed economic considerations in their treatment of the question of compulsory licensing decree provisions. Thus, in the *United Shoe Machinery* case, Judge Wyzanski stated:[41]

> Similar reasoning dictates the decree's treatment of patents. Defendant is not being punished for abusive practices respecting patents, for it engaged in none, except possibly two decades ago in connection with the wood heel business. It is being required to reduce the monopoly power it has, not as a result of patents, but as a result of business practices. And compulsory licensing, on a reasonable royalty basis, is in effect a partial dissolution on a non-confiscatory basis. . . .

A more striking example of the application of economic considerations is found in the *General Electric* case, where Judge Forman ordered dedication of certain patents. He there stated:[42]

> Where the profit margin on the production of lamps is as narrow as it is at the present time any licensing fees may prove an important factor in limiting or inhibiting the growth of competition. In view of the fact that General Electric achieved its dominant position in the industry and maintained it in great measure by its extension of patent control the requirement that it contribute its existing patents to the public is only a justified dilution of that control made necessary in the interest of free competition in the industry.

In some decisions, however, the emphasis has been on past conduct rather than economic considerations. Of these the most specific is the decision on remedies in the *I.C.I.* case, where Judge Ryan stated:[43]

> We decree compulsory licensing because the patent rights which were granted the defendants were misused. The failure to export products manufactured under the patents resulted from the agreement to divide territories. What might have been done lawfully by one, acting as a result of his own decision, became unlawful because it was brought about by common agreement. . . . The needs and requirements of local markets from which the patentee was excluded by the underlying agreement were met by patent grants to fellow conspirators. Thus, the patents themselves and the right to grant licenses under them were used to implement and carry out the allot-

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[40] *Supra* note 36 at 368.

[41] United States v. United Shoe Machinery Corp., 110 F. Supp. 295, 351 (D. Mass. 1953), *aff'd* per curiam 347 U.S. 521 (1954).

[42] *Supra* note 33 at 844.

[43] United States v. Imperial Chemical Industries, 105 F. Supp. 215, 222 (S.D.N.Y. 1952).

ment of territories. The use of these existing patents must be regulated because of their past abuse.

Although the courts do not appear to have stressed the point, another consideration can be pointed to as the basis for entry of compulsory licensing decree provisions. Pure Section 2 cases aside, the antitrust cases involving patents have turned on conduct by which the patents have been used in connection with license practices not contemplated by the patent laws. Entry of a decree provision requiring licenses on stated terms is self-executing and frees the court of the need to attempt the framing of an all-inclusive statement of prohibited license provisions and of the need to dwell on the circumstances under which a refusal to license is permissible. A commentary on this subject states:[44]

> The difficulties in framing an effective decree are particularly apparent in cases where patents have been used to effectuate monopolistic control. So long as the patents are not canceled, a mere reshuffling of patent ownership will be ineffective in breaking up monopoly, and as long as the patentee is free to grant or withhold a patent license at his pleasure, the striking down of one set of restrictive conditions attached to a patent license may lead only to the adoption of another set of conditions which achieve the same effect. . . .
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> Until the past few years the patent laws generally afforded immunity from antitrust prosecution if restrictions were embodied in patent licenses, and even in those cases where the antitrust claim was allowed, the relief adopted was an injunction against the enforcement of the then existing patent licenses.

## SOME INITIAL OBSERVATIONS ON THE EFFECTS OF THE COMPULSORY LICENSING AND DEDICATION DECREE PROVISIONS

In the absence of detailed factual studies directed to a significant number of the decrees with compulsory licensing or dedication provisions, it is not possible to draw final conclusions as to the effects of the decrees. We can, however, draw a picture of some of the variations that may be expected by looking to the available records, and can point to some of the existing information that suggests one conclusion or another as to the effects of the decrees in specific cases.

Viewed solely from the statistical standpoint—and on the assumption that the issuance of licenses is a measure of the effects of the decree provisions in increasing competitive effort[45]—the compulsory licensing decree provisions have an impressive record. An attorney formerly with the Department of Justice and particularly familiar with these decree provisions has stated:[46]

> Judgments which require compulsory licensing or dedication are intended to give others an opportunity to use patents held by the defendant-licensor. The next ques-

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[44] *Compulsory Licensing by Antitrust Decree,* 56 YALE L.J. 77, 81 (1946).

[45] It has been said that undue freedom in granting patent licenses—such as by the issuance of licenses at small royalties to all comers or on a royalty-free basis—"may produce just the deadly inertia and lack of initiative in an industry which the patent system is supposed to forestall." Bush, *Proposals for Improving the Patent System, Study No. 1, Subcommittee on Patents, Trademarks, and Copyrights, United States Senate* (1956), p. 14. So viewed, the issuance of licenses may not represent a desirable increase in competitive effort.

[46] Hollabaugh, *supra* note 34.

> tion is whether or not competitors and would-be competitors have actually taken licenses under these judgments. While no total figures are available, it is clear that a great many judgment licenses have been issued. For example, one defendant-licensor has 384 licensees; another had 160 inquiries for a judgment license and 71 licenses executed; and still another had a total of 226 inquiries from which 116 licenses were granted. Then there are some defendant-licensors who have issued no licenses as apparently no one felt that the patents were of sufficient strength or value to justify asking for a license. On the other hand, I can recall an instance where representatives of two companies stated that they were going to take a judgment license, not because they wanted the patented art, but to be absolutely sure that the defendant-licensor who had been an aggressive fellow in enforcing his patents would not have an opportunity to assert the patents against them. There are, of course, many factors which bear on the question of licensing, including the scope and strength of the patents, the availability of other technology, and the aggressiveness with which the owner enforces his patents.

As the above quotation indicates, however, these data do not form a reliable basis upon which to draw any final conclusions.

Turning to some of the patterns of experience with the compulsory licensing decrees, a first consideration is the extent the decrees have led to new entries into the business in question. Most of the patent-antitrust cases have involved charges that the patents are being used to foreclose competition and the entry of competitors. In some instances the entry of compulsory licensing or dedication decree provisions has been emphasized as a means of assuring the entry of competitors. The A.T.&T. decree[47] is a recent example. The complaint alleged that the company had restrained and monopolized the manufacture, distribution, sale and installation of telephone equipment. The government further alleged that the company had a strong patent position that had been used to protect it against alternative forms of communication and to divide fields of manufacture. By the consent judgment entered January 24, 1956, all the patents owned by the defendants, A.T.&T. and Western Electric Company, were made subject to compulsory licensing to all domestic applicants and some 8,600 patents involved in license exchange agreements with General Electric Company, R.C.A., and Westinghouse Electric Corporation were made subject to royalty-free compulsory licenses.

At the time of its entry, the decree was hailed by some as "a sweeping patent victory" that "will open up the electronics and television industry to competition."[48] Substantial evidence, however, points the other way. A.T.&T. has had a long standing and well-publicized policy of licensing all applicants under any patents at reasonable royalty rates.[49] At the time of the decree a number of existing licensees indicated that the royalties involved were competitively unimportant and that they had received very valuable access to "know-how."[50] It may be added that the decree expressly permits the company to condition the grant of a license on the grant of a license back under the patents of the licensee.[51] Certainly, in the absence of a

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[47] United States v. Western Electric Inc., Civil Action 17-49 (D.N.J.).

[48] *Business Week,* January 28, 1956, p. 160.

[49] See, e.g., Part 3, T.N.E.C. Hearings 961; McHugh, "Bell System Patents and Patent Licensing," *Bell Telephone Magazine,* January, 1949; *Business Week,* February 4, 1956, p. 27.

[50] *New York Times,* Wednesday, January 25, 1956.

[51] Decree, para. X.

factual demonstration that the patent royalty fees previously charged by A.T.&T. and Western Electric spelled the difference between entry and non-entry into manufacture of the patented equipment, it is merely an expression of opinion to say that the decree is entitled to credit for causing the entry of new concerns into the field. Moreover, such expression also involves a prediction of future events rather than a representation of fact.

Earlier decrees provide additional suggestions as to the effects of compulsory licensing and patent dedication provisions in stimulating the entry of competitors. Prior to the entry of the decrees in the *Hartford-Empire* case, glass-forming machinery was made for sale or lease only by Hartford-Empire and by Lynch Corporation, both of whom were defendants in the antitrust action and were made subject to the compulsory licensing provisions of all the decrees. A decade has now passed since the final settlement decree entered in the case, and 15 years have elapsed since entry of the first decree by the district court. Yet at the present time the manufacture of glass-forming machinery for use by ware manufacturers is still practically confined to Hartford-Empire and Lynch, and there is some evidence that in the intervening years Lynch has become a less strong competitive entity vis-a-vis Hartford than it was prior to the decree.[52]

In the *Vehicular* case,[53] the industry was comprised at the time of the decree of five major parking meter manufacturers, all of whom were defendants in the antitrust case. Prior to entry of the first decree in 1944 two parking meters were under development by prospective competitors and shortly after the war both meters were manufactured. In one instance the meter construction was not thought to involve questions of infringement of the Vehicular patents with the result that the manufacture proceeded without raising any questions of patent license. Experience with this meter proved disappointing and the business was later sold to one of the five pre-war manufacturers in the field. The other new entry into the field has been conspicuously successful and currently sells from 60 to 70 per cent of the parking meters in this country. One of the five firms in the industry prior to the decree has dropped out, so that at the present writing there are no more concerns in the industry than prior to the decree, and there is evidence that the sales are less evenly distributed among the competitors than prior to the decree.

A different pattern emerges in the *Besser* case.[54] Here there was a history of patent infringement threats and other repressive conduct by the major manufacturer

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[52] In 1945, the year of the Supreme Court decision in the Hartford-Empire case, sales of Lynch stock took place at from approximately $13 to approximately $17 per share. After reaching a peak of 26½ in 1946, the stock has declined. Some sales took place in 1956 at $9 per share, the lowest price since at least 1937. Earnings per share in 1956 are not yet available, but the 1955 earnings of 0.44 per share are the lowest since at least 1937. Business reverses unrelated to the antitrust action probably account for a major proportion of the decline. By way of contrast, Emhart Manufacturing Company, a holding company now operating Hartford-Empire as a division, after a period of reduced earnings after 1946 has since had a steady earnings record of over twice the 1946 rate, and the lowest stock sales price in 1956 was almost twice the highest price in 1946. Again, factors other than the business involved in the antitrust action probably account for a major proportion of the gain.

[53] United States v. Vehicular Parking Ltd., 54 F. Supp. 828 (D. Del. 1944).

[54] United States v. Besser Mfg. Co., 96 F. Supp. 304 (E.D. Mich. 1951), *aff'd sub nom.* Besser Mfg. Co. v. United States 343 U.S. 444 (1952).

of concrete blockmaking machines against each attempted entry into the field. In the period since the decree—and a patent decision holding the principal patents invalid or not infringed[55]—a number of additional manufacturers have entered the field. Until detailed study has been completed it is not possible to draw conclusions as to the extent this history is due to the compulsory licensing decree provisions, the same results could or should have been obtained by alternative decree provisions directed to specific conduct, or would have taken place regardless of the antitrust decree. The facts suggest, however, that the combination of the antitrust decree and the patent infringement judgment has substantially encouraged entry into the business.

The antitrust decisions themselves emphasize the importance of considering the nature and scope of the patent rights in evaluating the effect of compulsory licensing and patent dedication decree provisions. Thus in the *Alcoa* case the company had some 800 patents, but only 11 were found to be "competitively significant."[56] In the *United Shoe Machinery* case[57] the company had nearly 4,000 patents, budgeted over $4 million annually for research, and in a number of instances had purchased patent rights from outsiders. Yet Judge Wyzanski concluded that "it is clear that United's present dominance does not rest primarily on patents."[58] It seems evident that in cases such as these—where the patents are of limited competitive importance—the compulsory licensing decree provisions inherently cannot have a greater importance in facilitating the entry of competitors into the field.

We also have some preliminary data on the effects of royalty-free compulsory licensing, or dedication vis-a-vis reasonable royalty compulsory licensing. As noted above, Judge Forman found that the profit margin in the lamp industry was so low that the decree must be based on the use of patents without any royalties.[59] Other data point the other way. In a number of cases the courts have refused to find that royalty-free licensing or dedication—as distinguished from reasonable royalty licensing—was necessary.[60] In the *Hartford-Empire* case a group of independent users of glass-forming machines took the position that reasonable royalty licensing protected their interests better than royalty-free licensing because they needed the research services of Hartford in order to compete with larger users who could develop their own machines.[61] A further variation is found in the *National Lead* case[62] where the National Lead Company joined with the Department of Justice

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[55] Whitman v. Andrus, 194 F(2d) 270 (6th Cir. 1952).

[56] United States v. Aluminum Co. of America, 91 F. Supp. 333, 417 (S.D.N.Y. 1950).

[57] United States v. United Shoe Machinery Corp., 110 F. Supp. 295, 333 (D. Mass. 1953), *aff'd* per curiam, 347 U.S. 521 (1954).

[58] *Id.* at 333. See Kaysen, *United States v. United Shoe Machinery Corp.* (1956), pp. 78-91.

[59] *Supra* note 42.

[60] United States v. General Instrument Corp., 115 F. Supp. 582 (D.N.J. 1953); United States v. Imperial Chemical Industries, *supra* note 43.

[61] Brief on Behalf of Certain Medium Sized Glass Manufacturing Companies With Respect to the Remedy, No. 11, October Term 1943, Supreme Court of the United States. Another group of independent glass manufacturers supported the royalty-free provisions of the district court decree on the ground that the decree adequately provided for the continuance of the Hartford-Empire services. See *Compulsory Patent Licensing by Antitrust Decree,* 56 YALE L.J. 77, 102-3 (1946).

[62] *Supra* note 36.

in seeking compulsory royalty-free licensing of the patents, thus indicating that this company thought its competitive position would be strengthened by royalty-free access to the patents. Yet National Lead shared with its co-defendant, DuPont, a predominant share of the titanium business.

The *Vehicular Parking* case[63] provides further data on royalty-free licensing. There, Magee-Hale—the highly successful new concern in the business—sought a compulsory license under the decree and argued vigorously in the resultant royalty-setting proceeding that it should be required to pay only nominal royalties on the ground that the patents did not justify greater royalties, and it could not afford to pay any substantial royalties.[64] Yet Magee-Hale has paid patent royalties to its incorporators in far greater amount than the royalties sought to be charged for license under the patents involved in the antitrust case.

Two other considerations enter into an evaluation of the effects of the compulsory licensing and patent dedication decree provisions. One is the extent these decree provisions are really just a practical and convenient way to foreclose the possibility of further abuse of patent rights. Arguments made by the Department of Justice in seeking compulsory licensing decree provisions have emphasized this aspect of the decrees,[65] as have commentaries on the decrees.[66] Antitrust enforcement policy has long been based on the principle that a demonstrated "proclivity in the past" to violate the law "warrants effective assurance that no such opportunity will be available in the future,"[67] and that "there is no reason why the protection of the public interest should depend solely on * * * somewhat cumbersome procedure when another effective one is available."[68] The question remains, however, that in thus using broad strokes to overcome the effects of one restraint on competition, the courts may in the long run lay the basis for another. In this area, particularly, an evaluation of the situation demands the results of detailed case studies.

Finally, it is difficult to separate punitive from remedial effects of the decrees. At best, even a decree contemplating a reasonable royalty or other compensation for compulsory use of property ties the hands of the defendant and to an extent reduces the value of that property.[69] The emphasis on past conduct used by the Department of Justice to support its prayers for compulsory licensing and patent dedication relief is as consistent with an effort to mete out punishment as an effort to cure a restraint of trade. While the Supreme Court in the *Hartford-Empire* and *National Lead* cases[70] stated clearly that the objective of Section 4 decrees is remedial and

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63 *Supra* note 53.

64 See unreported preliminary report of Arthur G. Connolly, Esq., special master in United States v. Vehicular Parking, Magee-Hale Park-O-Meter Company, Intervenor, dated April 20, 1950.

65 E.g., Brief for the United States in Besser Mfg. Co. v. United States, No. 230, Oct. Term 1951, Supreme Court of the United States, pp. 73-4.

66 E.g., Compulsory Licensing by Antitrust Decree, *supra* note 44.

67 United States v. Crescent Amusement Co., 323 U.S. 173 (1944).

68 *Id.* at 190.

69 E.g., United States v. Crescent Amusement Co., *supra* note 67, at 189; United States v. Corn Products Refining Co., 234 Fed. 964, 1,018 (S.D.N.Y. 1916) appeal dismissed 249 U.S. 621 (1918).

70 Hartford-Empire Co. v. United States, *supra* note 5 at 414 et seq; United States v. National Lead Co., *supra* note 36 at 348.

not punitive, other judicial statements show that punishment has been a factor.[71] Here, again, the matter is one that peculiarly demands the case-by-case approach.

In seeking further enlightenment on the questions arising in connection with the compulsory licensing and patent dedication decree provisions, two decrees have been chosen for study as a pilot project. One is *United States v. Besser Manufacturing Company*.[72] The other is *United States v. Vehicular Parking Ltd.*[73] Each decree was entered after actual trial; each required the issuance of compulsory licenses at reasonable royalties; and each has been in effect for a time sufficient to observe results. One consideration that motivated the selection, however, was the thought that differences between the two cases will enhance the value of the conclusions reached. In addition to the differences between the two industries involved, the two cases involved substantial differences with respect to the factual patterns upon which the antitrust charges were made. In the *Besser* case—while both Section 1 and Section 2 violations were charged—much of the emphasis was placed on the individual acts of Besser charged to violate Section 2. In the *Vehicular Parking* case the primary concern was the network of patent license agreements and their restrictive provisions.

In studying the two cases a particular effort has been made to evaluate the importance of the patents involved in the atmosphere of the time the acts of Sherman Act violation took place. Effort has also been made to ascertain what the members of the industry in each instance thought of the patents involved in the antitrust cases as well as patents in general. While this effort has entailed considerable study and research beyond the evaluation of the conditions in the industries since the decrees, it is felt that the conclusions reached can have meaning only in relation to the scope and importance of patents to the business concerns involved.

The availability of information is a key concern in the conduct of a study of the present kind. In the present instance good fortune has been encountered in several respects. With regard to the *Besser* case, the public record of a recently decided treble damage action provides a picture of industry events subsequent to the antitrust trial. In the *Vehicular Parking* case an extensive compulsory licensing royalty proceeding, a number of patent infringement actions, and the public record of a tax proceeding concerning the principal concern now in the field, greatly expand upon the information it was initially thought possible to obtain. By reason of these and other sources of information it is felt that the depth of factual information collected is considerably greater than that which would be anticipated.

It is too early to state final results of the case studies. A few facts of each case nevertheless warrant comment. In the *Besser* case there was a history of threats of patent infringement action, as well as the filing of infringement suits against the

[71] E.g., United States v. Imperial Chemical Industries, *supra* note 43. The Western Electric decree, *supra* note 47, provides for royalty-free compulsory licensing as to 8,600 patents involved in agreements with R.C.A., General Electric, and Westinghouse Electric Company. Were the decree entirely remedial in character it is difficult to see any rational basis for treating these patents on a different footing than other patents, which were made subject only to royalty-bearing compulsory licenses.

[72] *Supra* note 54.

[73] *Supra* note 53.

customers of competitors, to forestall competition. The compulsory licensing provisions of the decree—as well as a concurrent decision holding the main patents invalid and not infringed—has destroyed the basis for such threats and infringement suits. Yet the market power of Besser has increased rather than decreased in the years since the decree—indicating that factors other than the patent threats and suits were at least primarily responsible for the Besser market position. At the same time there are competitors who have undertaken manufacture since the decree who place considerable value on the freedom to manufacture without patent threats and to that extent benefit indirectly from the compulsory licensing provisions of the decree.

In the *Vehicular Parking* case there was a patent pool formed to fix prices and exclude competitors. Patent infringement threats and suits against the customers of non-licensees were freely made. Since the decree the nature of the industry has completely changed—but not in a way that might be anticipated from the decree. Only one significant new firm—Magee-Hale—has entered the field, and its entry seems to have been independent of the decree. The only other substantial effort to enter was unsuccessful for reasons unrelated to patents or the decree. Magee-Hale is now the major manufacturer of parking meters and enjoys a sales volume almost twice that of all the other firms combined. In this instance it does not appear that the entry of any new businesses can be attributed to the decree, and at most the compulsory license provisions gave some assurances to the company that is now the leading concern in the industry.

It is not anticipated that the present pilot study will lead to conclusions having general applicability. It is hoped, however, that further studies will be made and that eventually a fund of factual information based on numerous case studies covering the full range of significant variations will be accumulated. It should then be possible to indicate the influence of the various factors on the effect of compulsory licensing and patent dedication decree provisions and thereby draw generally applicable conclusions as to the meaning of these decrees with respect to the general operation of the patent system and to state the criteria that should govern their entry.

# Licensing Abroad of American-Held Patents, Trade-Marks, and Techniques*

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SUMMARY

LICENSING ABROAD of American-held patents, trade-marks, and techniques is a rapidly expanding practice of U.S. businesses. They have found that licensing is a technique for meeting increasing restrictions on trade and payments, of gaining additional profits from these proprietary items, and of extending the benefits of the American competitive system to other countries.

The present study of this segment of international business and legal practice is an attempt to obtain information on the motivations of companies engaged in licensing, on the legal and economic and governmental problems faced, and on the nature and extent of licensing. Such information is not readily available in published sources. The Foundation has found it necessary to embark on an extensive interview and questionnaire approach. To date some 65 corporations have been interviewed and a mail questionnaire has been distributed. Both of these approaches will be continued and expanded during the coming months.

In addition to gathering information concerning the broad picture, the Foundation staff is analyzing some of the basic economic, legal, and negotiating problems of licensing. A report on the conclusions from this pilot study will be forthcoming later in the year. The present paper is in the nature of an interim report on the motivations and problems of licensing, on the roles of government, and on some tentative analyses of the effects of licensing on the economics of countries involved.

THE AMERICAN FIRM that obtains patents or registers its trade-mark in the United States frequently has the same motivation to obtain patents or register its trade-marks *abroad*—that of protection. Patenting of products or processes abroad or registration of trade-marks is a means of preventing unprivileged competition from arising in foreign markets. If the firm has overseas branches or wholly-owned subsidiaries, it may patent or register abroad to protect its foreign operations. Or, it may wish to secure export markets for itself against foreign competition. Complementary to either practice, or as a primary policy of itself, the firm may license foreign firms to manufacture, use, or sell products covered by its foreign

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patents and/or trade-marks. In most cases, in order for the foreign firm to exercise effectively the privilege it has been extended, it must also obtain certain secret or specialized technical know-how held by the licensor. Thus, licensing of patents and trade-marks is closely tied to exchange of technical knowledge. In many instances, what the licensee wants primarily is the know-how; the patent and/or trade-mark is desired for the privilege and protection each gives. The existence of the foreign patent or trade-mark usually derives directly from a prior ownership by the American firm of the corresponding *American* rights. The American patent system encourages the research and development by American firms which are extended to foreign firms under licenses. In all but the strictest legal sense, therefore, the practice of licensing of foreign rights held by Americans is an extension of the benefits of the American patent and trade-mark systems.

In most instances, the rights (patents and trade-marks) which an American firm acquires abroad are supplementary to the rights that it has previously acquired under the American systems. Since many countries abroad require filing of patent applications within a year after the patent applications are filed in the "home" country, the decision which faces the American firm is whether the protection or potential licensing abroad is desirable enough to warrant the expense of obtaining and maintaining the foreign rights. Apparently, this decision is taken almost wholly on the basis of whether the protection obtained is worth the cost. The profitability of future licensing is usually a secondary consideration in the initial decision to file or register abroad.

Once the foreign rights have been obtained, licensing becomes the chief means whereby the benefits of the encouragement of American research and development, themselves a product of the American patent system, are extended abroad profitably to both parties. Foreigners will, of course, be benefited by exports of American products which have been produced under encouragements of the patent system. But an even larger benefit accrues to the foreign country when its industries are made more efficient, and a wider range of goods are produced at lower cost through obtaining American know-how and patent rights. Collaterally, U.S. firms obtain significant benefits from research carried out by foreign companies through licensing. The flow of technology and of patent rights into the United States is an important aspect of international business operations. This project of The Patent, Trade-Mark, and Copyright Foundation has been delimited initially, however, to cover only the flow of U.S. rights to foreign recipients.

## OBJECTIVES AND SCOPE OF THE STUDY

While the transfer and exchange of patent rights and production techniques have marked international business relations for decades, the past 10 years have witnessed an increased emphasis on foreign licensing. Interest in the problems and procedures of licensing has risen rapidly both within and outside of business circles; governments abroad have shown a preference for licensing arrangements over direct investment and over imports in many instances, and the U.S. Government has given positive encouragement to foreign licensing. Yet, no comprehensive study has been made of the many aspects of licensing; such as, its extent, the motivations behind it, its effect on economic development or on productivity abroad, the problems and procedures of negotiation, and the variety of legal and administrative problems surrounding the successful negotiation and continuation of an agreement. The sparsity of information on these important aspects of international business relations is attested by the fact that the card-catalog references in the Congressional and New York Public Libraries on foreign licensing are nil. A few materials have been found scattered through a small number of business oriented periodicals. Whereas the impacts, problems, and advantages of exports and of foreign investments have been widely examined, those of licensing have not. Nor is it possible to transpose the analyses and conclusions concerning exports and foreign investment wholly into the problems of licensing, for these three ways of doing business abroad have essential differences.

A distinguishing characteristic of licensing is that the property transferred is intangible. In its pure form (i.e., when unaccompanied by a *sale* of goods or services), licensing differs from export trade in that it does not involve the shipment of goods abroad—though the goods sold under license in the foreign market may be identical to those made in the United States—and the foreign exchange transferred from the licensee's country is only a fraction of what would be required for the importation of equivalent end-products. Licensing differs also from direct investment in that the former does not *require* a cash investment on the part of the American firm, and it does not involve participation by Americans in the ownership or management of the foreign licensee; however, licensing does not preclude an equity ownership or partial control.

"Pure" licensing is a means of doing business abroad when economic, political, or private business problems reduce the profitability or unduly increase the risk of export trade or direct investment. However, licensing may be combined with either exports or investment to provide greater protection or greater certainty in business relations or greater profitability.

The differences between licensing, exporting, and investing indicate that there are differences in proximate motivations for each. Although the ultimate motivation for all is business profit, the reasons why one tactic is chosen over another (or why they are combined in some instances) is one of the major questions to be examined in this Foundation study. Another topic of inquiry is the impact of tax and antitrust law on foreign licensing; these problems do not arise in the same way under exports or investment. Other important aspects of overseas operations —governmental policies and economic effects—also will require examination, because the specific problems and results differ as between licensing and export or investment.

## MOTIVATION TO LICENSE

The rapid growth of licensing since World War II has apparently been significantly a result of trade and currency restrictions abroad reflecting the dollar-shortage. These restrictions have militated against large dollar-purchases by foreign countries and against their acceptance of some investments by U.S. firms which would not contribute to their development programs in ways that the government desires and yet which would require sizable fixed repayment in dollars. Licensing has become a welcome substitute, in some instances, for trade and investment.

The postwar disturbances to technological developments, especially in Europe, apparently have also been a strong factor in encouraging the growth of licensing. As European nations were aided by the European Recovery Program, however, their reliance on American techniques diminished to some extent. But, the desire in the underdeveloped countries for industrialization has sparked their drive to acquire modern techniques. Both because of their need for technical know-how and of their desire for economic nationalism (i.e., greater national self-sufficiency), some countries have preferred licenses over either commodity or capital imports.

Also, the postwar tensions and war fear in a large number of countries, which could result in expropriation or nationalization of industries (or firms), tended to dampen the involvement of capital by American firms either in direct investment or export capacity.

These motivations may be hoped to be temporary, however, and there is evidence that many American firms are being motivated to license abroad increasingly by a better appreciation of opportunities to make profitable use of a proprietary item which originated basically for purposes other than licensing. For example, with over-all economic growth both in the United States and abroad, many firms have embarked on expanded and aggressive overseas operations as part of the general drive for markets. In doing so, they have expanded their patent programs in the United States and consequently abroad and have found that licensing will bring returns which they otherwise would not obtain. Some American firms have found that licensing is particularly justified in conditions where costs abroad are lower (especially taking transportation into account) and its exports are thus discouraged and/or where tax considerations or the lack of available capital militate against direct investment abroad.

The shifting nature of motivations could well bring a shift in the orientation to filing of patents and registering of trade-marks abroad if it is found that licensing abroad is an operation which can stand on its own feet rather than involve unattractive exports or investment. While it is not now apparent that many U.S. firms alter their foreign patenting programs in order to license abroad or that they have significantly modified their research and development to meet responsibilities under licensing agreements, such results might conceivably occur with a *continued* growth of licensing—particularly of cross-licensing. Cross-licensing is an arrangement under which the parties agree to *exchange* present and, in some instances, future patents and know-how relating to the products covered. The acquiring of technology from abroad under such arrangements constitutes an important motivation to licensing by some American firms. Recent evidence shows that German and American firms are entering into quite close and extensive business partnerships based on the exchange of rights to produce specified products, to use particular trade-marks, and to be informed of technical developments made by each.[1]

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[1] See *New York Times,* February 3, 1957, for a review of the extensive cooperation between these companies.

### QUESTIONNAIRE AND INTERVIEW APPROACH

The normal research procedures of digging through secondary and then primary sources of information have not been available to the investigators in studying the motivations of American firms to license abroad. It was found necessary, therefore, to go directly to the business firms themselves.

A preliminary questionnaire was sent to a select list of 70 firms; they were asked to examine the questions to determine whether they could and would answer them at a later date. The response indicated that most would cooperate but that each had reservations concerning data which might be considered "confidential" to that firm. The response also indicated that a personal interview approach would be more fruitful in developing comprehensible and useful questions and answers. Officials of over 50 firms have now been interviewed "across-the-desk," with a cross-section of general counsels, export managers, executive vice-presidents, and presidents having been questioned. Interview time has been between one and three hours per firm. The results to date indicate that this method of investigation will produce comparable and useful information; this technique will be continued in order to diversify the sample and to obtain information concerning the experience of firms in each major industry, including large, medium, and small corporations.

Out of the experiences of personal interviews the Foundation staff developed a questionnaire which is being sent to a larger number of firms that cannot be canvassed personally. These questions are designed to obtain both quantitative and qualitative information on the motivations pertaining to and the nature and extent of licensing. Where a firm has not engaged in licensing abroad, it is hoped that the reasons for this decision can be set forth in a form that will illuminate some of the reservations of American firms or the alternatives which they have deemed more profitable. If, at the same time, it were found that the firms which did not license were filing patents abroad extensively, it is probable that they would profit from greater information as to the feasibility of licensing—a purpose of the present study.

### LEGAL ASPECTS

Foreign licensing is significantly affected by various legal problems. These include problems of compliance with different foreign patent and trade-mark systems, of payments of a variety of taxes, and of interpretation of the American antitrust laws. In order to delimit the study, an examination of foreign patent systems and of foreign tax systems has been excluded from this phase of our investigation. These problems are obviously important and might fruitfully be made topics in a larger study. We have, however, chosen to emphasize American tax and antitrust aspects.

The major problem with reference to taxation of royalties is that of who is to bear them—the licensee or the licensor. Most licensors attempt to avoid problems of foreign taxation by requiring that royalties be free of all local taxes. Such a provision is important in the event of changes in the tax law. For example, the recent attempt of the French Government to impose a "turnover tax" on royalty income to the licensor caused some American firms to re-write their agreements; otherwise, their license arrangements would have become unprofitable.

Differences in tax treatment of income received through royalties or as dividends have been instrumental in causing some firms to license rather than invest and others to conclude formal licensing agreements with their own subsidiaries. Taxation does not, however, appear to be a vital concern in decisions to license or not to license. If it were, there would probably be more use than there is of administrative techniques for reducing the impact of taxation. One such technique is that of establishing a subsidiary in a tax-haven country; the subsidiary would operate the licensing agreements and receive the income. It could retain royalty payments made to it and/or use them without their becoming subject to payment of U.S. taxes on any part of the royalties received. Few U.S. firms take advantage of this opportunity, partly because of the overriding weight of the desirability of administering the agreements from the home office. But these observations do not exhaust the possible impacts or avoidance of taxation; these problems will be examined more closely by the Foundation.

The issuance of licenses under patents or trade-marks involves a variety of practices which may or may not be illegal under the American antitrust laws and similarly may or may not constitute unfair competition. At the outset a business firm must make decisions regarding whether the licenses shall be exclusive or non-exclusive and, especially in the case of patent licenses, whether they shall contain restrictions on the quantity to be manufactured, territorial allocation, field of use, and first-sale price. These are illustrative of the numerous aspects on which legal trade attempts to monopolize under the antitrust laws of the United States and cognate laws relating to trade-marks and unfair competitive practices.

Some U.S. firms advocate the use of non-exclusive licenses to minimize risks of antitrust violation—at least non-exclusive with reference to field of use and sale. But, where the market abroad is not large and/or where the competition from other manufacturers is stiff, the licensee may insist on an exclusive right to manufacture and to sell in order to reduce his risks. The licensee may also desire the licensor to be excluded from the foreign market. Similarly, in order not to create competition for himself, the licensor may wish to exclude the licensee from the home market; and to protect his third markets abroad, the licensor may restrict the licensee to manufacture and sell only in the country within which the patent is granted or the trade-mark registered.

These restrictions need not be negative ones in the sense of stating that the licensee "cannot" manufacture, use, or sell the product in specified areas. The agreement may rather state the positive rights transferred—as permitting manufacture, use, and sale under the stipulated rights within the territory of the patent *or* within that territory plus other specified areas. The licensee may be permitted to operate under the patents filed in a variety of countries, thus opening opportunities in third markets to him. The licensor may reserve the right to operate in third markets himself and to permit any subsequent licensee to operate there, leaving such territory for open competition.

Since many of the antitrust laws of the United States cover trade or commerce with foreign nations, interpretations of these laws impinge on foreign licensing agreements. There is great need for clarification not provided in existing judicial decisions involving the foreign commerce of the United States. Most of the decided cases have involved so-called international cartel arrangements for division of markets or price-fixing. Consequently, courts have had little occasion to adjudicate the legality of patent or trade-mark licensing as separable transactions not integrated with an over-all illegal purpose of misuse of patent and trade-mark rights.

It is nevertheless true that some business executives and their legal counsel feel that the Department of Justice and the courts have taken such an inflexible attitude toward any restrictions whatever of the licensee or licensor in the sale of products that it is best to counsel them to grant exclusive licenses only to manufacture, but to grant non-exclusive licenses to use or sell. The major provisions to be avoided, they argue, are those which expressly or by implication unduly restrict the domestic or foreign commerce of the United States or that in any way restrict the operations of the licensee with regard to products of his own design, made with his own processes and under his own trade-marks. This view stresses that licenses should not be used as the means of dividing world markets or fixing prices.

Before World War II, licensing was sometimes employed to share markets; it was a front for the intent to restrict. The attitude of American firms toward licensing seems to have shifted significantly since World War II, however. Many see it now as a means of making profit from extending a proprietary right to others. For these, licensing results in a desirable extension of competition and a reduction of costs of production with the most efficient firms expanding their production and possibly their exports.

The cartellization of some European industry, however, makes it difficult for many foreign licensees to understand why American firms will not grant them exclusive rights—not only in their own country but also in third countries. Where it is necessary to grant the licensee some exclusive rights—as may be the case where the foreign government insists on exclusive privileges at home and in third markets, so as to expand exports—the American firm must find some means to prove that the exclusion is not unduly restrictive of trade or commerce of the United States. One means of supporting the argument that the license is a bona fide business transaction and not just a front for trade restriction is the extent to which the license is used in foreign *production*. Under this test, licensing of know-how becomes important so as to facilitate the licensee's production. On occasion, the Department of Justice has recognized the importance of know-how by insisting on its being granted when seeking relief against patent abuses.

There remains considerable uncertainty as to the rights of exclusion which may be granted under licenses abroad, and recent court decisions (e.g., the Timken ball-bearing case) have caused many U. S. firms to feel that the trend is toward more stringent interpretation of the legislation. This uncertainty has caused some officials to urge creation of a mechanism through which license agreements could be cleared. The problems created by uncertainty, the possible actions to protect against litigation which licensors might take, and the feasibility of governmental clearance are continuing topics of the present study.

ENCOURAGEMENT BY THE U.S. GOVERNMENT

The U.S. Government considers patents and trade-marks as important contributions to that confidence necessary to support lasting business relationships. One official has stressed this as follows:

> A world in which men may enjoy the good things produced by their neighbors in all parts of the globe, and may buy each other's products with confidence in their quality and in the integrity of the maker and the seller is a world that will not be troubled by fears and dissension. The marketing tools provided by patent and trade-mark protection are essential to the creation of such a world. One of the surest foundation stones upon which a market for a product can be built is confidence on the part of the buyer that the product will always be the same quality and will always do what it has done before. Integrity of brand names, assurance that a trade-mark will appear only on the products made, or controlled, by a particular maker is a potent instrument for building such confidence.[2]

In order to encourage interest in licensing, the Government helps protect licensors of defense items, extends guaranties, and offers basic information concerning potential licensees, conditions abroad, and means of protecting foreign rights. For example, the Bureau of Foreign Commerce collects and disseminates information on means of protecting industrial property rights throughout the world. The information concerns laws governing patents and trade-marks in a host of countries and is available to trade associations, attorneys, and other interested parties. In its World Trade Information Service, the Department of Commerce also publishes studies on patent and trade-mark regulations of various countries. A variety of other services are provided also. Many licensors have found the Department of Commerce's information services useful in determining the advisability of pursuing licensing arrangements further than the investigatory stage, but they rely more on their own contacts to develop the initial exploratory situation.

### *1. Licensing for U.S. Defense*

In order to facilitate exchange of patent rights and of technical information for defense purposes, the U.S. Government has negotiated a series of bilateral agreements with Belgium, Netherlands, Greece, Turkey, Japan, the United Kingdom, Italy, Norway, Germany, Denmark, and France. The Department of State, which is responsible for negotiating the bilateral technical exchange agreements, has asserted that the success of national and allied measures for the defense of the Free World will depend in large measure upon the efficient production of military materiel for the armed forces. This production can be accelerated and made more efficient and inexpensive if technological advances are readily exchanged among the allied nations; an effective interchange depends upon the individual companies in the respective countries. To encourage such interchange, the bilateral agreements attempt to establish procedures which will protect the property rights of the owners of patents and technology.

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[2] E. E. Schnellbacher, "Patents and Trade-Marks as International Marketing Tools," *Bulletin,* American Patent Law Association, April-May 1956, pp. 146-147.

Foreign governments have a direct interest in such exchanges and have sometimes called to the attention of respective private parties the desirability of a licensing arrangement. Even under private arrangements, governments are concerned that the fees be reasonable so as to keep defense costs low and that the agreements will permit flexibility to meet changing military demands. But the foreign government's interest is more direct when it becomes the licensee. In this event, the American licensor can hardly bargain at arm's length; the licensor's interest is protected by a Technical Property Committee of the U.S. Government, which recommends to the foreign governments what means might be employed to assure "prompt, just, and effective compensation" for any use or disclosure of technical information.

While there is little evidence that the bilateral agreements have stimulated an expansion of licensing, this aspect of the study may turn up important elements concerning effective government policy.

### *2. U.S. Guaranties*

Since licensing is motivated in many instances by the desire to avoid currency restrictions imposed on trade or returns from direct investment and since political uncertainty has given rise to licensing instead of direct investment in other instances, the U.S. Government's program of convertibility guaranties under the International Cooperation Administration has been extended to licensing agreements. The objective of the program—like that of the bilateral agreements—is to foster respect for and understanding of free institutions through the encouragement of private commercial contacts. The program is, in essence, a special type of insurance operation under which the insured pays a fee for protection against certain risks: namely, that the local currency receipts of the licensor arising from his agreement abroad might be blocked and not be convertible into dollars and/or that his proprietary rights might be lost through expropriation of the licensee, confiscation by the host government, or war.

These guaranties are available in any country which has instituted the program by signing agreements with the United States; approximately 30 countries have entered into specific agreements, including nearly all nations of Western Europe and several countries in Latin America and the Far East. Guaranties may be obtained for any contribution of capital goods, materials, equipment, *services, patents, processes,* or *techniques* in the form of a loan, the purchase of a share of ownership or participation of *royalties,* earnings or profits. But the guaranties are available only for *new* agreements and at a premium of ½ of one per cent per year of the amount of protection provided under *each* risk. The guaranty agreement is a contract between the licensor and the U.S. Government extending up to 20 years. To enter into the contract, the licensor must supply a copy of the licensing agreement and show that he has the necessary approvals from the government of the foreign country concerned.

The necessity of disclosing provisions of the licensing contract to the U.S. Government has prevented some firms from using the guaranty program; they consider that disclosure of some information in the agreement is undesirable. However, a variety of firms have made use of the guaranties. For example, NABISCO obtained a guaranty to convert lira into dollars up to $900,000 over a period of 10 years; Godfrey L. Cabot, Inc., obtained a guaranty of up to $1 million on marks arising from a German arrangement; Johns-Manville insured up to $350,000 arising from another German agreement; and Clark Equipment Co. insured returns from direct investment and a licensing agreement up to $479,000. About half of ICA's guaranties during 1950-1955 covered royalty payments or equity investments received for patent rights or technical assistance.

Despite the coverage of the program, comparatively few licensors have found it desirable to use the facilities. Many have found that where the host country was politically stable and economically sound enough to warrant a license agreement, it was also sound enough not to require a guaranty. A major question remains of how to make the guaranties more attractive. One answer would be to find adequate ways of protecting a licensor against expropriation. It is, as yet, difficult to know how to insure expected royalty payments against the risk of expropriatory actions. The ICA has not found it possible to insure against this eventuality because of the difficulty of finding a means to measure the loss the licensor would suffer if such action prevented execution of the agreement. For example, suppose that a license agreement provides for a 6 per cent return for 15 years and the government takes over the licensee firm at the end of five. What would the royalties have been over the remaining years? No solution to this question has been found, and the ICA offers expropriation insurance to licensors only where fixed and definite royalty payments are required. If an agreement calls for a minimum payment of $25,000 per year for 10 years and a total fixed payment of $250,000, then a contract would be written for that amount against the risk of expropriation; so far, few have been written.

### POLICIES OF FOREIGN GOVERNMENTS

Foreign governments have attempted through requirements of approval of licensing agreements and through currency restrictions to encourage those arrangements which it wishes to be made and to discourage others. In some instances, governments publish lists of industries needing foreign technical and capital assistance; as development programs progress, the lists are changed to reflect the opening up of new opportunities. Positive inducements are often provided through tax freedom for a period of years; this preference may redound to the benefit of either the licensee or the licensor, but in either case, the conclusion of an agreement is facilitated through such reductions in cost of operation. Also, a preferential exchange rate may be offered for the transfer of royalties or in calculating the value of services and equipment contributed to the licensee.

Some governments have used the requirement of approval of both licensing and direct investment so as to encourage the former and discourage the latter. The French government, for example, has refused permission to some U.S. firms or their subsidiaries to establish plants in France; the government has considered that French capacity was already adequate to supply the demand for the products involved. Under these conditions, France could well agree to a licensing arrangement with a U.S. firm, particularly if the agreement reduced the costs of the French plant and enabled it to compete better with imports and in third markets. The antipathy to the introduction of U.S. firms, which might out-compete "home" enterprise because of advanced technology and scientific management, does not extend to licensing operations; under licensing the "home" firms obtain these same techniques for their own improvement.

While the policies of foreign governments are important in the over-all picture of foreign licensing, their detailed examination will have to await a more extended study than the current one by the Foundation.

### ECONOMIC EFFECTS ON COUNTRY OF LICENSEE

Foreign licensing has often been referred to as a "Private Point Four" program; it is non-financial foreign investment which may or may not be directed toward specified economic goals but which has a considerable impact on the success of developmental or productivity programs. It directly supplements the "productivity drive" of European countries under the aegis of the International Cooperation Administration and the European Productivity Agency, and it helps accelerate economic growth in the less developed countries.

The pilot study cannot hope to delineate and analyze all of the effects of licensing on both industrialized and developing countries. Three main aspects have been blocked out for systematic study: the balance-of-payments effects, productivity effects, and the impact on capital formation in the licensee country.

#### *1. Balance-of-Payments Effects*

If we look upon licensing as a substitute for exports (from the standpoint of the licensee country, a substitute for imports), the short-run balance-of-payments effect is clear. Local manufacture of the goods made under license saves foreign exchange far in excess of the amount required to pay royalties. If the license arrangement is a substitute for direct investment, the effect is less clear: depending on the terms of the license agreement, the royalties may or may not exceed profit remittances (above the repayment of invested capital) from the alternative direct investment.

In many cases a licensing arrangement is a substitute for nothing. If, in the absence of licensing, the goods simply would not be available in the licensee country (that is, they would *not* be imported), the balance-of-payments effect would be a drain of exchange to the amount of royalty payments. For this reason, many countries have subjected royalty agreements to almost as stringent exchange control as has been the case with merchandise imports. In the United Kingdom, for example, licensing agreements (prior to 1953) would not be approved by the British government unless it could be shown that they would result in import savings, or in a substantial improvement of export prospects.

In some cases licensing has been a significant contributing factor towards easing balance-of-payments problems by increasing the variety and quality of goods available for export. This appears to have been the case in Japan, where development of export industries has clearly been stimulated by licensing agreements, and where licensing activity receives effective government encouragement.

The above discussion refers only to short-run balance-of-payments effects. In the long run, the balance-of-payments effect of licensing would show up through the contribution to increased productivity and economic development in general.

### 2. *Productivity Effects*

By far the majority of licensing agreements involve the transfer of the patent right to use advanced technology, and in most cases they also involve the transfer of "know-how" in its application. Thus, without question they contribute to increased productivity in established foreign industries. There are, however, two special cases to be considered in which licensing may not increase the wealth or productivity of the licensee country.

The first is the case where licensing is a substitute for direct investment. Would the possible alternative of establishing a U.S. subsidiary abroad have the same productivity effect in the licensee country, a greater effect, or a smaller one? Very probably the answer is mixed, depending on what part of the world we are considering. It is commonly accepted that in Europe, for example, a U.S. subsidiary is much more efficient than its European counterpart even where technical knowledge and access to patent rights are equal. This is simply because European management techniques, though highly developed, are not oriented towards efficient operation as much as American techniques. Consequently, if productivity were the only consideration (which it never is), licensing in Europe would be less desirable than direct American investment.

In underdeveloped areas, however, a serious impediment to economic progress along Western lines—which is a major goal for most underdeveloped countries—is the extreme shortage of men capable of handling modern management, supervisory and technical jobs. Under licensing agreements these necessary skills tend to be developed. In cases of direct investment they often are not; the top jobs are frequently filled by Americans, and while this provides an initially more efficient operation, it does little to teach local businessmen American management methods. This is why many underdeveloped countries go out of their way to encourage licensing agreements which provide for temporary management advice and technical assistance.

The second special case arises when a licensing agreement is made in a country poorly suited to produce economically the goods concerned. This is not an unusual situation where there is a driving urge for industrial expansion at almost any cost. In Turkey, for example, electric light bulbs are made under an American license (with a "know-how" agreement added) for the highly protected local market at costs far in excess of the costs of imports. This example can be multiplied many times, and the effect may well be to restrain the growth of national productivity by diverting labor and capital from occupations where there is a real comparative advantage. This, however, is not uniquely a fault of licensing. It is a fault inherent in the economic nationalism which characterizes most of the world's underdeveloped countries. Given this economic nationalism, the licensing procedure undoubtedly tends to increase productivity. That is, if the desire is for diversification or controlled imports, licensing supports the national objectives.

### *3. Effects on Domestic Capital Formation Abroad*

Licensing, in many cases, provides a new opportunity for investment and in fact *requires* an expansion of domestic capital in underdeveloped countries. Such new opportunities affect also the composition of domestic capital formation. Investible funds in these countries typically go into unproductive uses such as real estate speculation and hoarding, or are invested in securities abroad. This is partly because of the shortage of profitable investment opportunities at home. The licensing procedure helps to open up opportunities for domestic capital by making it profitable for the American firm to contribute a patent right and technical knowledge at a minimum of financial risk.

It is now recognized that successful development of the world's backward areas will require considerable mobilization of domestic capital. Foreign capital will continue to be needed, of course, but it can seldom have much more than marginal significance in light of the tremendous size of the development problem. This is especially true in the field of *private* business development, where foreign capital is hard to get (as contrasted with *social* capital development exemplified by roads, ports, irrigation, power projects, etc., for which foreign capital can be made available on a government-to-government basis, or through such institutions as the International Bank for Reconstruction and Development). This, of course, is the field in which the licensing procedure contributes most to the objectives of both the United States and the developing country.

It is logical to expect that licensing also has a beneficial effect on the quality of domestic capital formation abroad. In the underdeveloped countries newly discovered investment opportunities can profitably be exploited with antiquated production methods, and, indeed, they often are. However, when modern methods can be made available at a reasonable royalty rate, the resulting use of capital is improved, and profitability is usually enhanced.

Thus, the effects of licensing on domestic capital formation are likely to be beneficial, both in increasing the amount of capital and in improving its composition. Whether this contribution is of sufficient size to be significant, however, would depend in part on the effects in the country of the licensee and on the impact on the over-all allocation of the world's resources. Once again, these broader effects will have to be left to a larger study.

## PROFITABILITY TO AMERICAN LICENSORS

While the motivation of particular firms to license abroad seems primarily to be that of obtaining additional revenue, the costs of licensing are so closely tied to operations which would be carried out anyway that it is difficult to obtain a judgment on the specific profitability to the licensor. The costs of licensing arise conjointly with those for research and development, engineering services, home office management, and management of overseas operations. While it is possible to separate the costs of home operations from those related to overseas transactions, it is not always possible to separate those research and development costs or engineering costs which go into domestic business from those entering into licensing arrangements; separation, when done, is usually purely arbitrary.

Given this situation, many firms have adopted the policy of not ascribing any costs to licensing operations; they, thereby, consider that all royalty returns are just "that-much-more" revenue. This is hardly accurate accounting procedure, and it provides no test of the proposition that licensing is "profitable." More accurate accounting might show that licensing was much less profitable on a direct revenue basis than is now thought. But the direct royalty receipts are not the only way of denominating the profitability of foreign licensing. The fact that some products similar to the licensor's are sold overseas may lead to increased exports of complementary products or sales of components to the licensee himself. On a broader scale, the assistance to economic development given by licensing may lead to larger exports of the licensor's products or to larger sales by the licensor to other American firms producing for export.

A more precise statement of the ways in which licensing has proven to be profitable to the licensors should be instructive not only to those already engaged in, but also to those anticipating, licensing abroad as well as to persons interested in evaluating the over-all benefit of United States international business activities.

# Public Attitudes Toward the Patent System*

JAMES N. MOSEL, Principal Investigator

SUMMARY

THIS PROJECT is a preliminary study of the content of public attitudes toward the patent system, the areas of ignorance and knowledge that exist, and the ways people come to acquire their attitudes and information about the system. The purpose of the project is to provide guidance for a public information program. Early results suggest that with many people misconceptions are common, attitudes are perpetually fluid and open to change, and that one of the main sources of attitude and information is other people rather than what is learned from mass media.

## WHY PUBLIC INFORMATION PROGRAMS FAIL

THE PUBLIC ATTITUDES PROJECT is designed as an exploratory investigation of public attitudes toward, and informational level about, the patent system. Its immediate practical objective is to provide guidance for public relations programing. The project is still underway. The purpose of this paper is to present some of the over-all considerations and concepts which provide the framework for the project, and to describe the nature of the research itself, together with a few brief preliminary findings.

The basic premise underlying this purpose is that an effective public information program must first know the shape of current attitudes and levels of information, the areas in which ignorance and doubt exist, and the misconceptions that prevail. Behind this premise is extensive research in the field of public opinion which shows that very often public information programs fail because of what psychologists sometimes call the "derailment of understanding"—audiences do not always perceive the same meaning in a communication as does the communicator. This in turn can lead to a "boomerang effect" whereby an information program may actually produce the opposite result from that intended. In simplest terms, the "derailment of understanding" is a form of what is called "perceptual distortion": people will misperceive or distort incoming information so as to accommodate it to pre-existing attitudes and beliefs. The meaning they get out of the message is modified to make it consistent with attitudes they already hold. We know that informational messages are more readily accepted if they are congenial with people's current outlook. If the message conflicts with these, its meaning will be distorted so as to support, rather than contradict, present thinking. And if the message's meaning is so clear and unambiguously stated that distortion is difficult, the audience will tend to protect its present thinking by discounting the message in some way or by developing new beliefs which discredit the source of the message.

* This is a research interim report on *Project 6a,* **Public Attitudes Toward Patents, Trade-Marks and Copyrights.** Mrs. Judy Geller, a psychologist in Washington, D. C., and Miss Pauline Kartalos are assisting on this project.

Because of the derailment effect, research on numerous information programs has shown in many instances that the program boomeranged by tending to reinforce present thinking rather than change it. The incoming information ran counter to the structure of current attitudes, was distorted so as to become congenial with it, and in so doing actually served to strengthen these attitudes. In order to decide what information should be given and how to give it, we must know something about the structure of these attitudes which already exist. And furthermore, this data must be gained with respect to certain types of audiences or publics.

### RELATIONSHIP BETWEEN THE PATENT SYSTEM AND PUBLIC OPINION

But beyond the immediate application to public relations programing, knowledge of public opinion is vital to a long-range understanding of the nature of the patent system. In the final analysis the patent system must be viewed as a social institution —a set of strategies for the satisfaction of certain needs in our society. If the system operates so that these needs are not satisfied, the resulting dissatisfactions become manifest in the structure of the opinion of certain publics. But the direction of cause and effect is not solely one-way. The character of the patent system not only affects the nature of public opinion, but public opinion also affects the character of the patent system. There are two basic ways in which this latter "feedback" effect can take place. First, dissatisfactions with the system may eventually create pressures for change. Opinion has the tendency to be converted into action—pressures which modify the patent system so as to make it more commensurate with human needs. It should be noted, however, that such pressures are often delayed because of the absence of any stable, clear-cut mechanisms through which dissatisfaction can be channeled. When this is the case, dissatisfaction may exist but ameliorative changes do not occur. This situation leads to a "cultural lag" where developments in one part of our social technology do not keep pace with developments in other parts. Opinion studies can often give cues concerning malfunctioning when direct channels of attitude expression are not available.

It should also be noted that even when "feedback" takes place, the results are not always ameliorative. Sometimes certain publics, because of their greater access to channels of influence, are able to press more effectively for change than other publics. This may indeed lead to changes in the patent system. These changes, however, may contribute to further malfunctioning because of an actual increase in dissatisfaction in other, unrepresented publics. This situation can easily be detected and understood by attitude studies of all relevant publics.

A second major way in which public opinion serves to determine the effectiveness of the patent system lies in the fact that opinion helps determine the way in which the existing system is *used* by those who must work with it. For instance, if an inventor perceives large corporations as essentially threatening and exploitative in their relations with inventors, that inventor will select courses of action provided by the patent system which are quite different from those selected by the inventor who views large corporations as a helpful means to attaining his own goals. Or take another example. In the preliminary work of the present project, we discovered a number of people who view the inventor as a helpless, impractical visionary who is incapable of properly placing his invention. In some cases this image of the inventor stimulates a certain pattern of "advice" from others which then guides the inventor along lines of patenting and marketing action which he would otherwise not choose. Similarly, utilizers of his invention develop certain administrative practices for dealing with these expected qualities of the inventor. The question of whether or not the inventor actually conforms to this popular image is not the issue here. The point is that if people believe the image to be true, they will act as if it were true.

Lastly, in all of the above we must note a curious phenomenon which is at work; namely, what the sociologist Robert Merton has called the "self-fulfilling prophecy." This simply means that opinions which are initially incorrect sometimes produce consequences which eventually make them correct. Suppose an inventor believes that industry is essentially exploitative in its intentions toward inventors. This attitude causes the inventor to be overly guarded, defensive, and demanding in his relations with industry. Industry, on the other hand, responds to this behavior by resisting the inventor's demands. The response of industry is then seen by the inventor as further evidence of exploitativeness, and his previous attitudes become reinforced. In other words, the inventor's erroneous beliefs created the conditions which, in a sense, made them true.

## EXPLORATORY INTERVIEWING

It is clear, then, that the patent system exists and grows in a context of public opinion, and that an understanding of this opinion climate will help us to understand the role of the patent system in present-day society. These considerations form, in a very general way, the framework within which the Public Attitudes Project has been planned. More specifically, the project is conceived as a pilot study to point directions rather than provide final answers. The study has begun in Washington, D. C., with a possible view to extension to other cities and other types of publics. In its present stage two groups are being studied: (1) university students at The George Washington University, and (2) a cross-section of the general public in Washington. Within each of these groups, analysis will be made of special subgroups, for example, engineering and technology students.

Exploratory interviewing of a sample of university students and non-students has been conducted, preliminary to the development of a pilot questionnaire. The purpose of this interviewing has been to tell us what questions we should and can ask, that is, to ascertain those aspects of the patent system which have meaning for people and those areas of orientation toward the patent system where attitudes can be said truly to exist. This is an important point. We are trying to distinguish between those areas of attitude where people can genuinely be said to hold crystallized opinions and those where the opinion had no prior existence, having been thrown together quickly in order to satisfy the demands of the interviewer. This difference, technically known as the extent to which an attitude is "structured," has a number of significant implications. One of these is the intensity of the attitude. Highly "structured" attitudes, that is, those which are well worked out and highly crystallized, are usually held more intensely. They are also more resistant to change and usually more important to us personally (or "ego involved" in technical language). Consequently, attitudes differ considerably in their implications for action, depending upon how highly structured they are. There are several ways for gaining clues concerning the structuredness of attitudes, and one of these has been used in the exploratory interviewing phase of the project. Considerable research by other investigators has shown that in response to broad, non-directive questions about issues, people's more structured attitudes appear as more salient. That is, such attitudes come out earlier, with greater frequency, and with less hesitation. Using this approach, plus mild probing, to find out what is behind expressed attitudes, it is possible to locate those attitude areas where people have pre-existing conceptions and to distinguish these from areas where they are just "talking off the top of their heads."

### EXPERIMENTAL QUESTIONNAIRE

From the exploratory interviewing an experimental questionnaire has emerged which can be used either as an interview questionnaire or, with slight modifications, as a self-administering questionnaire. This instrument is being administered to groups of non-engineering students, engineering students, and a group of employed engineers. The questionnaire is designed to explore more fully and in a more systematic way the meaningful attitude areas uncovered in the preliminary interviewing. But attention will also be paid to the areas where no substantial attitudes exist since these areas are of great practical significance. It is easier to create attitudes where no previous attitude exists than supplant an existing attitude with a new one. We wish to learn, then, not only what opinions already exist, but also those areas of thinking where opinions are not yet formed and where people may actually be seeking information.

Beyond this, our purposes require that the questionnaire also cover two additional types of data. The first of these is the *informational support* which attitudes have. By this we mean the amount and kind of factual information upon which a person's attitudes rest, how much he knows about the object of his attitude. The necessity for this should be obvious. We must know those areas where information and ignorance exist before attempting to conduct a program to provide further information. Furthermore, attitudes which are based on information must be dealt with in very different ways from those attitudes which lack an informational basis. We sometimes find well-informed people whose attitudes are nonetheless highly emotional and unrealistic. So far we have uncovered two types of such persons. One type holds his attitudes apart from his information; he uses "logic-tight compartments" to house his attitudes and keeps them dissociated from his knowledge. He simply doesn't use his information. The other type uses his information, but employs it to support existing attitudes and beliefs. This is especially easy to do in a subject-matter area like the patent system where the "facts" are not completely self-interpreting. Thus we find persons who are about equally well informed on the patent system can easily hold extremely different attitudes toward it—because each has used his information in a different way. The effect is basically the same as the phenomenon of "perceptual distortion" described earlier in this report.

In order to gain some insight into the way information relates to attitude, our questionnaire contains a series of information questions of a factual sort. These take the form of a short information test which is given at the end of the interview (where it will not contaminate responses to the attitude questions). In analyzing the results, information-test scores will be used to study how attitudes vary as a function of information.

## SOURCES OF PUBLIC INFORMATION

The second additional type of data we include relates to the *source* of people's information about the patent system, that is, the media through which people acquire their knowledge of the patent system. An understanding of media sources is important to an understanding of how attitudes "get that way." Media operate as filters, as selective purveyors of information, and there is strong reason to believe that to some extent people's attitudes are influenced by the types of media to which they are exposed. Not only is the type of information a medium carries important, but also the prestige of the medium. Research in the field of communications shows that media differ considerably in prestige and credibility in the public mind, and that these factors in turn affect the acceptance of the information transmitted.

We must distinguish here between formal mass media on one hand, and informal personal media on the other. The former includes such sources as magazines, newspapers, radio, television, pamphlets, etc., while the latter refers to *persons* who provide information and views to their associates in a direct, face-to-face manner. Such persons are sometimes called "opinion leaders." The term is somewhat misleading because it suggests that such persons are "leaders" in the more general sense. They are not. They are simply ordinary people who take a greater interest in the subject, expose themselves more to information about it, and then pass on laterally to others of their own kind the information which they have acquired, usually with a bit of persuasion added. Their influence is known to be highly significant inasmuch as their activities can easily affect the thinking of other people. Working through personal contact, they can adapt their influence to the requirements of the individuals with whom they talk; they are persons, not cold mass media, and consequently are less likely to be rejected as "propaganda." And because of their personal ties to the persons with whom they speak, their information and views are more likely to be listened to and followed.

It is also known that opinion leaders are important as mediators of mass media. Most studies of public attitudes show that very few people indeed are directly exposed to the contents of information programs and of those who are exposed, many do not retain what they learn. Opinion leaders, however, because of their greater interest in the subject at hand, deliberately expose themselves to such information. In passing the information along sideways to their associates, they in a sense serve as relayers and reinforcers of the content of mass media. In this role they supplement and strengthen mass media, thus contributing a "second exposure" which otherwise would be lacking.

In view of the above considerations, our research questionnaire is also designed to obtain preliminary information concerning the types of formal mass media through which people learn of the patent system, the prestige and credibility of these media as a factor in opinion formation, what kinds of mass media transmit what kinds of information, and lastly, the role and effects of opinion leaders in supplementing, reinforcing, or nullifying what is learned from mass media.

### ATTITUDE BREAKDOWN

So far we have discussed the role of public opinion as a factor in the operation of the patent system, the relation between public opinion and people's levels of information about the patent system, and the media through which such information is delivered to the public. The main object of our project is, of course, the character of the opinions and attitudes themselves. In order to understand and describe a public attitude, it is first necessary to develop some sort of "model" or "conceptual scheme" which establishes the categories of description. We need to formulate in advance of data collection those characteristics of attitudes to which our description must be directed. Fortunately, we have considerable guidance from the work of other researchers. The conceptual scheme which has emerged from this work provides the framework for the development of the attitude part of our questionnaire. With such a framework before us, the task of developing significant questions becomes a systematic and orderly one, with each question contributing information about a certain aspect of the conceptual scheme.

Viewed in broadest outline, the description of an attitude breaks down into three general categories. First, a description of the *object* of the attitude as it is perceived by the individual. In addition, there are a number of discernible aspects of the object which our description must include. These will be mentioned later. Second, there are the *action tendencies* aroused by awareness of the object—what the individual *does* about his attitude. Such actions may be classified as basically "approaching," "avoiding," or "attacking." Third, is the *policy stand* which an individual assumes with respect to the attitude object. This is essentially the sort of measures which he is "for" and "against" as regards the attitude object. It is this aspect of an attitude which forms the content of conventional opinion polling studies.

The present project is attempting to obtain information regarding each of these three components of an attitude. But we are especially interested in the first component—the characteristics of the object of the attitude as perceived by the individual. The object of the attitude is, of course, the patent system. And as mentioned above, there are a number of different aspects to this object. First is the extent to which an attitude toward the patent system is *differentiated*—the extent to which the attitude is a highly generalized and amorphous affair or sharply differentiated into a complex of many specific aspects. A person who sees the patent system in a highly differentiated way is aware of many different facets to the system and tends to hold different attitudes toward each of these facets. He tends to be more sophisticated in his thinking. He is more aware of nuances and subtle differences in various parts of the patent system. On the other hand, the person whose attitude shows little differentiation tends to see it as a monolithic mass; to him the patent system is "all of a piece" and his attitude tends to be a very generalized one.

Closely related to the differentiation of an attitude is the matter of its degree of *structuredness*. This simply means how well organized and integrated the person's attitude is; how clearly and sharply he sees the object of his attitude. The importance of knowing about the structuredness of attitudes was brought out earlier in this paper where it was pointed out that the less structured an attitude, the easier it is to change it. Highly structured attitudes are hard to change. "The effective propagandist fishes in muddy waters" is an old saying which points up the fact that persuasion is easier when people's views are unclear or "unstructured." Furthermore, structuredness is an important factor in the intensity of an attitude. The more structured the attitude, the more intensely it is likely to be held. And the more intensely an attitude is held, the more likely a person will take action on his attitude.

Another aspect of the object of attitude is its *saliency*, by which is meant the extent to which the object—the patent system—stands out in the everyday concerns of a person. Ordinarily, the more intense and structured the attitude, the greater is its saliency. To a patent attorney, the patent system is obviously extremely salient; to the engineer who is just beginning a career of invention it may have only moderate saliency. Also, for persons who have rather differentiated attitudes toward the patent system, the various differentiated aspects may have different saliencies. To the inventor, the patenting process may have greater saliency; to the manufacturer, the legal implications of patent rights may have greater saliency.

Lastly, there is the *feeling tone* of the attitude object. Broadly stated, this is a matter of whether people feel pleased, displeased, or neutral toward the patent system. But beyond this it is usually necessary to learn more specifically about these feeling qualities. Is a given person's negative feeling tone basically one of simple irritation, or is it based on a feeling of being threatened? Is his neutrality a matter of having no feeling, or is it a matter of having a feeling midway between approval and disapproval?

The questionnaire techniques employed to gain information on the above aspects of attitudes toward the patent system rely heavily upon the use of "open-ended" or "free-response" questions. This puts a premium on interviewer skill and requires the interviewer to do considerable "probing" in order to elicit full replies to the inquiries. This probing must be "non-directive," that is, avoid bias by providing no cues to the interviewee as to what kind of reply is sought. For example, the interviewer explores a certain reply by asking, "Could you tell me more about what you mean by that?" He avoids giving the interviewee definite choices, until, perhaps, the very end when he wishes to check on his own interpretation of the interviewee's answer. Later, when the questionnaire is used on a cross-section of the general population, economy in interviewing will forbid the use of such depth interviewing. But by that time, the earlier work on students and engineers will have largely defined the total universe of replies so that open-end questions and extensive probing can be replaced by multiple-choice questions. The interviewer will know the possible range of replies for any given question since these will have been established in advance in the earlier phases of the study. The interviewer need only present the interviewee with these alternatives with the request that he classify himself in the appropriate response category. The method has its shortcomings and we lose some of the depth in so doing. But from present indications the loss of depth may not be so great as it might appear. Our evidence so far indicates that in the case of the ordinary citizen there is probably not much "depth" to lose. We will have more to say about this when we turn to some of the preliminary findings. But before doing this, it might be well to bring together the discussion to this point and present in outline form the kinds of attitude information we are seeking. This outline is both our theoretical "model" or framework highly condensed for describing an attitude, and at the same time, the skeleton structure of the questionnaire.

1. Characteristics of the attitude object (i.e., the patent system).
   a) Content of the attitude, described in terms of the amount of differentiation and structuredness.
   b) Saliency of attitudes toward the patent system.
   c) Feeling tone toward the patent system.
2. Relation between attitudes and information. The amount and kind of informational support upon which attitudes rest.
3. Channels through which information is obtained.
   a) Formal mass media. Their prestige and content.
   b) Informal "opinion leaders" and other person-to-person sources.
4. Policy stand of the individual with respect to the patent system—the things he is "for" and "against."
5. Action tendencies which attitudes toward the patent system arouse. The kind of behavior the individual takes in response to his attitudes.
6. Relation of the person's attitudes toward the patent system to other, more general attitude orientations which the person holds in other areas of living.

The results obtained so far are of a preliminary nature and lend themselves only to qualitative statements. It should be remembered that these findings are tentative and may be extensively revised when data based on larger samples are finally obtained.

One of the most obvious things we notice among our student (both engineering and non-engineering) interviewees is the rather undifferentiated and unstructured nature of their attitudes toward the patent system. On the whole their attitudes are vague, generalized, and somewhat unorganized. Many of them, however, have differentiated attitudes toward some small facet of the total patent system. In these cases the differentiation is almost always the result of some personalized experience, either of their own or of an acquaintance. "Other people" appear to be a very important source of the information upon which our interviewees' attitudes rest. For many the patent system tends to be seen largely in terms of how it affects people whom they have known.

Furthermore, few of our interviewees have any sharply defined attitudes toward the system *per se;* rather, their attitudes toward the system are "borrowed" or transferred from attitudes which they already hold about other things. A rather common finding is the person who really holds no attitude toward the patent system as such, but when confronted with questions about it, he fabricates them on the spur of the moment, simply by applying to the patent system frames of reference which he has developed for economic, political, and social issues. We find, for instance, the case of a man who has very little pre-established thinking about the patent system, but who is extremely conservative in his economic and political thinking. When faced with assuming a position on the patent system, he merely brings his conservative frame of reference to bear on it. He is quite willing to make judgments about the system, although he really cannot be said to have an attitude toward it. We find that in such cases it is possible to predict what a person will say about the patent system simply from a knowledge of his more general economic, political, and social attitudes. (This is what we meant earlier when it was said that there is very little "depth" to lose in employing less searching attitude study techniques.) The main exception to this finding occurs when the individual has had a personalized exposure to the patent system, usually through the intermediary of an acquaintance. In this case, his attitude toward the patent system is more "tailor-made" and is less dependent on his other attitudes.

The results may be viewed in another way. We can say that when a person does not possess a firm informational foundation, his attitudes toward the patent system tend to be determined by his *identifications*. If the person identifies with the inventor, he views the system in terms of one set of standards; if he identifies with top management, he uses another set of standards for evaluating the patent system. The person's image of the inventor appears to be a particularly interesting determiner of which way a person's identifications go. We have consistently found a rather popular image of the inventor as a helpless, idealistic, impractical dreamer who must be protected and safeguarded so that the products of his ingenuity may profit society. When this image is held, identification frequently goes to the inventor perhaps because of the American cultural habit of siding with the underdog. This in turn predisposes the attitude-holder to note and remember those instances of inventors who were "taken." On the other hand, when the person does not hold this image (as, for instance, when he personally knows an inventor who is the antithesis of the popular image), his exposure and retention of what he reads and hears about the patent system seems to be less biased.

At the present stage of our work, it appears that to a large degree attitudes toward the patent system are being determined by social factors over which there is very little control. This is due to the fact that most people lack a firm informational foundation as a basis for their attitudes. But since attitudes form even in the absence of such a basis, their formation is largely left to social happenstance.

Only an adequate informational foundation can provide the basis for a predictably sound public opinion. And only when an adequate informational foundation replaces the psychological intricacies of social happenstance, can public opinion serve in the betterment and successful operation of the patent system. If our present data are any indication, there is considerable room for improvement on this count, and an enlightened, psychologically sound public information program is clearly called for. It is the future purpose of the Public Attitudes Project to spell out some of the possible directions that such a program might take.

# Incentives to Inventing for National Defense*

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## Summary

THIS PROJECT, conducted under an agreement with the National Inventors Council, seeks to uncover the major incentives and deterrents which affect inventing for national defense. Since the main data collection is still in process, no results can be reported at this time. This article presents the conceptual framework for attacking the research problem, and describes the research plan now being implemented.

### OBJECTIVES

WHAT IS IT THAT CAUSES an inventor to produce an invention which is utilized by national defense agencies? And how can the rate and quality of such inventing be increased? These are the two broad objectives underlying Foundation Project 6b. This investigation is being conducted by the Foundation under an agreement with the National Inventors Council of the Office of Technical Services, Department of Commerce. Because of the quasi-governmental nature of the National Inventors Council, the project was first presented to the Foundation's Advisory Council at its April meeting of last year. The consensus of the Advisory Council's reaction was that the Foundation should undertake the project. The purpose of the project is to discover those factors which, from the viewpoint of the inventor, act as incentives, deterrents, and obstacles to inventing for national defense. It should be stated at the outset, however, that the project is modest in scope and financing, and the results are intended to provide only a limited set of answers.

There are at least three ways in which defense inventing could be increased. First, we could simply increase the number of inventors. On a probability basis this could lead to an increase in defense invention, even though the proportion of defense inventors remained constant. Second, without changing the number of inventors, we could increase the proportion of these who devote themselves to defense inventing. And third, without changing either the number of inventors or the proportion who invent for defense, we could increase the output rate of those inventors who are engaged in defense inventing. Each of these approaches involves a different set of determining factors. The present project is exploring all three, but the emphasis will fall mainly on the second approach, that is, increasing the proportion of existing inventors who invent for national defense. The reason for

* Professor Mosel wrote this research interim report on *Project 6b*, **Attitudes of American Inventors Toward Defense Invention.** Miss Pauline Kartalos is assisting on this project.

this emphasis is twofold. This approach would appear to be the most practical in terms of what actually could be done by the National Inventors Council and other organized groups. Then again, this approach is more susceptible to the rather restricted research methodology which time and money impose upon the project.

### DEFINITION OF "DEFENSE INVENTION"

The answer to our basic question will vary considerably depending upon the definition of "defense invention" we adopt. After considerable discussion with the National Inventors Council and with a number of the Foundation's research consultants, two definitions emerged which could be given operational statement: (1) An invention resulting from the *intention* to produce a defense invention (regardless of whether the invention has been utilized, licensed, or assigned to a national defense agency or its contractors). The man who is inventing with the intention of producing a defense invention is, motivationally, a defense inventor, and whether or not he is successful now (or in the past) in gaining acceptance of his invention is another matter. The point is that we want more of this kind of inventor. (2) An invention which has been assigned to, or used by, or licensed by a defense agency or its contractors (regardless of whether the inventor originally intended it to be a defense invention). This definition seems necessary in order to cover those cases where an invention is produced by an inventor who did not realize his invention's defense implication, but which later was adopted and adjusted to meet some defense need. Here, the inventor is not motivationally a defense inventor, but he is such *de facto*. These two definitions do not apply to the same inventions. But there are, of course, those idéal cases where both definitions apply—where the inventor is both psychologically and *de facto* a defense inventor.

The problem of definition has been met by the decision to study the factors affecting both definitions of "defense invention." Our solution simply says that there are two criteria by which an invention may qualify as a "defense invention" and that in some instances it may check out on both criteria.

### INCENTIVES

There is one other distinction which it is necessary to make before turning to the work of the project. This is the distinction between incentive and non-incentive determinants of defense inventing. A large number of factors are clearly of an incentive or deterrent character; that is, they affect the inventor's motivation to invent and the decisions he makes in marketing his invention. One example would be the kind of inventions the inventor prefers to make. Another would be the kinds of rewards and gratifications he seeks from his inventing, and his beliefs about various government or business organizations as sources for these rewards and gratifications. But there is another class of determinant which does not act directly as an incentive or deterrent but which influences defense inventing by providing a situation that predisposes the inventor to invent in a certain direction. A few hypothetical examples will illustrate this kind of determinant. It is conceivable, for instance, that an inventor living in Pennsylvania would have a much higher probability of producing a defense invention than an inventor living in Nebraska. This could be explained in terms of differences in opportunity to learn of invention needs, ease of finding support and guidance, opportunities for marketing his invention, and the amount of stimulation he receives from other people—to mention just a few factors. Similarly, the chemist who is employed in the cosmetic industry would have a lower probability of defense inventing than a chemist employed in the fuel or explosives industry. In these cases "inventive opportunity" or exposure to facilitating influences serves as a determinant of inventive behavior. Non-incentive determinants such as these are ordinarily very difficult to control, "to do something about." Furthermore, their systematic study requires a research methodology which is beyond the limits of our project. Project 6b is therefore focusing upon incentives and deterrents to defense inventing. It is expected, of course, that we shall learn something of the non-incentive or situational factors, but there will be no systematic study of these.

A study of "incentives" and "deterrents" requires further definition of these terms. As a general principle of human behavior, people do what they perceive is worthwhile to do. Their definitions of what is and what is not worthwhile are learned. People may learn "incorrectly" and they may change their definitions, but at any given moment a person's behavior is principally what he thinks is worthwhile at that moment. "Incentives" are the rewards and gratifications which make certain kinds of behavior worthwhile. Incentives always have two properties: (1) They represent things (or experiences) which people want and seek. When they are attained, the want is reduced (temporarily) and the person experiences "gratification." Thus incentives have a *gratification* property. (2) Incentives also have a *stimulus* property, which is highlighted by the name "incentive" itself. Because of their gratifying property, the anticipation of incentives serves to arouse the want and to impel behavior in the direction of attaining the incentive. An incentive, then, is any thing, experience, or state of being which stimulates behavior and which has the property of bringing gratification when it is attained. A "deterrent" is a "negative incentive"; that is, it is a thing, experience, or state of being of which people want less, instead of more. Deterrents also arouse behavior, but the behavior is directed to avoiding the deterrent rather than attaining it. Gratification results when deterrents are removed, lessened, or avoided.

Incentives and deterrents to defense inventing are revealed in the inventor's likes and dislikes, his goals, his criticisms, his attitudes and beliefs. It is important to stress that incentives and deterrents exist only to the extent to which they are real for the inventor. They may or may not correspond to the objective, factual situation. An inventor, for example, may eschew offering his invention to a defense agency because he believes that he will get more "run-around" than in industry. Whether or not this is true is another question which cannot be examined in our project. The important thing is that if the inventor believes it to be true, he will act accordingly and his actions based upon this belief will be just as "real" as they would be if his belief were true. This consideration points up the need for an additional type of information, namely, how inventors come to *acquire* their perceptions of what is an incentive or a deterrent.

We can now define more specifically the basic questions underlying the project. What are the incentives and deterrents which inventors associate with inventing for national defense agencies (and their contractors)? And what are the incentives and deterrents which they associate with other, competitive channels of invention acceptance? And how do they acquire these associations? Along with information leading to the answers to these questions, the project also solicits from inventors their ideas concerning how present incentives and deterrents might be altered so as to increase inventing for national defense.

## CONCEPTUAL SCHEME

Beyond these preliminary considerations, the first step in the project has been the development of a theoretical "accounting model" designed to identify and interrelate all types of determinants which might affect an inventor's defense-inventing behavior. This model served as a guide for the preparation of the questionnaire and for the subsequent phases of the research. The model was based partly on what is known from other, similar kinds of human behavior, and partly upon data obtained from an exploratory series of interviews with inventors drawn from a list provided by the Patent Office and the National Inventors Council. The purpose of these interviews was to discover the existence of various *types* of determinants, without regard to their specific form. The concern was not with proof but with the identification of variables which might have a bearing upon the problem.

The accounting model is based upon the principle that inventing for national defense is not a single event, but a chronological sequence of events. The model identifies at the outset the main stages in this sequence and specifies the types of determinants which might conceivably occur at each stage. The sequence begins with the existing condition that a man is motivated to invent, and then marks off the various stages which lead to or away from the end-state of having an invention used by, assigned to, or licensed by a defense agency or its contractors. The gross outline of the model is given below, together with some of the kinds of information which are necessary to understand each step in the sequence.

1. The inventor conceives of an invention. He does this either:
   a) With the intention of producing a defense invention.[1] (But the invention may not as yet be adopted by defense.)
   b) Without the intention of producing a defense invention. (In this case, however, his invention could still become adopted by defense at a later date.)[2]

   For each of the above alternatives we seek information on the determining factors, such as: the inventor's personal interests and inventive preferences, his occupational and employment situation, his knowledge (or ignorance) of

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[1] This category provides for defense inventors according to our first definition; that is, one who *intends* to produce a defense invention.

[2] This category provides for inventors falling within the second definition; that is, those whose invention actually becomes adopted by defense, regardless of the inventor's original intention.

defense invention needs, the role of information and influence from other people, etc.

2. The inventor *channels* his invention; that is, he patents and/or takes it to some organization (including one which he himself may establish) for sale, use, assignment, or licensing. There are many sub-steps in this process which are not shown here, but the major channels available are:

   a) He takes the invention to a defense agency (or its contractors); in which case two outcomes are possible:
      (1) The invention is accepted in some way (used, licensed, assigned), or
      (2) The invention is not accepted, in which case he either
         (a) Takes the invention to a non-defense organization, or
         (b) Ceases in his efforts to place the invention.

   b) He takes the invention to a non-defense organization.

3. The inventor experiences, or anticipates, certain consequences from the channel which has accepted his invention. These consequences may be either:
   a) Positive, in which case they are rewards and gratifications that act as incentives, or
   b) Negative, in which case they act as negative incentives or deterrents.

It is important to note that what happens at any given stage may become a determinant in all previous stages. Thus, an inventor's perception of the attractiveness of defense as a channel (stage 2) may be a factor in whether or not he is motivated to conceive of a defense invention (stage 1). And since stage 3 (the consequences of defense and non-defense acceptance) may affect all preceding stages, this stage is an extremely important one.

The above is merely the barest outline of the model. The complete model contains many sub-steps and breakdown categories in which various kinds of determinants are specified. These are too complex to be explained here, but the over-all outline above will suggest how the model was used to generate the questionnaire. The model tells us where to look and what kinds of information to seek, and shows just where each piece of information belongs in conjunction with all other pieces of information. The model will also help in the interpretation of results because it provides a rationale for interrelating the data. As actually constructed, the questionnaire investigates for each inventor the above sequence of events and attempts to uncover the factors which determined the flow of events at each stage.

### TYPOLOGY OF DEFENSE INVENTIONS

Based on the model it is possible to establish a typology of inventions. There are four basic types in the typology:

1. Inventions resulting from the intention to produce a defense invention. All such inventions are called "defense-intended." There are two classes of these:
   a) Inventions which actually did eventuate in a defense invention. (These are called "defense-completed.")

b) Inventions which did not eventuate in a defense invention; that is, they were eventually accepted by a non-defense organization, or they lay unaccepted. (These are called "defense-deterred.")

2. Inventions for which there was no original intention of producing a defense invention. These are called "defense unintended." The same two sub-classes exist as for "defense-intended" inventions.

Note that the fourth class ("defense-unintended and defense-deterred") consists of those inventions which were neither intended as a defense invention nor did they ever become such. The three other classes of inventions all qualify as a "defense invention" according to one (or both) of the definitions established earlier. One of the problems of the research will be to study the patterns of determinants which characterize each of these four classes of inventions.

## INTERVIEW QUESTIONNAIRE

Based upon the accounting model and considerations growing out of it, an experimental interview questionnaire was developed for the purpose of studying systematically, for individual inventors, the role of the various possible determinants suggested by the model. This questionnaire underwent a number of revisions in structure, wording, and content, and when in final form was used as the basis for a series of approximately 50 interviews with inventors drawn from the list provided by the Patent Office and National Inventors Council. The purpose of these interviews was (1) to test the accounting model for completeness and adequacy of its rationale, (2) to test and refine the questionnaire based upon the model and (3) to obtain specific qualitative information which will be used as part of the answer to the question underlying the project. This information is largely "clinical" or "depth" information, which would not be obtainable if the questionnaire were administered by mail. It will serve as a background for interpreting the large-scale quantitative data that will be obtained in the major phase of the research.

The major data-collection phase will be conducted by mailing a modified form of the interview questionnaire to a sample of sufficient size to guarantee about 500 usable returns. The modifications in the interview questionnaire are made only for the purpose of adapting the questionnaire to the self-answering situation imposed by mail contacts. The essential elements of the original questionnaire remain unaltered. The data to be collected will be susceptible to extensive statistical analysis, and will be studied to uncover determinants, their relative significance, their interrelations, and to test certain hypotheses about these determinants which are implied by the accounting model. And all of these factors will in turn be related to background data on inventors, to type of invention, and to the type of recommendations they have for motivating the inventor toward increased defense inventing.

At the present writing the interiew questionnaire is being modified to meet the requirements of mail distribution, and will very shortly be submitted to the main sample of inventors.

# The Research Program of the Patent, Trademark, and Copyright Foundation*

L. JAMES HARRIS, Executive Director

## GENERAL ORGANIZATION

THE FOUNDATION IS AN ORGANIZATION in The George Washington University devoted to factual research and to education in the fields of the patent, trademark, copyright, and related systems. It is an integral part of The George Washington University,[1] subject to the jurisdiction of its Board of Trustees.[2] In addition, it has an Advisory Council[3] of distinguished men from various fields, to advise on policy and on the formulation and carrying out of the work program, a Director and Executive Director who in general elaborate and translate into concrete terms the character of the Foundation[4] as set forth in the Declaration of Trust, and a Research Staff[5] of qualified men from various disciplines.[6] National and Area Committees[7] have been established in the major metropolitan cities of the United States for the purpose of assisting in the Foundation's work and soliciting members.

At the present early stage of development, Foundation projects are primarily concerned with patents—although the Foundation is also studying other methods of protecting industrial and intellectual property, including, of course, trademarks and copyrights. More specifically, it is now seeking to increase the understanding of the nature and value of patents. This has never been done in systematic form, on the basis of factual[8] research under the auspices of a university.[9] A coordinated[10] attack is being made by carefully selected investigators from the various fields of interest.[10a] The Foundation is striving to apply to legal, economic, and sociological problems the principles of scientific inquiry which business itself has been employing for some years.[11] Furthermore, the research is being integrated[12] with the University's educational facilities for instruction and training of students[13] and is being conveyed to the citizenry of the country[14] to provide a factual, comprehensive understanding of the patent and related systems.

To make clearer to the reader the approaches used on the different projects and how they fit into the over-all program, brief reference will be made to the projects now in progress. The Foundation is currently engaged in nine major projects. Although each one of these projects was originally conceived in pilot form as part of an over-all attack on the problems of interest to the Foundation, the design of these studies was based upon the combined judgment of the entire staff. The Foundation was guided by a study of the most promising tools of research available for the problems concerned.

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* An address presented under the auspices of The Patent, Trademark, and Copyright Foundation before the Connecticut Patent Law Association with some changes and the addition of annotations.

FIRST BASIC CATEGORY

The Foundation's work falls into three *basic* categories. The first or general category, employing statistical, economic, and accounting procedures, *inquires broadly into the value and nature of the patent system.* The Foundation has been engaged in two general projects in this category. One, the over-all exploratory study on the "Value of the American Patent System,"[15] conducted by Dr. Jesse Markham and his associates, employing economic and accounting techniques, has been completed. The second general project, the "Patent Utilization" study,[16] employs statistical methods and continues under Dr. Joseph Rossman and Dr. Barkev Sanders.

The "Patent Utilization" study investigates a scientifically selected sample[17] of patents from the universe of patents issued by the Patent Office. By statistical methods, a quantitive examination of what happens to patents is being made. To date the researchers have accumulated some very interesting information as to the use[18] of patented inventions. In fact, they seem to have established that much more use is made of patented inventions than has heretofore been realized and has uncritically been asserted year after year.[19] Naturally, there have been many problems in effectively applying statistical methods to intangibles, but through careful pretesting[20] and ingenuity[21] the techniques of the statistical discipline have been effectively applied.[22]

The project on the "Value of the American Patent System"[23] was undertaken as an exploratory study to check the validity of the approaches in the Foundation's other fact-finding studies by (1) critical assessment of the available literature relevant to the subject; (2) an investigation of the various gross data available in the agencies of government, etc., and (3) interviews with business executives who make decisions on research and patent policies for some of the larger corporations. Through these means it was sought to determine whether data were available to which various economic and accounting methods, concepts, and indexes might be applied in order to establish a gross or partial measure of value. A positive finding might have reduced the burden on factual research.

This project provided a most important check on the validity of certain planning assumptions that had been made. Since these assumptions had to be based on technical judgments, it was important that they be scientifically examined, and corrected if necessary, in the light of the findings. Because the Foundation was sensitive to the urgent need for information in the fields of its interest, the decision was made not to delay the pilot projects for this over-all exploratory study. Thus, the Foundation engaged in modest pilot projects within the over-all plan of investigation conceived when the Foundation was placed in operation, and at the same time undertook to assure, by checking scientifically, that the planning assumptions were valid. Since the assumptions are under constant examination as the investigations proceed and as more and more facts are marshalled, this checking process entailed no additional procedures. This also gives the supporters of the Foundation tangible evidence that the work program is measuring up to expectations of feasibility from the standpoint of expended time.

## SECOND BASIC CATEGORY

The second *basic* category *concerns the attitudes of people in different capacities or roles toward the patent system.* It isolates the patent system as a central idea to which the participants in our economy react. We are engaged in three studies in this category, which involve primarily the motivation and attitudes of individuals, such as the inventor (in the study of the "Attitudes of American Inventors Toward Defense Invention")[24] and of different publics (in the study on the "Public Attitudes Toward the Patent System").[25] A contemplated project on the role of patents in executive decisions[26] also falls in this category.

The "Public Attitude Toward the Patent System,"[27] a psychological study, is investigating the problems of communication with the view of providing guidance in public relations programs. Another reason for undertaking this project is to obtain information on the interaction of public opinion and the operation of the patent system. Viewed as a social institution, the system should operate so that certain needs are satisfied. The character of the patent system thus affects the nature of public opinion and public opinion in turn affects the status of the patent system.

At the request of the National Inventors Council, the Foundation has undertaken the study of the "Attitudes of American Inventors Toward Defense Invention."[28] The Council is planning an accelerated program of positive steps to produce more and better defense inventions. Because of the public interest involved and our accumulating experience in the study of invention, we have undertaken this project.

The principal recommendation made by Dr. Markham and associates based upon the exploratory study on the "Value of the American Patent System," is that studies be initiated, in addition to the projects in which the Foundation is already engaged, to develop information concerning the influence of patent considerations upon research, development, and production decisions.[29] We are presently planning a series of case studies (which would fall in the second category) to implement this recommendation.[30]

## THIRD BASIC CATEGORY

The third *basic* category *concerns the relation of the patent to different aspects of industrial organization and functioning.* That is, we are looking at the patent in context with other economic and social factors in business and industry. In this category is the project on the "Role of Patents in the Creation and Growth of Small Industrial Units."[31] It is focused on the "industry," and employs economic and statistical techniques. The projects on the "Taxation of Patents"[32] and "foreign licensing"[33] are also in this category. Both of these are focused on the "company." Accounting techniques are utilized primarily in the "taxation" study, and economic techniques in "foreign licensing."[34] The study on the "Effects of Certain Antitrust Decrees Involving Patents as a Major Factor,"[35] is an "inter-company approach" in which legal research methods are primarily employed, although economic factors play an important part.

The "Role of Patents in the Creation and Growth of Small Industrial Units"[36] is a multiple industry project. Here the Foundation is completing a trilogy of industry studies—one on steel,[37] one on electronics in the Boston area,[38] and the other on custom heat-treating.[39] This project is concerned with the significance of patents for small business, especially new industrial units competing with established industry. The approach is from the industry inward, stressing the role of the patent in the industrial environment in which a firm operates. This project, along with the project on the "Effects of Certain Antitrust Decrees Involving Patents as a Major Factor," will, we believe, throw needed light upon the part played by the patent in the dynamic balance of the competitive forces in our economy.

Litigation situations[40] are involved in the study of the "Effects of Certain Antitrust Decrees Involving Patents as a Major Factor." It explores the monopoly and antimonopoly aspects of certain antitrust decrees, starting with the patent and the decree and moving outward to determine their effects upon the patricular industry. This study should help develop standards for guiding the collection of factual data from which conclusions may be drawn as to the efficacy of the patent provisions of the decrees.

The Besser Decree[41] and the Vehicular Parking Decree[42] have been studied to date. A report on the former will be included in the next *Journal* and a report on the latter is being prepared. Preliminary examinations are being made of other consent decrees to select the next for study—one involving an industry structure and behavior with complications that test out methodology on a larger scale than the Besser and Vehicular Decrees.

Some of the areas being studied in the project on the "Taxation of Patents"[43] are the relation of taxation to research and development outlays from which patents arise, the effects of the present capital-gains treatment, the extent to which inventors and other owners of patent rights are motivated by tax considerations, and a contrast of foreign tax treatment of income from patents with American practice.

The "licensing study"[44] concerns the foreign area, or more specifically, international business dealings involving patents as a major factor. At present, this project is focused primarily on the relation of American patents, trademarks, and techniques to foreign licensing. The project is also seeking information on the relation of American-owned foreign patents to licensing operations abroad by American business.

## SPECIFIC ILLUSTRATION OF RESEARCH WORK

For a fuller understanding of the nature of the Foundation's research work, the reader is referred to the study of the "Role of the Patent in the Creation and Growth of Small Industrial Units,"[45] the "industry" project under Dr. Irving H. Siegel. The researchers sought to avoid bias in their findings by restriction of the inquiry to industries known in advance to have a strong patent interest; or by restriction to the patent feature in the businessman's thinking and environment. In other words, it was sought to ascertain the role of patents, whether large or small, in context with other factors. The study started with three diverse industries—a mature industry reputed to be "monopoloid" and technologically stable, but recently approaching a new technological frontier (iron and steel);[46] a young industry which has spent all its life on the technological frontier (electronics);[47] and a specialized service industry which has arisen between the producer and the producer's customers (custom heat-treating).[48]

Three other industries that are growing and which appear to have room for "small business" will be investigated in the course of the next year—aluminum fabrication, fabricated plastics products, and scientific and other instruments.[49] In connection with one or more of these industry inquiries, Foundation researchers may have occasion to get in touch with some of the readers of this article. They may mail a questionnaire, they may visit in person, or they may call on the telephone. It is hoped those contacted will find it possible to cooperate either in supplying information, which will be held in the strictest confidence, or technical guidance. The results of Foundation studies do not disclose directly or indirectly the operations of cooperating companies.

To elaborate further on the matter of technical guidance, if you are contacted with reference to the "industry" study it may well be that the researcher will be an economist or statistician. He will have an interest in the fields of the Foundation's research but not always as an engineer or patent attorney. Although he may have an appreciation of the relevance of these disciplines to the subject matter under consideration, he may lack firsthand experience in fields other than his own. Accordingly, your assistance at a critical juncture of the study could help maintain the desired quality of the Foundation's research.

What types of information might the researcher on the "industry" study request? First, he might ask if the patents are owned, or licensed from or to others; second, if these were instrumental in the establishment or growth of the firm in arriving at its present share of the market or in determining its present assortment of products; third, if these patents have been the subject of litigation and the outcome of such litigation; fourth, about the role of "know-how," information derived from customers or suppliers, and information derived from trade and professional literature; fifth, the role of government contracts, especially provisions respecting patent rights; and other relevant questions along similar lines.

If the reader is interested in the first fruits of this type of "industry" inquiry, he is invited to consult the reports and discussions on steel, heat-treating, and electronics in the first issue of the Foundation's *Journal of Research and Education*[50] and the proceedings of the First Public Conference in the *Journal's* 1957 *Conference Supplement.*[51]

## THE FOUNDATION'S SUPPORT AND SCOPE

The Foundation is not endowed. It is dependent upon various types of membership—upon individuals, firms, corporations, and other organizations.[52] Subscribers to the Foundation's publications contribute only a small part of the cost of these publications.

The Foundation is unique in that it attempts to pursue its research program as a cooperative enterprise financed by private funds. It is dedicated to the idea that unbiased knowledge can be developed for the benefit of all on the basis of funds provided principally by those who are prominently identified with our free enterprise system.

The Foundation's program is also unique in its effort to ascertain dispassionately under university auspices the facts about a patent system and related systems that have proved a model for other nations of the world and yet must be continually reexamined better to perform its social and economic functions in an everchanging technological, economic and social environment.

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FOOTNOTES

[1] "There is hereby created and established in The George Washington University . . . a continuing foundation for patent, trademark, and copyright research and education, to be known as The Patent, Trademark and Copyright Foundation . . ." (Declaration of Trust Establishing the Foundation, Art. I).

[2] "Vesting in the Board of Trustees of this University complete discretion to carry out the Foundation objectives set forth in its Declaration of Trust gave the seal of assurance that this work would be carried on, and I quote from the Declaration of Trust, 'without regard to, and independently of, the special interest of any group or body politic, whether political, legal, social, or economic.'

"This is the Foundation's guarantee of inquiry unhindered by partisanship and preconceptions." —S. Chesterfield Oppenheim (*The Patent, Trademark, and Copyright Journal of Research and Education,* I, Conference Supplement, 1957, p. 10).

[3] Members of the Advisory Council, past and present, are:

Willard C. Asbury, Vice President, Esso Research and Engineering Company
Joseph W. Barker, Chairman of the Board, Research Corporation
Vannevar Bush, former President, Carnegie Institution of Washington
*Emanuel Celler, Chairman of the House Judiciary Committee
Cyrus S. Ching, Industrial Relations Consultant
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[4] In order to carry out this function, the Director and Executive Director are responsible for public relations, fund raising, personnel, design and implementation of programs, direction and coordination of administrative and research work, review of project reports and other material submitted for publication, and management of the *Journal*.

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* Ex Officio members of Advisory Council.

† Deceased.

[5] The officers and members of the Research Staff are:

O. S. Colclough, B.S., LL.B., LL.D., Director.

L. James Harris, A.B., LL.B., S.J.D., LL.M., Executive Director.

S. Chesterfield Oppenheim, A.B., A.M., J.D., S.J.D., Adviser on Research; University of Michigan Law School.

P. J. Federico, B.S., A.M., LL.B., Consultant to the Foundation; Examiner in Chief, Board of Appeals, U. S. Patent Office.

John C. Green, B.S., LL.B., Consultant to the Foundation; Director of the Office of Technical Services, Department of Commerce.

Irving H. Siegel, B.S., A.M., Ph.D., Principal Consultant on Projects 3a and 6b; Member of the Staff of U. S. Council of Economic Advisers.

Jerome Jacobson, A.B., Consultant on Project 5a; Economist, Washington, D. C.

J. N. Behrman, B.S., M.S., Ph.D., Principal Investigator on Project 5a; University of Delaware.

George E. Frost, B.S., J.D., Principal Investigator on Project 4a; Patent Attorney, Chicago, Ill.

**John Lindeman, A.B., A.M., former Principal Investigator on Project 5a; Economist, Washington, D. C.

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James N. Mosel, A.B., A.M., Principal Investigator on Projects 6a and 6b; The George Washington University.

Joseph Rossman, B.S., A.M., LL.B., M.P.L., Ph.D., Co-Principal Investigator on Project 1a; Patent Attorney, Philadelphia, Pa.

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Robert M. Weidenhammer, Ph.D., Research Associate on Project 3a; University of Pittsburgh.

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Robert B. Bangs, A.B., A.M., Ph.D., Co-Principal Investigator on Project 7a; Chief, Far East Section, Division of International Finance, Board of Governors of Federal Reserve System.

Joseph P. Driscoll, A.B., LL.B., Co-Principal Investigator on Project 7a, tax specialist, Dallas, Texas.

[6] In keeping with the national character of the Foundation, members of the Research Staff are located in different parts of the country.

[7] The following eminent attorneys are the members of the National and Area Committees:

*Washington, D. C.:* John W. Malley, Esq.—Chairman; Max C. Louis, Esq.; Edgar Jay Brower, Esq.; Richard G. Radue, Esq.; W. Frederick Weigester, Esq.; James P. Burns, Esq.; R. L. Underwood, Esq.

*Boston:* Merwin F. Ashley, Esq.—Chairman; Melvin R. Jenney, Esq.; Yardley C. Chittick, Esq.; Clarence S. Porter, Esq.

*Chicago:* James P. Hume, Esq.—Chairman; John Dienner, Esq.; Carl C. Blatz, Esq.; Robert C. Brown, Jr., Esq.; William T. Woodson, Esq.

*Cleveland:* Albert R. Teare, Esq.—Chairman.

*Detroit:* G. H. Willits, Esq.—Chairman.

*Milwaukee:* Harold S. Silvers, Esq.—Chairman; Ernest W. Schultz, Esq.; Maurice A. Weikart, Esq.; Joseph P. House, Jr.

*New York:* George S. Hastings—Chairman; William J. Barnes; John C. Blair; Wentworth B. Clapham; Floyd H. Crews; John B. Cuningham; Charles H. Erne; Dean S. Edmonds;

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**Currently in Burma as economic consultant.

‡Projects on which these researchers worked are completed.

James M. Heilman; Theodore S. Kenyon; Joseph L. Sharon; Lenore B. Stoughton; Harold Stults; Philip Young.

*Philadelphia:* John D. Myers, Esq.—Chairman.

*Pittsburgh:* Karl B. Lutz, Esq.—Chairman; Horace B. Cooke, Esq.; Donald L. Fowler, Esq.; Frank E. Foote, Esq.; Andrew H. Schmeltz, Esq.

*San Francisco:* Paul D. Flehr, Esq.—Chairman; Carl Hoppe, Esq.; Robert G. Slick, Esq.; Samuel B. Smith, Esq.

*St. Louis:* Alfred W. Petchaft, Esq.—Chairman; Lloyd R. Koenig, Esq.; Frederick M. Woodruff.

The *National Directors* are: Fulton B. Flick, Lawrence C. Kingsland, Harry H. Semmes.

8 "One idea that dominated the initial thinking was the urgent need for substituting factual information for mere opinion evidence. It was recognized that the patent laws and the patent system had been almost invariably approached from the standpoint of their history and a set of basic, a priori premises from which stemmed abstract generalizations and logical deductions. This approach, sometimes characterized as an 'old art of evaluation,' left a wide gulf between theory and fact, between reasoning and actual functioning.

"In this respect, the Foundation was originally conceived as a means of filling this gap in order that assumptions and divergent viewpoints may be tested in the light of empirical data. In this 'new art of evaluation' of the patent system the Foundation found one of its taproots."—S. Chesterfield Oppenheim. *Ibid.*

9 "A second ruling idea was that this enterprise should be under the aegis of a university as a nonprofit research and educational program. This may be rightfully claimed, I hope, as a novel approach. There had been no previous organized and systematic effort in any university for probing into the breadth and depth of the patent system as an institutional organ of our technological, economic and social life."—S. Chesterfield Oppenheim. *Ibid.*

10 "The principal objective of the Foundation is to illuminate the significance of the patent and related rights in the past development, current operation, and future course of the American enterprise system. This interest has naturally led to the engagement on research projects of scholars able to handle economic, accounting, statistical, psychological, and other social science tools. Such interdisciplinary cooperation is beset by various difficulties, but it also affords important opportunities for the advance of knowledge along a common path into new fields." (*The Patent, Trademark, and Copyright Journal of Research and Education,* I, June 1957, p. 5.)

10a *Supra* note 10.

11 "In a broad sense, The Patent, Trademark, and Copyright Foundation represents an experiment in interdisciplinary, or perhaps better, multidisciplinary research. It is an experiment in the reintegration of specialized information, in the re-establishment of the community of knowledge. An interdisciplinary approach would always seem to be pertinent to the study of phenomena that have wide cultural implications, regardless of the particular contexts in which these phenomena may arise. Such an approach seems implicit in the concept of a university. In any case, the need for a coordinated attack on problems of knowledge is becoming more generally appreciated, as is evidenced by the founding of new journals that cut across the boundaries of conventionally recognized subjects, by the reorganization of university courses and departments, by the development of 'operations research,' 'team research' and similar group activities at the schools and in industry." (*Id.* at 4.)

12 "A third predominating idea was that a university offered an ideal meeting ground for integrating the disciplines of the physical and social sciences that impinge upon the Foundation's fields of study. It was contemplated that the facilities of the university would provide the channels of research and education in curriculum, instruction and training from which would flow a broadened knowledge and understanding of the industrial and intellectual creations of the systems encompassed by the Foundation's explorations."—S. Chesterfield Oppenheim. (PTCJRE, I, Conf. Supp., 1957, p. 10.)

13 "A limited number of Student Research Assistantships, a means of training students in original research, are available to candidates for degrees at The George Washington University and to graduate students at other universities in cases where the field of specialization of the student is pertinent to the research program of the Foundation. Each Research Assistant receives an appropriate remuneration and follows an approved program of research under the direction of a member of the Foundation's Research Staff. In appropriate cases, academic credit is given for satisfactory completion of the program.

"Another means adopted for achieving the Foundation's objective to promote education and training is a patent, trademark, and copyright seminar which has recently been established jointly with the faculty of The George Washington University Law School on the current developments in the fields of the Foundation's work. This seminar and lecture series is particularly helpful to students who plan to become patent specialists, to teachers of the law, to law students who plan a career in the social and physical sciences, and other qualified and interested professional persons. . . . Students are introduced to the patent, trademark, and copyright systems as functioning legal, social, and economic institutions. One of the primary objectives in this type of teaching is to achieve the advancement of the students with the progress of research. The inclusion of the interdisciplinary aspects of research provides the students with a more comprehensive understanding of the systems to the end that they will be better able to make informed contributions to these systems. Scholars in the various disciplines involved in the work of the Foundation participate in the series." (PTCJRE, I, June 1957, pp. 15-16.)

[14] The Foundation ". . . is performing this task not only in educational programs of individual instruction and lectures, but also by making available pamphlets, annual bulletins, and *The Patent, Trademark, and Copyright Journal of Research and Education* to the general public. Progress reports and newsletters on the work of the Foundation are distributed periodically to the members and donors." (PTCJRE, I, Conf. Supp., 1957, p. vii.)

[15] PTCJRE, I, June 1957, pp. 20-56; Conf. Supp., 1957, pp. 108-127.

[16] PTCJRE, I, June 1957, pp. 74-111, Conf. Supp., 1957, p. 66-83; and see p. 300 *infra*.

[17] "A 2 per cent sample from all the patents issued in 1938, 1948, and 1952 was selected for this pilot study. Ideally the sample would have included some patents from each of the 17 years covering the term of a patent. The three years were selected because it was felt more could be learned from a study where the sample represents the two extremes and roughly the mid-point of the 17-year period. The sample is what in statistics is regarded as a probability sample; that is, initially every patent in these three years had a known probability (in this case the same probability) of being included in the sample. The method used in selecting the sample was systematic sampling, using the patent numbers as the basis for sampling." (PTCJRE, I, June 1957, p. 77.)

[18] Commercial exploitation (used commercially): Making or selling the patented invention, or using the patented invention in the production of goods or services, or making financial arrangement(s) with a third party(s) for the production, use, or sale of the patented invention. "Use (used) in production: making or selling the patented invention, or using the patented invention in the production of goods or services." (*Id.* at 108.)

[19] "People have guessed from one or 2 per cent on up to 50 per cent. Five per cent is a common figure. Ten per cent is a common figure. Some say 20 per cent. Some try to work out a reason for their guess, to make it look like more than a guess, and some don't. But the results aren't any more reliable in one case than in the other."—P. J. Federico. (PTCJRE, I, Conf. Supp., 1957, p. 76.)

[20] "The first phase of the study consisted of initial interviews conducted with inventors and assignees in greater Washington, D. C.; Maryland; Delaware; and greater Philadelphia. All the inventors who could be contacted cooperated in the study. However, these interviews with inventors and assignees are, at best, suggestive since there were only 40 patents involved in this phase, of which 26 were assigned. There were 45 inventors involved.

"The second phase, the pre-pilot sub-sample, consisted of a sub-sample of 10 per cent, taken randomly from the 2 per cent sample; limited, of course, to inventors who had not already been interviewed. The purpose of the pre-pilot phase was to test the mail questionnaires and the mailing procedures before launching the larger study involving some 1,850 patents and more than 2,000 inventors. This 10 per cent sub-sample represented 178 patented inventions and 211 individual inventors. . . ." (PTCJRE, I, June 1957, p. 100.)

[21] See the questionnaires for inventors and assignees and the instructions for filling them out which are reproduced in the PTCJRE, I, June 1957, pp. 102-111. "The addresses used for mailing questionnaires to inventors were the latest available in the Patent Office files of patents granted. In the pre-pilot phase of this study about 41 per cent of the initial mailings were returned by the Post Office because the address obtained was not current. For many of these inventors current addresses were obtained eventually by writing to assignees, if the patent was assigned, and/or to attorneys. Where these means proved unproductive, we resorted to others, such as writing to co-inventors and searching various directories. The same procedures are being followed in subsequent phases of mailing of questionnaires to inventors. Various standard manufacturers' indexes and registers have been used in securing current addresses of assignees. Few difficulties have been encountered, except in cases where the assignee is an individual." (*Id.* at 101.)

[22] "In summary, I just want to say that it's a pleasure and not a very common pleasure to

examine a study plan in which such careful thought to the problems of design and execution has been so obviously given."—W. Duane Evans (PTCJRE, Conf. Supp., 1957, p. 79).

[23] *Supra* note 15.

[24] PTCJRE, I, June 1957, pp. 168-173; Conf. Supp., 1957, pp. 132-134; and pp. 185-215 *infra*.

[25] PTCJRE, I, June 1957, pp. 159-167; Conf. Supp., 1957, pp. 130-132; and p. 243 *infra*.

[26] See PTCJRE, I, June 1957, p. 23 and Conf. Supp., 1957, p. 112; and p. 265 *infra*.

[27] *Supra* note 25.

[28] *Supra* note 24.

[29] *Supra* note 26.

[30] See p. 265 *infra*.

[31] PTCJRE, I, June 1957, pp. 57-73, 112-118, 119-126; Conf. Supp., 1957, pp. 44-65, 84-98, 134-136; and pp. 216-217 *infra*.

[32] PTCJRE, I, June 1957, p. 14; Conf. Supp., 1957, pp. 137-139; and pp. 244-264 *infra*.

[33] "Relation of American-Held Patents, Trademarks, and Techniques and American-Owned Foreign Patents to Foreign Licensing," PTCJRE, I, June 1957, pp. 145-158; Conf. Supp., 1957, pp. 128-129; and pp. 220-243 *infra*.

[34] *Supra* note 33.

[35] PTCJRE, I, June 1957, pp. 127-144; Conf. Supp., 1957, pp. 17-43; and see p. 300 *infra*.

[36] *Supra* note 31.

[37] PTCJRE, I, June 1957, pp. 112-118; Conf. Supp., 1957, pp. 44-65; and pp. 216-217 *infra*.

[38] PTCJRE, I, June 1957, pp. 119-126; Conf. Supp., 1957, pp. 134-136; and pp. 218-219 *infra*.

[39] PTCJRE, I, June 1957, pp. 57-73; Conf. Supp., 1957, pp. 84-98.

[40] Andrus v. H. W. Bell Co., Civil Action 7-314 (S.D.N.Y. 1942). United States v. Besser Mfg. Co., 96 F. Supp. 304 (E.D. Mich. 1951), *aff'd* sub nom. Besser Mfg. Co. v. United States, 343 U.S. 444 (1952). Whitman v. Andrus, 93 F. Supp. 383 (E.D. Mich. 1950), 194 F. 2d 270 (6th Cir. 1952), *cert. denied* 344 U.S. 817 (1952). See also United States v. Vehicular Parking Ltd., 54 F. Supp. 828 (D. Del. 1944). Magee-Hale Park-O-Meter Co. v. Vehicular Parking, Ltd., 180 F. 2d 897 (3rd Cir. 1950).

[41] United States v. Besser Manufacturing Co., 96 F. Supp. 304 (E.D. Mich. 1951), *aff'd* 343 U.S. 444 (1952).

[42] United States v. Vehicular Parking, Ltd., 52 F. Supp. 749 (D.C. Del. 1943), 54 F. Supp. 828 (D.C. Del. 1944), 56 F. Supp. 297 (D.C. Del. 1944), 61 F. Supp. 656 (D.C. Del. 1947), 7 F.R.D. 336 (D.C. Del. 1947); 74 F. Supp. 4 (D.C. Del. 1947).

[43] *Supra* note 32.

[44] *Supra* note 33.

[45] *Supra* note 31.

[46] *Supra* note 37.

[47] *Supra* note 38.

[48] *Supra* note 39.

[49] See pp. 216-217 *infra*.

[50] *Supra* note 14.

[51] *Supra* note 14.

[52] There are four classes of membership, namely, Life Members, contributing in any one year $10,000 or more; Sustaining Members, contributing from $500 to less than $10,000; Participating Members, contributing from $100 to less than $500; and Members, contributing from $15 to less than $100. All memberships other than Life are for a period of one year.

# Incentives and Deterrents to Inventing for National Defense*†

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SUMMARY

TO ASSIST THE NATIONAL INVENTORS COUNCIL in its efforts to increase the flow of defense inventions, this study attempts to identify some of the major deterrents and incentives which affect the production and submission of inventions to defense agencies. The results indicate that:

The major deterrent to an inventor *conceiving* a defense invention comes from his ignorance of defense needs and problems. The major deterrents to his *developing* an invention with defense possibilities are his belief that the financial rewards are smaller than they are in non-defense, and his unfavorable expectations concerning the procedures, organization, and personnel that defense negotiations entail. The major deterrents to *submitting* his invention to defense are his ignorance of how to proceed and whom to contact, and, again, his unfavorable expectations concerning defense procedures, organization and personnel.

## INTRODUCTION

THE NATIONAL INVENTORS COUNCIL assigned to the Foundation the project of studying the reasons for the lag in the number of unsolicited defense ideas being presented to the Council or to defense agencies by competent inventors. The project's aim was the analysis of the incentives and deterrents which affect the inventor while he is making inventions having a possible defense use. In addition, it hoped to uncover how inventors get defense ideas, where they try to market them, and what attitudes they hold toward the agencies which evaluate inventions. This report describes the findings based on 500 mail questionnaires, and maps out broadly the general direction in which the Council may look for solutions.

* Professor Mosel wrote this research report on *Project 6b,* **Attitudes of American Inventors Toward Defense Invention.** Miss Pauline Kartalos is assisting on this project.

The reader is referred to Mr. Green's article on pp. 266-269 in this issue of the *Journal.* He surfaces some of the problems of the National Inventors Council with respect to inventions for defense.

† Arrangements are being explored to permit further analysis of the rich material gathered in this project.

## PROCEDURE

The first step in the investigation was to arrive at a more specific statement of the problem. Part of this task involved the development of a definition of "defense invention." From these considerations, a hypothetical "accounting model" or conceptual scheme was developed, designed to indicate in a general way the main kinds of factors affecting defense invention. These background considerations, together with the conceptual scheme or "accounting model" underlying this study, have been discussed in the article "Incentives to Inventing for National Defense" (*The Patent, Trademark, and Copyright Journal of Research and Education,* Vol. 1, No. 1, pp. 169-173). This article should be read for a fuller understanding of the results which follow.

Based upon the accounting model, a very broad interview guide was used as the basis for a number of intensive, non-directive, exploratory interviews with inventors. These exploratory interviews uncovered the specific variables which were needed to fill out the accounting model.

At this point, we knew what specific *kinds* of determinants to look for. The remainder of the investigation, that is, the sampling with mail questionnaires, served to reveal the relative frequency of these determinants, their specific form, and the ways in which they affected defense invention.

From this preliminary work a trial questionnaire was constructed and tested on a sample of 50 inventors. From this test, the final form of the mail questionnaire was developed. A list of 503 competent inventors had been received from the National Inventors Council, with an additional 543 names from the Patent Office. Because the final survey was to be based on at least 500 replies, it was necessary to increase the total number of names to get the necessary number of returns. An additional 1,320 names were selected from *Who's Who in Engineering* (1954 edition) of those who had been awarded patents. On July 3, 1957, a total of 2,366 questionnaires was mailed, and within three weeks the necessary 500 returns were available. Since then over 161 additional questionnaires arrived which could not be included at that time in the analysis. It is hoped that these may be analyzed later if NIC should consider them of interest.

Of the 500 who completed a questionnaire for this report (21% of the total mailing), 58 per cent were from the *Who's Who* list, 19 per cent from the NIC list and 23 per cent from the Patent Office list. But within each group, 29 per cent of the *Who's Who* group replied, 25 per cent of the NIC and 28 per cent of the Patent Office lists. The total per cent of replies to date from the total mailing of 2,366 is 28 per cent.

## AN OVERVIEW OF THE RESEARCH PROBLEM

A basic premise of the conceptual scheme which underlies this study is that the act of producing a defense invention consists of three broad stages:

1. Conceiving and developing a defense-invention idea.
2. Bringing the invention to the attention of a defense agency (or its contractors).

3. Finalizing negotiations so that the invention becomes assigned to, used by, or licensed by a defense agency (or its contractors).

Production of a defense invention may "go wrong" at any one of these three stages. Thus, in order to understand the deterrents and incentives affecting defense invention, we must seek the answers to the following questions:

1. What are the factors which affect an inventor in conceiving and developing an invention which he thinks may have defense value?

2. What are the factors which affect whether or not he brings his invention to a defense agency (or its contractors)?

3. What are the factors which affect the finalizing of the inventor's negotiations with a defense agency (or its contractors)?

These three stages, then, represent possible "attrition points" at which an invention may be halted in its movement toward defense-invention status. This investigation has attempted to determine, as far as our sample is concerned, the relative attrition of defense inventions at each stage and to uncover the factors responsible for this attrition. The answers to these questions will, in a broad sense, show where remedial action would best be directed and what conditions must be changed by this remedial action.

## ANALYSIS OF ATTRITION IN DEFENSE INVENTION

In line with the three stages discussed above, an analysis was made of the attrition of defense invention at each stage. The flow of inventions and accompanying attrition is shown below:

*Stage 1.* Of 500 inventors in our sample, 63 per cent had conceived an invention which *to them* appeared to have defense possibilities.

*Stage 2.* Of the above 63 per cent (or 315) inventors, 38 per cent (or 119) did *not* bring the "defense invention" to the attention of a defense agency (or its contractors).

*Stage 3.* Of the 223 inventors who *did* bring the invention to the attention of defense, 37 per cent (or 82) inventors had the experience of having their invention rejected *by defense.* 18 per cent (or 40) of the inventors decided *themselves* to discontinue negotiations with defense. 60 per cent (or 136) finalized negotiations with defense so that the invention was ultimately used by, assigned to, or licensed by a defense agency (or its contractors). *Note:* These last three percentages do not total to 100 because some inventors had all three types of experiences, with different inventions.

It will be seen from the above that the attrition between producing an invention and taking it to defense is almost the same as that between taking an invention to defense and having it rejected by defense. In other words, about the same proportion of inventors fail to submit inventions to defense as are turned down by defense.

While the proportions are about the same, the absolute numbers are not. In our sample, there were 119 instances of not bringing an invention to the attention of defense, while there were 82 instances where defense made a turn-down. It should also be noted that there were 40 instances (18%) where the inventor himself terminated negotiations with defense. Thus the total attrition is actually greater *after* an invention has been brought to the attention of defense than it is in bringing it to the attention of defense. It is assumed, however, that the 37 per cent attrition due to defense turn-downs is legitimate and must therefore be accepted as a justifiable loss reflecting non-applicability to defense needs. After an invention has been submitted to defense, the major target for remedial action lies in the 18 per cent where inventors themselves discontinued negotiations.

Seen in this light, the major attrition points which are worthy of remedial action are the *first* and *second stages.* The major attrition point appears to be at the second stage—failure to bring an invention (which the inventor thinks has defense possibilities) to the attention of defense. It appears that once an invention is brought to the attention of defense, the changes are favorable for its acceptance. The second major attrition point is *stage one*—conceiving an invention with defense possibilities. Thirty-seven per cent of our total sample have never conceived such an invention. The 18 per cent of instances where inventors themselves withdrew from defense negotiations represents a remote third attrition point.

From the above it is clear that the major remedial effort should be directed at (1) helping existing inventors to conceive defense inventions, and then, (2) getting them to bring their inventions to the attention of defense. Consequently, the major emphasis in the results that follow will center around the factors responsible for success and failure at these two points.

## CONCEIVING A DEFENSE INVENTION

Of the sample of 500 inventors, 63 per cent reported that they had at one time or other produced an invention (patented or unpatented) which seemed to them to have possible defense use (regardless of whether it was eventually used by, licensed by or assigned to a defense agency or its contractors). Thus about two-thirds have produced a "defense invention" within the meaning of the first definition of "defense invention" described in the previously cited *Journal* article; namely, an invention resulting from the intention or recognition of producing a defense invention. It would appear that the frequency of conceiving defense ideas is rather high.

### *Realization of Defense Possibilities*

The next question is how inventors first realize the defense possibilities of an invention. Table 1 gives us the broad outlines of the answer. It will be seen that the great majority (71%) of those who have produced a "defense invention" (in the sense of the above paragraph) *realized the defense possibility from the start* because it was suggested by the nature of the invention itself. The next most frequent pattern (43%) was for an inventor to be assigned to work on a problem which was clearly a defense problem; in this case the realization was a natural consequence of the nature of the *problem* rather than of the inventive idea. The third most frequent pattern (26%) was for the realization to come *during* the development of the invention. The remaining three patterns in Table 1 are all characterized by the realization coming *after* the invention's completion. It will be seen that these patterns of experience are rather infrequent.

TABLE 1

HOW INVENTORS FIRST REALIZE THE DEFENSE POSSIBILITIES OF AN INVENTION

| Pattern of Realization | Per Cent of Inventors* |
|---|---|
| My realization of possible defense use was apparent from the start because it was suggested by the nature of the invention itself. | 71 |
| I was assigned to work on a problem which was clearly a defense problem. | 43 |
| My realization of possible defense use came during the development of the invention. | 26 |
| My realization of possible defense use came after the invention was completed. | 12 |
| My realization of possible defense use came after the invention was completed but before patenting. | 10 |
| My realization of possible defense use came after patenting. | 8 |

* Per cents are based on 344 inventors who reported having produced an "invention (patented or unpatented) which seemed to have possible defense use, regardless of whether it has ever actually been used by or licensed by or assigned to a defense agency (or its contractors)."
Per cents do not total to 100 because many inventors had more than one pattern of realization (with different inventions). The total number of responses was 584.

The above results suggest that the defense possibilities of an invention occur to the inventor most typically as an inherent part of his original idea, or as part of the problem he attempts to solve. The defense possibilities of an invention do not tend to be something which is "worked into" an invention after it has been developed. Typically the inventor tends to see the defense possibilities early in the task—or not at all.

It seems reasonable to conclude that realization of defense possibilities exists only when there is initial awareness of defense needs, problems, and operations. Consideration might well be given to means for increasing this initial awareness.

### *Effect of Military Service*

Military service appears to be a factor in getting ideas for defense inventions. One-third (33%) of our sample reported military service, principally in the Army (with Navy in a remote second place). Of those answering the question, 41 per cent claimed that while in the service they got specific ideas for defense inventions. Military experience appears to make an appreciable contribution to increasing inventors' awareness of defense needs and problems. These results suggest that efforts to stimulate defense invention might most profitably be directed to inventors with military experience and to those currently in military service.

### *Inventors' Future Expectations*

The majority of inventors are fairly optimistic about the likelihood of their producing a future invention having defense possibilities; 62 per cent say that it is at least somewhat probable that they will do so. Table 2 shows the breakdown of their expectations.

Given these self-expectations, inventors were queried as to whether there were any factors which might increase the likelihood of their producing an invention

TABLE 2

INVENTORS' ESTIMATES AS TO LIKELIHOOD OF PRODUCING A FUTURE INVENTION WITH DEFENSE POSSIBILITIES (N=500)

| Self-Estimate | Per Cent |
|---|---|
| Highly probable | 34 |
| Somewhat probable | 28 |
| Possible but not probable | 30 |
| No likelihood at all | 3 |
| (No reply) | 5 |
| | 100 |

having defense possibilities. Here again, inventors appear optimistic. Only 14 per cent of our sample said that there was *nothing* which could increase this likelihood. For those who believed that this likelihood could be increased, Table 3 shows the various factors which were cited as being able to bring about the increase.

TABLE 3

FACTORS WHICH INVENTORS FELT COULD INCREASE THE LIKELIHOOD OF THEIR PRODUCING A DEFENSE INVENTION IN THE FUTURE

| Factor | Per Cent* |
|---|---|
| Financial rewards and greater incentives | 24 |
| Knowledge of what is needed by defense | 15 |
| Change of job; into defense field | 14 |
| More time to work on ideas | 9 |
| More money for more research sponsored by defense agency | 7 |
| Contact with defense man who is interested and has authority | 7 |
| War emergency | 6 |
| Other† | 30 |
| Don't know | 3 |
| (Unusable replies) | 1 |

* Per cents are based on 306 inventors who felt that the likelihood could be increased. Per cents do not total 100 because some inventors mentioned more than one factor.

† The category "other" contains a large miscellany, too heterogeneous to be classifiable.

The most frequently cited factor was financial rewards (24%). This seems to suggest that even when awareness of needs exists, lack of financial return acts with appreciable frequency to deter the pursuit of an idea. It should be noted, however, that this acts only as a deterrent to *developing* an idea, not to *conceiving* of an idea. Lack of awareness of defense needs appears to be the primary deterrent to *conceiving* an idea.

The second most frequently mentioned factor was *awareness of defense needs* (15%). This factor demonstrates the impracticality of attempts to increase defense invention simply by "encouraging" and "motivating" inventors to invent for national defense. Our data suggest that such attempts must fail unless the inventor is first aware of defense needs and problems. He cannot rely on his own everyday experience as a source of such awareness because defense problems are highly particularistic and "unguessable-at." Hence the inventor must develop the required awareness through other channels. At present there seems to be no systematic, institutionalized mechanism for educating the inventor as to defense needs. The results of our preliminary depth interviews with inventors (done prior to the mail questionnaire survey) showed that with inventors not employed in defense, the awareness of specific defense needs and problems arose out of haphazard and almost accidental circumstances. The problem of how to develop awareness of defense needs among inventors deserves serious attention.

The third most frequently mentioned factor was "change of job into defense field" (14%), which was mentioned almost as often as "awareness of defense needs" (15%). This finding speaks for itself. It probably reflects inventors' realization that such a change would bring with it increased awareness of defense needs, encouragement, facilities, and assignment to defense problems.

### *Satisfactions Sought from Inventions*

In order to gain some idea of the motivations behind defense inventing, we inquired into the satisfactions which inventors seek from inventing in general. They were asked, "What is the most important thing you want in return for an invention of yours?" The replies are shown in Table 4. *Financial returns (for self or employer)* tops the list (40%). This is by far the most frequently mentioned reward; all others are mentioned with decidedly smaller frequencies. The only other rewards sought with any degree of frequency are *recognition by employer (including job advancement)* with 16 per cent, and *wide use of invention* with 14 per cent.

TABLE 4

REWARDS SOUGHT IN RETURN FOR INVENTION (N=500)

| Reward | Per Cent |
|---|---|
| Money; financial benefits for self or employer | 40 |
| Recognition by employer; job advancement | 16 |
| Wide use of invention | 14 |
| Satisfaction of accomplishment; "psychic income" | 9 |
| Benefits to country and society | 7 |
| Patent rights (protection, control, etc.) | 2 |
| More work (given more chance to invent) | 1 |
| Other | 5 |
| (Unusable replies) | 6 |
| | 100 |

These rewards must not be equated completely with the motivations which prompt inventors to invent. Although such rewards are undoubtedly a component in their motivations, there are assuredly other factors which inventors themselves are incapable of recognizing and which are not sufficiently conscious to be detected by the methods used in the present investigation. The preliminary depth interviews when examined qualitatively suggest that one such unconscious factor is that many inventors invent because they have a psychological need to do so—the satisfaction comes from the inventing process itself, not just from any rewarding consequences. This need may or may not lead to tangible rewards and satisfaction, but it still exists. It does not seem likely, then, that provision of greater financial returns alone would increase the number of people inventing. Nevertheless, financial rewards offered by defense may serve as incentives, the anticipation of which would strengthen the "need to invent" when it already exists and guide it into defense channels. Another consideration in the interpretation of "money" as the most frequently mentioned goal will be brought out in the paragraph which immediately follows.

With the above finding in mind, we asked inventors how well their patents have paid off financially. The replies are displayed in Table 5.

TABLE 5

HOW PATENTS HAVE PAID OFF

| | Per Cent |
|---|---|
| Very adequately | 31 |
| Fairly adequately | 20 |
| Not very adequately | 11 |
| Hardly at all | 5 |
| Not at all | 8 |
| I have lost money on them | 6 |
| (Unusable replies) | 19 |
| | 100 |

We see that 51 per cent report that patents have paid off at least fairly adequately, while 30 per cent indicate that financial returns have fallen short of expectations. It would appear, then, that satisfaction with financial returns is modest. This fact helps explain why 40 per cent of the inventors claimed that financial returns was the thing they wanted most from their inventions. The explanatory principle involved here is that in such surveys as this, people tend to report as "wanted most" that thing with which they are least satisfied. Consequently money is claimed as "wanted most," partially because financial returns have on the whole been disappointing—not because money is the goal which initially motivates invention. So again, we are brought back to the position that increased financial rewards in defense invention might turn more existing inventors to defense invention, but it probably would not create motivation to invent (at all) if none existed to begin with.

## *Defense As a Source of Satisfactions*

The conceptual scheme underlying our investigation postulated that inventors' *expectations* concerning the ability of defense agencies to yield satisfactions would be a determinant of defense inventing. Consequently, as a follow-up to the above inquiry into what inventors wanted most in return for their inventions, we asked whether they felt they were most likely to obtain the factor "wanted most" from defense agencies or from industry. Table 6 gives the results.

TABLE 6

INVENTORS' EXPECTATIONS AS TO OBTAINING FACTOR "WANTED MOST" FROM DEFENSE OR INDUSTRY (N=500)

| MENTIONED AS MOST LIKELY TO YIELD FACTOR "WANTED MOST" | PER CENT |
|---|---|
| Defense agencies | 7 |
| Industry | 54 |
| Equally from both | 13 |
| Not certain | 21 |
| (Unusable replies) | 5 |
| | 100 |

These figures show a strong plurality (54%) favor "industry" as the most likely source of the satisfactions which inventors want in return for their inventions. "Defense agencies," in fact, have the least frequency of mention (only 7%). It is important to note that after "industry," the most frequent category of reply is "not certain" (21%), which indicates a possibly favorable circumstance, namely, that there is a sizable number of inventors who are still open-minded and thus subject to persuasion in favor of defense. It is also interesting to note that 13 per cent believe that both defense and industry are equally good as sources of satisfactions. This group, at least, is not unfavorably disposed toward defense. On the whole, however, it is clear that over half do not perceive defense as a satisfying place to take an invention.

In an effort to pinpoint more closely inventors' expectations of defense and industry relative to providing satisfactions, we asked for their preferences with respect to a series of more specific issues. Tables 7 to 10 show the results. In each of these tables the question asked is used as the label for the table.

TABLE 7

"If you had an invention which had equal utility to both industry and defense agencies, which, in general, would you *prefer to work with?*" (N=500)

| | PER CENT |
|---|---|
| Industry | 61 |
| Defense agency | 10 |
| No preference | 19 |
| Not certain | 9 |
| (Unusable replies) | 1 |
| | 100 |

Industry is clearly preferred (61%), while "no preference" contains the next largest percentage.

TABLE 8

"In general, which do you think is *easier to work with* in *developing* an invention?" (N=500)

| | Per Cent |
|---|---|
| Industry | 58 |
| Defense | 9 |
| Both are equally easy | 7 |
| Not certain | 24 |
| (Unusable replies) | 2 |
| | 100 |

Again, industry is preferred; the percentage of "no preference" inventors has decreased, while the percentage of "not certain" has almost tripled. In other words, uncertainty is greater, but among those who are certain, preference is more sharply divided than in Table 6.

TABLE 9

"Which do you think is financially more rewarding?" (N=500)

| | Per Cent |
|---|---|
| Industry | 68 |
| Defense | 3 |
| No difference between the two | 5 |
| Not certain | 21 |
| (Unusable replies) | 3 |
| | 100 |

Again, industry is preferred, while defense drops to its lowest value (3%) in this set of four tables. Uncertainty remains high, while the "no preference" group continues to be very small. In general there is considerable uncertainty, but among those who are certain, opinion strongly favors industry.

TABLE 10

"Which do you think gives the most over-all satisfaction in the long run?" (N=500)

| | Per Cent |
|---|---|
| Industry | 46 |
| Defense | 11 |
| Both are equal | 17 |
| Not certain | 24 |
| (Unusable replies) | 2 |
| | 100 |

These results give a picture of expectations for *over-all satisfaction.* As before, industry has the plurality, but the figure is not a majority as it was in the above three tables. Uncertainty remains high, while the number favoring defense and giving "both are equal" replies is somewhat higher.

In general, then, the above tables show that inventors prefer to work with industry, and are especially critical of defense with regard to developing an invention and financial rewards.

*Deterrents to Producing Defense Inventions*

We have seen that inventors prefer industry over defense. In an effort to uncover specific obstacles which deter the production of defense invention, inventors were asked "Has there been any special circumstance or event which has already deterred *you* or *your firm* from inventing for defense agencies?" Thirty per cent reported that there were such special circumstances or events, while 59 per cent said "no," and 9 per cent were not sure (the remaining 2% gave unusable replies). A tabulation of the factors mentioned by those saying "yes" was made; it is presented in Table 11.

TABLE 11

DETERRENTS TO SELF AND FIRM IN INVENTING FOR DEFENSE AGENCIES (N=152)

| Deterrent | Per Cent |
|---|---|
| Lack of interest on the part of government agency | 14 |
| Too many security restrictions | 10 |
| Lack of time to do research | 7 |
| Loss of right to inventions via patent waiver | 6 |
| Lack of funds to do research | 5 |
| No profit in defense research | 4 |
| Lack of knowledge of defense problems | 3 |
| Inadequate facilities to do research | 2 |
| Lack of technical personnel | 2 |
| Other* | 47 |
| | 100 |

* The category "other" contains a diverse miscellany, too heterogeneous and specific to be classified.

The most frequently mentioned deterrent is "Lack of interest on the part of the government agency" (14%). "Security restrictions" (10%) and "Lack of time to do research" (7%) are next in frequency. The great spread of factors mentioned, and the very large category of unclassifiable "other" indicates that on the whole, inventors are by no means in agreement concerning the obstacles which deter them. It would seem, however, that the three most frequent deterrents exist for an appreciable number of inventors, and, to some degree, are open to remedial action.

In an effort to gain more detail on deterrents, we asked a "projective question" wherein the inventor is required to characterize *other* people's behavior. This was done to stimulate the expression of negative experiences which might not otherwise be communicated. Thus we asked: "Do you know of any special circumstance or event which has prevented or deterred *other* inventors or firms from inventing for defense agencies?" Nineteen per cent said "yes" to this question, while 57 per cent said "no," and 20 per cent were not sure (the remaining 4% gave unusable replies). As one might expect, inventors are more familiar with their own deterrents than they are with other people's. A tabulation of the deterrents mentioned by those who said "yes" is presented in Table 12.

It will be seen in Table 12 that "Too much red tape" and "Poor financial reward" head the list with 16 per cent and 11 per cent, respectively. "Fear of government taking away invention rights" runs in third place with 10 per cent. This latter

TABLE 12

DETERRENTS TO OTHER INVENTORS AND FIRMS IN INVENTING FOR DEFENSE AGENCIES (N=97)

| Deterrent | Per Cent |
|---|---|
| Too much red tape | 16 |
| Poor financial reward | 11 |
| Fear of government taking away invention rights | 10 |
| Security restrictions | 8 |
| Lack of money for development | 7 |
| Can't put the time and effort into defense | 7 |
| Create item only to lose contract to other bidder | 5 |
| National Inventors Council is uninterested | 2 |
| Poor information on defense needs | 1 |
| Other* | 33 |
| | 100 |

* The category "other" contains a diverse miscellany, too heterogeneous and specific to be classified.

factor is possibly a "projection" into other people of a fear which inventors themselves feel but are not prone to admit about themselves; consequently, they tend to "see" it in other people rather than in themselves. We believe that while these factors are mentioned as "other people's deterrents," they are really expressions of our responding inventors.

Finally, to get some idea of how inventors would overcome these deterrents and stimulate the production of defense inventions, we asked: "If you were given the responsibility to increase the number and improve the quality of inventions for defense, how would you proceed?" The resulting list of suggestions is too long to be reproduced here; however, an edited compilation of these suggestions is contained in an appendix to the report submitted to the National Inventors Council. These suggestions give a qualitative picture of how inventors perceive the problem and how they visualize the required remedial action. On reading over these proposals, one observes that some of them are already in effect. The real point, however, is that these suggestions reveal inventors' beliefs, their ignorances and biases. Any attempt to improve affairs must begin with the situation as the inventor sees it. Hence, just because an idea is already implemented does not mean that the item does not deserve attention. In such cases, inventors should be made aware that it has been implemented. The suggestions offered frequently represent points where the inventor needs to be educated, rather than actions which should be implemented on their face value.

## SUBMITTING INVENTIONS TO DEFENSE

Once an inventor realizes that his invention might have defense value, the next step is to bring the invention to the attention of a defense agency. In this section we shall examine some of the factors which affect the submission of such inventions to defense agencies.

As was noted earlier in "Overview of the Research Problem," there is a major loss in defense invention resulting from the fact that inventions with possible defense utility are not brought to the attention of defense. Of the 315 inventors who had produced an invention which they thought had defense possibilities, over one-third (38%) failed to submit the invention to defense. A more complete picture of the attrition at this point is given by the figures in Table 13. The question in this table was asked of the 315 inventors who said that they had produced an invention (patented or unpatented) which they believed might have defense value.

TABLE 13

"Have you ever made an invention (patented or unpatented) which you thought had defense possibilities, but which was never brought to the attention of a defense agency or its contractors?" (N=315)

| Response | Per Cent of Inventors |
|---|---|
| Yes, this has happened | 38 |
| No, this has never happened | 42 |
| Not sure | 16 |
| (No reply) | 4 |
| | 100 |

Furthermore, 36 per cent of these 315 inventors report that they have *applied for a patent* on the possible defense invention without ever contacting a defense agency. Fifty-five per cent reported that they had never done this, while 7 per cent gave unusable replies. It appears, then, that if an inventor has an invention which he thinks has defense possibilities, and goes so far as to apply for a patent, he is more than likely to contact a defense agency. This suggests that the act of applying for a patent tends to bring the invention nearer to defense attention. Thus it might be well to consider catalyzing this tendency by focusing certain remedial efforts around the Patent Office in an attempt to pick up the 36 per cent who apply for a patent without contacting defense.

The picture with respect to *present patents pending* is also somewhat discouraging. Sixty-six per cent (or 207) of the inventors with possible defense inventions have patents pending at the present time (31% do not; 3% gave unusable replies). Those who have patents pending were then asked whether a defense agency knows about any of these inventions. Table 14 shows the results.

TABLE 14

INVENTORS WITH PATENTS PENDING WHOSE INVENTIONS ARE KNOWN TO DEFENSE (N=207)

| | Per Cent of Inventors |
|---|---|
| Invention known to defense | 37 |
| Invention not known to defense | 44 |
| Not sure whether invention is known | 19 |
| | 100 |

In only slightly more than one-third (37%) of the cases is the invention with a pending patent known to defense. Those with pending patents were also asked whether they *intend* to bring the invention to the attention of a defense agency. Only 20 per cent indicated that they so intended, while 51 per cent said "no" and 29 per cent were not sure whether they would or not. These results indicate that inventors with patents pending have on the whole not been active in submitting the inventions to defense. Furthermore, as far as their intentions are concerned, they are not much motivated to do so in the future.

Before turning to a consideration of the factors involved in the submission and non-submission of inventions to defense, it will be helpful if first we have some understanding of the manner in which submissions are made.

### *Some Aspects of Submitting an Invention to Defense*

Of the 315 inventors who had produced an invention which they thought had defense possibilities, 223 had actually submitted (or their employers had submitted) the invention to a defense agency. The form in which the invention was submitted is of some interest. Inventors were asked in what form they finally submitted their ideas to the defense agency. Table 15 shows the various patterns and their frequencies.

TABLE 15

FORM IN WHICH INVENTORS FINALLY SUBMIT IDEAS TO DEFENSE AGENCIES (N=223)

| Form | Per Cent of Inventors |
|---|---|
| Written description of the general idea | 26 |
| Sketches, drawings or technical data | 22 |
| A bare inquiry as to agency's general interest | 14 |
| Working model | 13 |
| Copy of patent or patent application | 13 |
| After actual testing | 6 |
| (Unusable replies) | 6 |
| | 100 |

This table suggests that inventors tend to submit ideas in rather tentative, undeveloped form. A "written description of the general idea" is the most common form (26%), while such detailed treatments as "working model" and "after actual testing" are comparatively uncommon. It should be noted that in only 13 per cent of the cases did inventors submit a copy of the patent or patent application. It is possible that the rather undetailed form of presentation may increase the difficulty of evaluating ideas by defense agencies, and in some instances may lead to a premature or ill-advised turndown. The considerable variability of forms of submission also suggests that perhaps inventors need more definite guidance concerning the form for presenting ideas.

In our sample, inventors were slightly more prone to apply for a patent on an invention *before* submitting it to defense, than *after*. Forty-six per cent reported the former experience, while 40 per cent reported the latter. There is also a slight difference in who initiates the contact with defense. Where the patent is applied for before going to defense, the inventor himself tends to make the decision to contact defense in 60 per cent of the cases. Where the patent is applied for *after* contacting defense, the inventor makes the contact in 44 per cent of the cases, while the inventor's employer does this in 52 per cent of the cases (in the remaining 4% of the cases, some other person made the contact). These results suggest that the inventor's employer is slightly more likely to influence submission to defense in the case of inventions for which no patent has yet been applied for. But in any case, it seems clear that with employed inventors, the employer is frequently (roughly one-half of the cases) influential in bringing the inventor's ideas to the attention of defense. It might be profitable, therefore, if consideration were given to developing ways of formally and systematically taking advantage of this influence in increasing the flow of ideas to defense. It appears that quite often the inventor's employer serves to promote the submission of inventor's ideas to defense, especially (but only slightly more) in the case of inventions without a patent application. The role of the employer will be examined more thoroughly in a later section of this report.

### *Factors Affecting Submission and Non-Submission*

To understand in a preliminary way some of the factors which inhibit inventors in submitting their inventions to defense, we asked the 119 inventors who had produced an invention which they thought had defense possibilities but which they had not submitted to defense, why they had not brought their invention to the attention of a defense agency or its contractors. The reasons are tabulated in Table 16.

TABLE 16

REASONS FOR NOT SUBMITTING POSSIBLE DEFENSE INVENTIONS TO DEFENSE AGENCIES (OR CONTRACTORS) (N=119)

| Reasons for non-submission | Per Cent of Inventors |
|---|---|
| Inventor's lack of money, time, facilities, to *develop* invention | 17 |
| References to invention (not suitable, not manufactured, not patentable or patented; someone else came up with same invention) | 16 |
| Inventor's lack of knowledge concerning *who* (contacts) and *how* (procedures) | 13 |
| Procedural delay and complexity of government (too slow, red tape, etc.) | 11 |
| Belief that competence, attitudes and treatment of government *personnel* would be bad | 11 |
| Invention had commercial utility (i.e., greater rewards and benefits if not placed with government) | 9 |
| Deterred by employers' lack of interest or help | 4 |
| Deterred by non-governmental outside *advice* or guidance (other than employer) | 2 |
| Invention previously committed elsewhere | 1 |
| Not classifiable | 16 |
| | 100 |

The two most frequent reasons are "limitations on the inventor's time, money, and facilities" and what might be called "restrictions residing in the nature of the invention" (not suitable, not manufactured, not patentable, someone else came up with same idea, etc.). The next most frequent reason—and perhaps the most correctable—is "inventor's lack of knowledge concerning *how* to proceed and *whom* to contact." It will be recalled that in an earlier paragraph, inventor ignorance concerning defense needs was an important deterrent to *conceiving* a defense invention. Thus it seems that ignorance is again important, this time in connection with how to submit an invention once conceived. Almost as frequent as inventor ignorance were negative attitudes toward government *personnel* and *governmental procedures.*

The above data were obtained from the 119 inventors who had produced what they thought was a possible defense invention but who had failed to bring it to the attention of defense. In an effort to check further on reasons for not bringing possible defense inventions to the attention of defense, certain questions were asked of the entire sample of 500 inventors. All inventors were asked: "Has there been any special circumstance or event which has deterred or discouraged you or your firm from bringing inventions(s) of yours or of your firm to the attention of a defense agency?" Twenty-three per cent or 114 replied "yes." These 114 inventors were then asked to describe this circumstance or event. Their replies are summarized in Table 17. The replies are classified into five categories which represent the source

TABLE 17

DETERRENTS TO SELF AND FIRM IN SUBMITTING POSSIBLE DEFENSE INVENTIONS TO DEFENSE AGENCIES (N=114)

| Source of Deterrent | Per Cent of Inventors* |
|---|---|
| 1. Limitations of inventor (Financial limitations; Knowledge of who and how; Inaccessability to defense) | 20 |
| 2. Character of defense negotiations (red tape, slow procedures, callbacks, inefficiencies, etc.) | 33 |
| 3. Attributes of defense agency personnel (Attitudes, personal relationships, biases, motives, interests, ability, knowledge) | 34 |
| 4. Consequences of defense acceptance (Unfavorable financial return; Loss of protection on invention; Security restrictions) | 26 |
| 5. Other | 4 |

* Per cents do not total to 100 because many inventors cited more than one deterrent. The total number of deterrents cited was 152; the total number of responding inventors 114.

of the deterrent. The most frequently mentioned deterrents are those relating to defense itself; namely, the character of *defense negotiations* and *defense personnel.* These two categories have a combined frequency of 67 per cent. Next in order was "consequences of having invention accepted by defense," this type of deterrent being mentioned by 26 per cent of the responding inventors. References to limitations on the inventor himself (financial, knowledge of how to proceed and whom to see, etc.) were made by 20 per cent of the responding inventors.

The entire sample of 500 inventors was also asked: "Do you know of any special circumstance or event which has deterred or discouraged *other* inventors or firms from bringing their invention(s) to the attention of a defense agency?" This question was asked in order to broaden the scope of the inventor's reporting. Here, only 12 per cent or 60 said "yes," as might be expected. These 60 inventors were then asked to describe the special circumstance or event. These replies are summarized in Table 18. The picture is much the same as in the preceding paragraph.

TABLE 18

DETERRENTS TO OTHER INVENTORS AND FIRMS IN SUBMITTING POSSIBLE DEFENSE INVENTIONS TO DEFENSE AGENCIES (N=60)

| Source of Deterrent | Per Cent of Inventors* |
|---|---|
| 1. Limitations of inventor (Financial limitations; Knowledge of who and how; Inaccessability to defense) | 42 |
| 2. Character of defense negotiations (i.e., procedures) | 67 |
| 3. Attributes of defense agency personnel | 75 |
| 4. Consequences of defense acceptance (Unfavorable financial return; Loss of protection on invention; Security restrictions) | 47 |
| 5. Other | 12 |

* Per cents do not total to 100 because many inventors cited more than one deterrent. The total number of deterrents cited was 87; the number of responding inventors 60.

These two tables combined indicate that the major deterrents are contained within the *procedures* and *personnel* of defense agencies themselves; the personal qualities of agency personnel are cited slightly more frequently. Next in frequency are the *consequences of having an invention accepted by defense.* A breakdown of these consequences reveals that "loss of protection on invention" is clearly the most outstanding deterrent. In third place are *limitations on the inventor himself,* with "financial limitations," "knowledge of who and how" and "inaccessability to defense" having similar frequencies of mention (the numbers here are too small to assign much significance to the small differences). It is interesting to note that as far as submission is concerned, "unfavorable financial return" is mentioned as a comparatively rare consequence.

Inspection of the response categories into which the replies in these two tables are classified will reveal that categories 2, 3, and 4 are primarily the inventor's *expectations*—expectations which in one way or another he has acquired relative to defense agencies (their procedures, personnel, and negotiational consequences). Regardless of whether or not these expectations are correct, the fact remains that they are the inventor's *beliefs.* It is suggested that the remedial action implied by these results should not only be directed toward improving the nature of defense agencies on procedures, personnel, and consequences of acceptance, but also toward changing the inventor's beliefs or expectations about them.

### *Inventors' Ratings of Defense Agencies v. Industry*

The above results suggest that one of the main deterrents to bringing an invention to the attention of defense lies within the procedures and personnel of the defense agencies themselves. To explore this point more fully we obtained a picture of how inventors viewed the *administrative organization and procedures and the attitudes of personnel* of defense agencies in comparison with industry. This information was obtained from the 223 inventors who had actually submitted (or had their employer submit) an invention to a defense agency. These inventors, then, had had either direct or fairly intimate indirect experience with defense procedures and personnel; their reactions are consequently not based solely upon hearsay or popular belief. The agencies from which such experience was gained are mainly the military agencies. Questioning on this point revealed that the Army, Navy, and Air Force (in that order) account for a total of 66 per cent of inventor contacts.

Inventors were first asked to rate defense agencies and industry on *administrative organization and procedures.* The percentage of inventors giving each rating is shown in Table 19.

TABLE 19

INVENTORS' RATINGS ON THE ADMINISTRATIVE ORGANIZATION AND PROCEDURES OF DEFENSE AND INDUSTRY*

| Rating | Per Cent of Inventors | |
|---|---|---|
| | Defense Agencies | Industry |
| Extremely well organized | 2 | 16 |
| Fairly well organized | 9 | 28 |
| Adequately organized | 13 | 16 |
| Poorly organized | 21 | 13 |
| Very poorly organized | 11 | 3 |
| Don't know | 29 | 12 |
| (Unusable replies) | 12 | 12 |
| | 97 | 100 |

* Ratings obtained from the 223 inventors who had brought (or had their employer bring) an invention to the attention of a defense agency.

These results show a markedly more favorable picture of industry over defense. Only 24 per cent say that defense is at least adequately organized, while 60 per cent say this of industry. For defense, the most frequent rating (21%) is "poorly organized"; for industry the most frequent rating (28%) is "fairly well organized."

Next, inventors were asked to rate industry and defense on the attitudes of their personnel toward the inventor. Table 20 shows the distribution of ratings.

As with administrative organization and procedures, inventors are more favorable to industry. Only 42 per cent of the inventors say that defense is "fairly or very interested and helpful," while 58 per cent say this of industry. On the whole, however, defense does better on personnel attitudes than it does on administrative organization and procedures; industry does about the same on both counts. For defense the most frequent rating (25%) is "fairly interested and helpful," with "somewhat indifferent and unconcerned" next (19%). For industry the most frequent rating (35%) is, as with defense, "fairly interested and helpful," with "very interested and helpful" in next place (23%).

Considered jointly, the results in the last four tables show that not only are the

TABLE 20

INVENTORS' RATINGS ON ATTITUDES OF PERSONNEL IN DEFENSE AND INDUSTRY*

| Rating | Per Cent of Inventors | |
|---|---|---|
| | Defense Agencies | Industry |
| Very interested and helpful | 17 | 23 |
| Fairly interested and helpful | 25 | 35 |
| Somewhat indifferent and unconcerned | 19 | 11 |
| Somewhat negative | 6 | 2 |
| Antagonistic to new ideas | 2 | 3 |
| Don't know | 5 | 6 |
| (Unusable replies) | 26 | 20 |
| | 100 | 100 |

* Ratings obtained from the 223 inventors who had brought (or had their employer bring) an invention to the attention of a defense agency.

administrative procedures and personnel of defense agencies the most frequent deterrent to submission of inventions, but also that defense agencies offer more of a deterrent than does private industry. It is natural, then, for inventions to be submitted to the channel with the least resistance. The results are also quite consistent with those discussed earlier in Tables 6, 7, 8, 9, and 10 where it was shown that inventors prefer to work with industry as against defense, and believe that industry is more likely to provide the satisfactions which they seek in marketing their inventions.

Inventors (i.e., those who had actually submitted an invention to defense) were also queried as to what *improvement* they thought was most needed in the administrative handling of inventors by industry and defense agencies. These suggestions are too bulky to list here; they are contained in special appendices in the report to the National Inventors Council.

### *Influence of Previous Industry Contact Regarding Invention*

In view of the greater attractiveness of industry as a channel for submitting inventions, one might expect that some inventions submitted to defense are first submitted to industry, and then, for some reason, withdrawn and resubmitted to defense. Or, to ask the question in another way, do inventors ever take an invention to industry *first,* and *then* go to defense? The answer is that in our sample of 223 inventors who have submitted an invention to defense, 18 per cent (41 inventors) report having gone *first* to a private company (exclusive of defense contractors) and *then* to a defense agency. (Seventy per cent report that this never happened to them, while 12 per cent gave unusable replies.) From this it would seem that in almost one-fifth of cases industry gets first crack at an invention (presumably having defense possibilities) and that defense gets a look at the invention only after negotiations with industry were for some reason unsuccessful.

The 18 per cent who had first gone to industry and then to defense were also asked as to the reason for finally turning to a defense agency. Table 21 shows a tabulation of these reasons.

TABLE 21

REASONS FOR SUBMITTING AN INVENTION TO DEFENSE AFTER FIRST CONTACTING PRIVATE INDUSTRY (N=41)

| Reason | Per Cent of Inventors |
|---|---|
| The company decided against accepting the invention | 17 |
| The company referred me to defense | 10 |
| Dissatisfaction with company's negotiations prompted going elsewhere with invention | 5 |
| Miscellaneous and unclassifiable | 60 |
| Ambiguous | 8 |
| | 100 |

The most common single reason is "company's decision not to use the invention." In these instances, it seems as though defense is getting the "leftovers" from industry. "Company referral to defense" is next, but this occurs only in 10 per cent of the cases. It appears that industry is not very active in sending inventors to defense agencies. Inventor dissatisfaction with industry's negotiations appears to be a very unimportant factor in the inventor turning to defense.

But perhaps the most notable point in the above data is that in the great majority of cases (70%), inventors had *not* had the experience of taking their inventions first to industry, then to defense. Since all the inventors involved had gone to defense with an invention, it is clear that most inventors who submit to defense do so directly, without any intermediate stops at industry. Since there are so few intermediate stops at industry, it does not seem likely that attempts to make industry a referral service would be very fruitful. It seems that if an invention is submitted to defense, it is submitted directly; if submitted to industry it tends to stay there and only rarely is it resubmitted to defense.

## *Role of Personal Influence*

By "personal influence" we mean the influence which other people have over the inventor with respect to submitting his invention to defense. Such persons may be of importance because they affect the inventor's decision as to where he should submit his invention, or because they may direct and guide him on how to proceed once the decision has been made. We have confined our investigation to the first type of influence since this is the more fundamental. We are interested, then, in learning to what extent inventors are exposed to suggestions from other people which affect the submission of inventions to defense.

All 500 inventors were asked if there had ever been any person(s) who had advised them *against* presenting their invention to a defense agency. Only 4 per cent reported that they had ever received such advice. The great majority, 89 per cent, said "no" (7% gave unusable replies). Those who had received such negative advice were further asked about the identity of the adviser. One-fifth of the responding inventors gave ambiguous replies, but of those who gave meaningful answers, 50 per cent mentioned "lawyer" and 38 per cent mentioned "friend." No one mentioned "relative," while about 12 per cent mentioned "employer." The absolute sample numbers involved here are too small to permit accurate comparisons, but the importance of the lawyer's role seems clear. It would appear from these results that on the whole negative advice from other people is a relatively rare deterrent to submitting an invention to defense, and that lawyers are the principal givers of such advice.

So much for negative advice. What about the advice of other people which encourages the submission of inventions to defense? Here we attempted to discover the extent to which other people's suggestions first give the inventor the idea of taking his invention to a defense agency. Because of the nature of this inquiry, we directed our question only to those 223 inventors who had actually submitted an invention to defense. We asked them: "Have there ever been any persons(s), other than your employer, who first gave you the idea of taking your invention to a defense agency?" Fifteen per cent of the inventors replied that there were such persons, while 73 per cent answered that there were not (12% gave unusable replies). The majority (63%) mentioned "friend" as the advice-giver, while 22 per cent mentioned "attorney." "Relative" and "employer" were rarely mentioned (7% in each case). We also inquired into whether the advice-giver merely suggested going to defense or did he also implement his suggestion by providing assistance in making contacts with defense. Of those who had received such positive advice the majority (61%) said that the advice-giver merely directed them to defense; 39 per cent said that the advice-giver also assisted in making contacts.

In summary, our results indicate the deterrent advice is comparatively infrequent —much less frequent than encouraging advice. Deterrent advice comes mainly from lawyers; while encouraging advice comes mainly from friends. Where encouraging advice is given, it is associated with assistance in making contacts in over one-third of the cases. It should be noted, however, that in either event, the inventor's exposure to suggestions and advice on submission to defense is rather slight.

### *Role of Job Assignment*

Another factor which conceivably could affect the submission of an invention to defense is the nature of the inventor's employment. Some inventors, by nature of their employment, may have their inventions automatically assigned or licensed to a defense agency (or its contractors). The 223 inventors who had submitted inventions to defense were queried on this point. Over half (54%) reported that they had had an invention automatically assigned or licensed to a defense agency (or its contractors) by the nature of their employment. Less than a third (32%) reported that this had never happened to them, while 7 per cent were uncertain and another 7 per cent gave unusable replies. It is very clear, then, that in a large number of cases inventions are brought to the attention of defense *not* because of the inventor's intentions or interests. In such cases the submission is induced by administrative and legal arrangements; the inventor's motivations regarding submission appear largely irrelevant.

This is a somewhat striking result. It means that, as the situation stands today, the "incentive" to submitting many inventions is not really an "incentive" or motivational affair at all. Administrative and legal arrangements which guarantee automatic submission are serving *in lieu* of inventor incentives.

*Deterrents to Invention Development*

Lastly, an inventor may fail to submit an invention to defense because he is unable to develop his ideas sufficiently to be presentable. To assess the extent to which this factor is at work, we asked the 223 inventors who had submitted inventions to defense whether there had been any special obstacle in developing defense inventions *prior* to bringing them to defense agencies. Over one-third (39%) reported that there were such obstacles, while 46 per cent said that there had been none. (Four per cent were not sure, 11% gave unusable replies.) The occurrence of such obstacles, then, appears to be a rather significant deterrent to bringing inventions to the attention of defense.

Those inventors reporting obstacles were further queried concerning the nature of the obstacle. This was done in two ways: first, by means of an "open end" question in which the inventor was merely asked to describe the obstacle; and second, by means of a checklist in which the inventor checks from a list all those obstacles that apply to him. The first type of question has the advantage of uncovering those obstacles which are foremost in the inventor's mind; the second type of question stimulates him to consider obstacles which might not otherwise come to mind in the haste of filling out a questionnaire. The results from the first type of question are shown in Table 22; while results from the second type question are displayed in Table 23.

In Table 22 it will be seen that the most frequently volunteered obstacle is "Lack of financial support" (66%). All other obstacles are mentioned with rather low frequencies, the next most frequently mentioned obstacle being "Lack of time" with 14 per cent. The second type question permits the inventor to indicate one or more obstacles, so the results in Table 23 are perhaps somewhat more complete. In this table we again see that "Financial resources" is the most frequently mentioned obstacle (88%). There is a jump down to "Insufficient time" (51%) and "Lack of

TABLE 22

OBSTACLES TO DEVELOPING INVENTIONS PRIOR TO SUBMISSION TO DEFENSE (N=86*) (OPEN-END QUESTION)

| Obstacle | Per Cent of Inventors |
|---|---|
| Lack of financial support | 66 |
| Lack of time | 14 |
| Lack of employer's support | 7 |
| Lack of defense agency initial interest | 5 |
| No expectation of patent protection | 3 |
| No expectation of financial reward | 3 |
| Lack of information on defense needs, and procedures for submission | 2 |
| | 100 |

* Based on inventors who experienced obstacles to developing their inventions *prior* to bringing them to the attention of defense. These same inventors had also actually submitted an invention to defense.

assistance" (47%). "Legal restrictions from job or other occupational activities" surprisingly enough was checked by 20 per cent, indicating that an appreciable number of inventors are not permitted (by legal and contractual arrangements) to develop inventions having possible defense value.

TABLE 23

OBSTACLES TO DEVELOPING INVENTIONS PRIOR TO SUBMISSION TO DEFENSE (N=86) (CHECKLIST QUESTION)

| Obstacle | Per Cent of Inventors* |
|---|---|
| Financial resources | 88 |
| Insufficient time | 51 |
| Lack of assistance | 47 |
| Legal restrictions from job or other occupational activities | 20 |

* Per cents do not total to 100 because many inventors indicated more than one obstacle. Based on same inventors as in preceding table.

On the whole, the above data suggest that a sizable number of inventors (over one-third) have been hampered in submitting inventions by obstacles to development; the most common of these obstacles being lack of financial resources.

CONTINUING AND FINALIZING DEFENSE NEGOTIATIONS

So far we have considered factors which affect conceiving of a possible defense invention and those which affect the submission of an invention, once conceived, to defense agencies. In this section attention turns to the process of continuing negotiations with defense after an invention has been submitted. The main question here is, What happens to an invention after it has been submitted to defense?

The 223 inventors who had submitted inventions to defense were asked whether any of their inventions had *ever* been licensed, used, or assigned to a defense agency or its contractors. The results are shown in Table 24.

TABLE 24

EXTENT TO WHICH INVENTORS HAVE HAD INVENTIONS ACCEPTED BY DEFENSE (N=223)

| Responses | Per Cent of Inventors |
|---|---|
| Have had invention licensed, used, or assigned to defense | 60 |
| Have not had invention licensed, used or assigned to defense | 24 |
| Not sure* of invention's disposition | 9 |
| Unusable replies | 7 |
| | 100 |

* "Not sure" reflects the fact that some inventors do not have control of the final disposition of their inventions, or are currently uninformed as to disposition.

Well over half of those who have submitted inventions to defense have (at one time or another) had inventions accepted. About one-fourth have never had an invention accepted. The 60 per cent with inventions accepted suggests that the frequency of acceptance across inventors is moderately favorable. (This does not tell us, however, what the acceptance rate is across inventions.)

The next question, then, concerns those cases where inventions are not accepted. Our 223 inventors were asked whether a defense agency had *ever* decided against using, licensing, or purchasing one of their inventions. Table 25 shows the replies. Over one-third (37%) have had inventions rejected. It is especially notable that while 60 per cent (Table 24) have had inventions accepted by defense, only about one-fourth (Table 25) have escaped the experience of having an invention rejected. It is clear, however, that more inventors have experienced acceptance than have experienced rejection.

TABLE 25

EXTENT TO WHICH INVENTORS HAVE HAD INVENTIONS REJECTED BY DEFENSE (N=223)

| Response | Per Cent of Inventors |
|---|---|
| Have had invention rejected by defense | 37 |
| Have not had invention rejected by defense | 26 |
| Not sure as to status of invention | 20 |
| Question inapplicable | 6 |
| Unusable replies | 11 |
| | 100 |

Those who had never experienced a turndown by defense were further asked whether they had submitted any inventions to defense (or its contractors) on which no final action had yet been received. The replies were about fifty-fifty (51% saying "yes"; 49% saying "no"). Apparently, among those who have not experienced a turndown, "awaiting final word" is a very common situation.

So far we have been concerned only with terminations of negotiations where defense initiated the rejection. Of special interest are those cases where the inventor himself decides against continuing negotiations with defense. Turndowns by defense are presumed to represent legitimate terminations. Withdrawals by the inventor, however, represent a possibly salvagable loss of defense inventions. Only 18 per cent of the 223 inventors who had submitted inventions to defense reported that they had withdrawn from negotiations on their own decision (74% said that they had never withdrawn, while 8% gave unusable answers). Decidedly more inventors are rejected by defense than withdraw from defense negotiations on their own. While the above 18 per cent is by no means negligible, it represents a smaller attrition of defense inventions than do the other attrition points considered earlier (i.e., failure to conceive a defense idea and failure to submit an invention to defense).

An analysis of the reasons given for withdrawing from defense negotiations is presented in Table 26. The most frequently cited reason (35%) is "procedural delay"; "attitudes of agency personnel" is in second place with 24 per cent. These two factors are reminiscent of the factors responsible for non-submission of inventions. Both factors represent aspects of the defense agency itself, and based as they are on actual experience, must be accepted as deterrents which are very real to the inventor. In principle, at least, both factors are remediable.

TABLE 26

REASONS FOR INVENTORS' DISCONTINUING NEGOTIATIONS WITH DEFENSE

| Reason | Per Cent of Inventors |
|---|---|
| Procedural delay (complexity, red-tape, frustration, etc.) | 35 |
| Attitudes of agency personnel (poor reception, not interested, antagonism, discouragement, etc.) | 24 |
| Nature of invention (not suitable, questionable usefulness; better inventions already available, etc.) | 12 |
| Limitations of inventor (limited finances, facilities, time, means, etc.) | 6 |
| Character of arrangements and consequences of having inventions accepted (wanted competitors to have royalty rights free, poor financial return, security restrictions, no protection, etc.) | 14 |
| Response not classifiable | 9 |
| | 100 |

Those who had withdrawn from defense negotiations on their own decision were also asked as to the eventual disposition of the invention. Of those who had withdrawn, only 43 per cent (or 17 out of 40) answered this question so that the resulting percentages are somewhat difficult to interpret. However, of those answering, 65 per cent indicated that they discarded the invention, while 19 per cent said that they sold or licensed it to industry. The fact that the majority of such inventions were eventually discarded by the inventor himself suggests that perhaps these inventions tend not to be of much value. This strengthens the conclusion that inventions lost through the inventor's withdrawal from defense negotiations are not an important source of attrition in defense inventing.

### *Effect of Secrecy Order on Development*

One of the possible deterrents to developing an invention once submitted to defense is the restriction imposed by a secrecy order. Among the 315 inventors who reported having produced an invention (patented or unpatented) which they thought had defense value, 36 per cent reported having a secrecy order imposed on any of their inventions (45% reported no secrecy order, while 10% were not sure). Those who had experienced a secrecy order were asked whether this hindered their further development of the invention. Seventeen per cent replied that the secrecy order did hinder their work.

### *Influence of Employer or Manager*

Our results show that if the inventor's employer or manager (when he is also an inventor) takes the invention to defense, there is a greater likelihood that the invention will be accepted by defense.

In our total sample there were 213 inventors who were also managers or employers. They were asked whether they had ever taken an invention (patented or unpatented) of one of their employees to a defense agency and have the agency decide against using, licensing, or purchasing the invention. Twenty-two per cent reported that they had experienced such defense turndowns. This figure is less than the turndown experienced by inventors themselves (37%).

Managers and employers were also asked whether they had submitted any inventions of their employees to defense (or its contractors) on which no final action had yet been received. Thirty-nine per cent said "yes." (Among inventors the figure was 51%, although for statistical reasons this figure is not strictly comparable with the 39% for managers and employers.)

When the inventor's employer or manager takes the invention to defense, it is also less likely that the employer or manager will himself decide to withdraw from negotiation with defense. Only 11 per cent of the 213 managers and employers reported that they had themselves discontinued negotiation with defense after submitting an invention of one of their employees. (Among inventors, it will be recalled, such terminations occurred in 18% of the cases.)

Among those managers and employers who did withdraw from defense negotiations, 49 per cent reported that eventually the invention was brought to the attention of a non-defense industrial organization. This figure is much greater than that for inventors (19% of those withdrawing from defense negotiations eventually took their invention to industry). Because of the poor response rate on this point among inventors, these two percentages are probably not very comparable. Even so, it is suggested that when managers or employers withdraw from defense negotiations the invention is more successfully placed with industry than is the case with inventors who withdraw.

From the above we see that when an inventor's employer or manager (providing that he is also an inventor) takes the invention to defense, there is less turndown by defense and less voluntary withdrawal from negotiations than is the case with inventors themselves. There are several possible explanations for this. With managers and employers there may be more selectivity and realistic objectivity in deciding what inventions should be submitted to defense. Or, it may be because employers or managers are better negotiators. A third possibility would be that inventors who work in an institutional setting (and thus have an employer or manager) may produce more marketable inventions.

## IMAGE OF THE NATIONAL INVENTORS COUNCIL

To assist the NIC in determining its role in the promotion of defense invention, we sought to determine the extent to which inventors knew about NIC, how they learned about it, and what they believed its functions to be. The data on these questions were obtained from all 500 inventors in the sample.

Seventy-two per cent said that they had heard of the NIC, while 23 per cent

TABLE 27

HOW INVENTORS LEARN ABOUT THE NIC

| Source | Per Cent of Inventors* |
|---|---|
| From an acquaintance or associate | 15 |
| From some magazine or journal | 53 |
| From some other published material | 22 |
| Unable to say | 20 |

* Per cents do not total to 100 because some inventors indicated more than one source. The total number of mentionings was 397; the total number of responding inventors (i.e., those knowing of NIC) was 352.

said that they had not (5% did not respond). Almost three-fourths, then, knew of the NIC.

Those knowing of NIC were asked how they learned of its existence. Table 27 shows a breakdown of the media through which they acquire their acquaintance. The most frequently mentioned source is "magazine or journal." The table indicates that the most available channel to the inventor has been printed media rather than people.

Those knowing of NIC were also asked as to its functions. A breakdown of the replies is given in Table 28. It will be seen that the majority of inventors see NIC as a clearing house or a committee to serve inventors. In actuality, the true function is to evaluate inventive ideas and forward them to the proper agency which then reports back to the inventor. The NIC is the one agency to which an inventor may go for guidance as to which defense agency might be interested in his invention. On the whole, the above table indicates that many inventors do not fully understand the exact function of NIC, which may be one reason for their non-use of its facilities.

TABLE 28

WHAT INVENTORS CONSIDER TO BE THE FUNCTION OF NIC

| Functions | Per Cent of Inventors* |
|---|---|
| Clearing House; screening, advisory or evaluative function | 27 |
| Serve inventors (reference specifically mentions assisting, informing, advising, etc., *inventors*) | 25 |
| Serve government (reference specifically mentions government or defense) | 3 |
| Stimulate invention | 6 |
| Stimulate invention for defense or government | 13 |
| Clerical functions (roster keeping, records, statistics, lists of names) | 1 |
| Improve, promote or guide patent law or patent system or patent office procedure, taxation, etc. | 4 |
| Evaluative comments—positive (favorable) | 1 |
| Evaluative comments—negative (critical) | 4 |
| Not classifiable (ambiguous) | 1 |
| "Don't know," or "not clear" | 15 |
| | 100 |

* Per cents do not total to 100 because some inventors mentioned more than one function. The total number of responses was 404. The total number of responding inventors was 293.

## INTERPRETATIVE SUMMARY*

The total body of data obtained in this investigation suggests that the process whereby inventors produce inventions which become accepted by defense is a complex affair, involving many decision-points and being affected by a multiplicity of determinants. This fact of multiple causation must be clearly recognized in any attempts to improve the flow of inventions to defense. It means that there is no single, unitary explanation to the phenomenon of producing defense inventions, nor is there a single cause, which if remedied would lead to an increase in defense invention. It is fruitless, therefore, to search for the one hidden underlying deterrent or incentive. Because there is no single basic determinant, there is no single formula or "magic pill" which could improve the flow of defense inventions. Rather, what is required is a broad program of remedial action, aimed at a large number of separate conditions.

The data indicate that the major loss of defense inventions occurs because inventors do not conceive and produce inventions which might have defense possibilities. Roughly one-third of our sample has never produced such inventions. The second major loss comes from the non-submission of possible defense inventions to defense agencies. Slightly less than two-fifths of those inventors who have produced possible defense inventions actually submit them to defense. Attrition of inventions due to inventors withdrawing from negotiations with defense agencies appears to be relatively slight.

The situation with respect to conceiving and producing an invention which might have defense possibilities appears to be as follows. To produce a possible defense invention, two requirements are necessary: a knowledge of defense needs or problems and the motivation to make an invention which will meet these needs and problems. Except for inventors who are assigned to defense problems by the nature of the employment, it seems that typically knowledge of defense needs serves to identify for the inventor which of the ideas he periodically gets have possible defense value. Inventors typically realize the defense possibilities in an idea very early (during inception or development) as suggested by the nature of the idea itself. It is not common for the realization to come at some time after inception and development. Reduced to simplest terms, the situation appears to be as follows: Inventors in one way or another periodically get ideas, at which time the decision to develop the idea into an invention is influenced by the anticipated use to which the invention might be put. If the inventor is aware of defense needs at the time and sees that the invention fits these needs, he may then start the development of what may terminate as a defense invention. It seems uncommon for an inventor to develop an idea and then start considering areas of application. Inventions tend to be produced with a specific use already in mind. Whether or not the

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* This discussion is based not only on the preceding statistical results but also on a qualitative analysis of the intensive interviews conducted earlier in the study. These interviews provide a background of subjective factors which were useful in interpreting the quantitative questionnaire data.

suggested use is worth pursuing then becomes a factor which affects the inventor's motivation to develop the invention. If the suggested use implies a marketing channel which is low in incentives and high in deterrents, it is likely that the inventor will discard the idea as not worth developing. All this means that two conditions must be met for an inventor to produce a possible defense invention: (1) he must realize defense possibilities in an idea very early in the process of inception and development; (2) the marketing channel of defense suggested by this realization must appear as an attractive channel, otherwise the idea will not be pursued further (in other words he must be motivated to develop the invention). Our data suggest that if defense does not appear as an attractive marketing channel, work on the invention is simply discontinued rather than reslanted in the direction of industrial applications. (On the whole, our data do not suggest that defense is losing many defense inventions to industry. More typically, inventors simply prefer to work on inventions which have obvious industrial applications. Thus defense is losing inventors' time and effort, rather than the products of his time and effort.)

Our data suggest that inventors are failing to produce defense inventions because of deficiencies in both of the above-mentioned required conditions. They are not sufficiently aware of defense needs to recognize a defense idea when they have one; and furthermore, even if the defense possibilities are recognized, inventors are not strongly motivated to pursue development of the idea because the defense appears unattractive as a marketing channel. Other possible deterrents, such as limitations on the inventor's time, money, and facilities, appear to be much less important. The inventor's expectations concerning defense as a marketing channel contain two major deterrents: the belief that financial rewards will be inadequate, and an unfavorable picture of the negotiational aspects of defense agencies. Inventors prefer to work with industry; they believe that industry gives more over-all satisfaction and greater financial rewards. They believe that the administrative and organizational structure for handling inventors in defense is inferior to that in industry. They also think that defense personnel are less interested and helpful in their contacts with inventors. Financial return, while not the only reward sought from invention, was found to be one of the most important goals which the inventor seeks. Money does not appear to be the motivation for an inventor having ideas, but it does serve to earmark those ideas which are worthy of development. Inventors show appreciable frustration concerning the financial rewards from their inventions in general. And since defense is seen as offering fewer financial rewards, and providing no substitute rewards, many inventors are not strongly motivated to develop those ideas with defense possibilities even when such possibilities are recognized.

The implications of the above for action are twofold: (1) Inventors should be made more aware of defense needs and problems. Such knowledge must be made available now, so that he can apply it to tomorrow's ideas. It does little good to give him such knowledge in the hope that he will "see" defense possibilities in inventions which he already has underway. (2) Inventors must be given a more favorable picture of defense as a marketing channel, particularly with respect to their expectations concerning financial rewards and the attractiveness of defense administrative procedures and personnel. There appears to be no substitute for the latter; the former (financial rewards) may conceivably be replaced by some other powerful incentive, such as widespread national recognition and prestige.

The above discussion relates to the process of conceiving and developing an invention which might possibly have defense use. The next stage at which a loss in defense invention may occur is in submission to defense agencies. A relatively frequent deterrent here is limitation on the inventor's time, facilities, finances. Almost as frequent, however, is the deterring effect of the inventor's lack of knowledge concerning whom to contact and how to set about it. Two other major deterrents relate to the defense itself; namely, inventors' unfavorable beliefs concerning defense personnel (i.e., competence, attitudes, behavior), and the delay and complexity of defense procedures. These two deterrents contained in defense itself have a combined frequency of mention which exceeds both "limitations on the inventor" and "inventors' lack of knowledge concerning who and how." Thus the inventor's unfavorable attitude toward defense procedures and personnel serves not only as a deterrent to *submitting* an invention to defense, but also, as noted earlier, as a deterrent to *developing* a possible defense idea once its defense potentialities are recognized. On the whole, the influence of other people, either as positive or negative advice, does not appear to be an important factor in the inventor submitting his invention to defense.

As previously mentioned, there is no indication that defense inventions are going to industry by default. In this sense, industry is not competing with defense. For instance, very few inventors take possible defense inventions to industry first, then to defense. Similarly, very few inventors withdraw from negotiations with defense in order to place their invention with industry. In another sense, however, there is competition—competition for the direction in which the inventor applies his time and abilities. Our data indicate that the inventor simply prefers to work on inventions which have an industrial application. The reason for his preference lies in his belief that industry offers greater financial rewards and is easier to work with from a procedural, organizational, and personnel viewpoint.

Reduced to simplest terms, the above discussion means this: The major deterrent to an inventor *conceiving* a defense invention comes from his ignorance of defense needs and problems. The major deterrents to his *developing* an invention with defense possibilities are his belief that the financial rewards are smaller than they are in non-defense, and his unfavorable expectations concerning the procedures, organization, and personnel that defense negotiations entail. The major deterrents to *submitting* his invention to defense are his ignorance of how to proceed and whom to contact, and, again, his unfavorable expectations concerning defense procedures, organization and personnel. It is clear that the effect of these deterrents is retrogressively cumulative; that is, the deterrents to submission act back and serve as deterrents to developing an invention.

These conclusions apply, of course, to the inventor who has the freedom to choose to do the kind of inventing he prefers. Inventors who work in an institutional setting where the nature of their employment prescribes work on defense problems are another matter. These inventors produce defense inventions because they are assigned to defense problems, and submission of their inventions to defense is determined by company action. Here, institutional procedures replace the individual's motivations and decisions. Since the flow of defense inventions from these inventors depends upon the character of their institutional setting, it is the institution itself toward which remedial action should be directed. The extent to which the managements of such institutions are maximizing the flow of potential defense inventions could not be adequately assessed by the present study. There were slight indications, however, that managements are fairly active in relaying to defense inventions produced by their personnel. This problem obviously requires special study, with particular attention being given to the possibility of a conflict of interests and to the ways in which such conflicts are resolved by industry.

Finally, it is clear that there are two broad ways of increasing the flow of defense inventions. One is to increase the incentives (rewards) of defense invention. This is primarily a matter of increasing the size and certainty of financial returns. The other way is to decrease the deterrents, which would involve reducing the barriers offered by ignorance of defense needs, "who and how," and improving the inventor's expectations regarding defense procedures, organization, and personnel. Ideally a combination of both would produce the greatest result. But since practical limitations would probably favor one of these approaches over the other, the following point should be borne in mind. Research on changing people's behavior in a wide variety of areas has shown that if a choice must be made, it is better to reduce deterrents (while keeping incentives constant) than it is to increase incentives (while keeping deterrents constant). Increasing incentives and rewards without reducing deterrents has been found to increase the conflict of competitive forces acting upon the individual with the result that the activity (in the present case, inventing for defense) tends to be avoided. On the whole, then, the more advisable approach would be in the direction of minimizing the barriers and deterrents which turn the inventor away from defense, rather than simply raising the size of the rewards obtained through approaching defense. Since the major deterrents were found to be based on lack of knowledge, beliefs and expectations, the ultimate answer to our problem must lie in the direction of education and attitude change.

# Role of Patents in the Creation and Growth of Small Industrial Units

IRVING H. SIEGEL, Principal Consultant

As THE ORIGINAL GROUP of three studies organized for this project approaches completion, plans are under way for extension of the inquiry to three additional industries.

The original studies dealt with the role of patents and other factors in the operations or prospects of small firms in (1) custom heat treating, (2) the Boston area electronics industry, and (3) the emerging "new" technology of iron and steel production. A final report on heat treating, prepared by Dr. Nathan Belfer, was published in the first issue of this *Journal* and discussed at the First Public Conference of the Foundation. An interim report on the Boston electronics industry was prepared by Dr. Weldon Welfling for the first issue and the First Conference too; and a supplementary report is presented elsewhere in the current *Journal.* Similarly, an interim report on patent and other aspects of the new steel technology was prepared by Dr. Robert M. Weidenhammer for the first *Journal* and the First Conference, and a final report is planned for the next issue.

The final report on the steel industry will analyze the replies of steel companies, research and engineering consultants, and suppliers to a questionnaire sent them by the Foundation. This questionnaire supplements Dr. Weidenhammer's earlier selective personal contacts. One variant of the questionnaire was sent to 11 steel companies; a second version, more appropriate to consultants and suppliers, was sent to six such firms. Both variants of the questionnaire sought information relating especially to three types of processes regarded as promising in recent trade and technical literature: direct reduction of iron ore, the application of oxygen in steelmaking, and continuous casting of steel. The questions fall into four categories: (1) company research and development activity; (2) company patent activity; (3) company experience with respect to infringements and interferences; and (4) company opinion on implications of the new technology for small business opportunities and on other topics. Most of the companies have responded to the Foundation, although some were not ready or were unable to supply requested information.

The three proposed new studies relate to patent and other factors in the operations and prospects of independent firms in the (1) aluminum fabrication, (2) fabricated plastic products, and (3) scientific and other instruments industries. These industries were selected because they were known to be relatively new and growing and to have room for "small business." But they are heterogeneous too, so the inquiries will have to be confined to manageably small geographic areas and to firms making specified classes of products or using specified processes. The investigators will have the benefit of experience already accumulated on the project with respect to the design and administration of questionnaires. They will give explicit attention to the infringement and interference experience of respondents. In this regard and on other aspects of their inquiries, they will have opportunity to consult with members of the Area Committees and selected members of the Foundation.

Upon completion of each trilogy of studies, an analytical summary report will be prepared for publication in the *Journal.* These reports will generalize the findings of the individual studies and in turn provide the basis for broader generalizations concerning the role of patents in the development of small individual units in the United States economy.

# Patents in Boston Area Electronics Industry*

WELDON WELFLING, Research Associate

THIS STATEMENT SUPPLEMENTS, and to some extent revises, the section entitled "Role of Patents" in the research project report on the Boston area electronics industry (published in the *Journal*, I, June 1957, pp. 119-126).[1] It is based on additional information gathered from businessmen, patent attorneys, bankers, and teachers subsequent to publication of that report. The new information strengthens the foundation for generalizations regarding the attitude of small electronics firms in the Boston area toward patents.

Naturally, the diversity of circumstances leads to different management estimates of the utility of patent protection, but further study leads to two main conclusions regarding the role of patents on small Boston area electronics firms:

1. Such firms, especially those that (a) are only a few years old, (b) have annual sales of less than $1-$2 million, and (c) have little or no outside financing, tend to have fewer patents and do not appear to be aggressive in obtaining them.

2. With growth and with the development of products having a clear market potential, such firms are likely to develop a more positive patent policy.

The rest of this statement amplifies these two general points.

Various characteristics of small Boston companies having little patent interest should be noted:

1. The management of some of these companies comes from the field of science rather than from business. Frequently, company policies and orientation reflect the interest of one scientist, or only a few.

2. Such companies are often engaged largely or wholly on government contracts. These contracts usually involve research and development, rather than procurement (i.e., delivery in quantity of items already in use).

3. Such companies frequently derive their original capital from founders and friends and finance their operations from current receipts.

Many of the newer firms surveyed in the Boston area, especially those with scientist management, regard the patent system as an impediment to their operations. Some interviewed officials consider the experience and bother of obtaining patents as unnecessary since, if they are found to be infringing the patents of others, they could easily make licensing arrangements. They also contend that developments come so fast that patents have little value. Closely related is the opinion that a patented

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* Dr. Welfling prepared this supplementary report on one of three case studies designed, carried out, and written up under the general direction of Dr. Siegel for *Project 3a*, **Role of Patents in the Creation and Growth of Small Industrial Units.**

[1] At this point attention might be called to a change now required in the last sentence of the second paragraph on p. 124. Datamatic, established jointly by Minneapolis-Honeywell and Raytheon, has recently been acquired completely by the former.

article or process may often with ease be modified sufficiently to avoid infringement. Furthermore, the expense of a few hundred dollars to obtain a patent may appear excessive. This judgment is more likely if the work covers a research project in which only one or a few devices will be produced and sold. The deterrents to obtaining patents on government work have already been described in the earlier paper.

With growth, a company's attitude toward patents is likely to change. In several relatively new firms in the Boston area, those in financial control have found it necessary to replace the original management or to promote mergers yielding the necessary combination of scientific and executive talents. The basic financial motive is to insure that heavy research and development costs actually result in future sales and assets, justifying the expenditures. Achievement of this objective need not involve patents, but there are companies with scientist executives and non-scientist directors which do emphasize the patent route. Thus, some heads of small research-based firms grant in conversation that, if and when they succeed in developing continuously marketable products and especially if they then need to seek outside financing, they will have to take more interest in patent protection.

When a firm succeeds in developing or acquiring a product with a continuing market potential, the advantages of patent protection become obvious. Such a firm, of course, tends to be somewhat larger and is also more likely to have outside financing, even a stock market listing. The product need not be a mass-production item; the significant criterion is whether or not there is a continuing market. (Some non-consumer items for laboratories, hospitals, or research establishments are illustrations.) Firms which have succeeded in launching products on the market are likely to speak of the necessity of "earning a monopoly" as a basis for their growth and for recapture of development costs.

In several instances, the producing firm is not the one having patent protection. Thus, large firms developing products not completely suited to their own manufacturing programs sometimes license smaller firms. In such cases, the smaller firms are assured only that a limited number of others will be allowed to enter the field. They also obtain benefits from the research facilities of the larger firm, facilities they could not themselves afford.

# Foreign Licensing*

J. N. BEHRMAN, Principal Investigator

SUMMARY

THE PROJECT ON FOREIGN LICENSING has received a substantial portion of the mailed questionnaires from respondents. On the basis of those already returned, we have made an examination of the characteristics of licensed rights. They relate to the product involved, some intangible assets of the company, and the role which the product or process may play in the economic and commercial growth of the foreign country.

We have also analyzed the responses to a question on the desirability of establishing an agency within the Administration to clear licensing agreements. A brief report on this question is given here.

## NATURE OF THE STUDY

PROJECT NO. 5A was conceived as a study of the relation of American patents, trademarks, and techniques and American-owned foreign patents and trademarks to the practice of foreign licensing. Obviously, U. S. patents and trademarks are not enforceable abroad against infringes, but they are usually the basis for Americans filing and registering in foreign countries. And it is only after the foreign rights are obtained that the U. S. company can license the use of these rights by foreign firms. Thus, foreign licensing is a direct outgrowth of the U. S. patent and trademark systems.

It was immediately found, however, that the subject of licensing could not be restricted to patents and trademarks but had to encompass the international transfer of technical know-how also since it most frequently accompanies a patent license and sometimes is important in supporting a trademark license. The investigation has thus encompassed transfer of various industrial property rights from Americans to foreign companies under license agreements.

The initial study has been restricted to the American side of the picture, for only by limiting its scope could the investigation be completed within a reasonable period of time. A full-scale study would require examination of foreign patent and trademark systems, legal protection abroad, commercial and financial regulations, foreign taxation, cross-licensing, and governmental attitudes toward licensing. It is hoped that studies of these aspects will be undertaken by scholars in foreign countries. Continuing research is desirable on the various patent and trademark systems of the world and their coordination through international conventions.

* This is a research interim report on *Project 5a*, **Relation of American Patents, Trademarks and Techniques and American-Owned Foreign Patents to Foreign Licensing.** Mr. Jerome Jacobson, Washington economist, is Consultant for this project.

In carrying our investigations forward, we have not been able to rely on secondary source materials, for the literature on the subject is sparse. We have had to gather new data and to ferret out information through interviews and questionnaires directed to corporation and government officials. Although we have uncovered a substantial number of articles on the subject, they do not deal with all phases of foreign licensing of interest to us, and many of them are duplicative. A bibliography is attached in Appendix I of this interim report.

### QUESTIONNAIRE RETURNS

In order to delineate the major problems surrounding licensing abroad, we interviewed some 65 companies in the United States concerning their experience. This procedure enabled us to concentrate our attention on the most significant problems and those which were faced by the majority of companies within an industry. That is, specialized problems, relating only to one firm or to special situations, were isolated. From this categorizing of the various aspects of foreign licensing, we were able to design a questionnaire for distribution by mail to a larger number of firms—nearly 400 in all. This distribution was also considered a sampling, for we made no attempt to canvass the entire business community or to "structure" the sample in any way save that of taking names of fairly large-size companies which we had reason to believe would be so widely engaged in foreign operations as to have some licensing arrangements abroad.

While not all of the questionnaires have been returned—we phased them to be sent over a period of several months—the response has been satisfactory. Replies have already been received from over 25 per cent of those questioned. The questionnaire is reproduced as Appendix II of the present report. The last two questions relate to the questionnaire itself, requesting guidance for its improvement. It was hoped that phasing the mailing would permit improvement of the questionnaire as we went along. However, fewer than 15 per cent of the respondents made suggestions for improvement, no two of them the same, another 15 per cent stated that the questionnaire was well adapted to its purpose. The remainder failed to reply to these two questions. We decided to keep the questions unchanged, maintaining a maximum of comparability among the replies.

While it would be misleading to attempt to draw conclusions from the number of questionnaires so far returned, or even to attempt *firm* conclusions from the final number we shall receive, we can now set forth some common viewpoints with their supporting reasons. It was reassuring to hear an official assert that his company's experience is hardly generalizable in the area of licensing and then to note during the interview or on examination of the questionnaire that the experience did fit a pattern for the industry or resemble the program of a firm in another industry having a similar policy approach.

In this interim report we have drawn from responses to several parts of the questionnaire. In Part I, rather than follow the specific questions of the questionnaire, we have re-arranged the answers in order to analyze what seem to be the most significant characteristics of the proprietary rights licensed. In Part II, we present responses to a single question on a proposal to clear licensing agreements with a new government agency in order to give the flavor of the information being gathered. All interviewed officials and all respondents to questionnaires have been assured that their replies will be kept strictly confidential. Therefore, illustrative experiences are not attributed to any company or official unless taken from previously published sources.

## I. CHARACTERISTICS OF LICENSED RIGHTS

The diversity of respondents gives us the opportunity to set forth a tentative picture of the characteristics of an American company's assets (patent, trademark, and know-how) that make licensing attractive to a foreign firm. The field of licensing is not restricted to any given industry or any given size firm. A large variety of products, industries, processes, and kinds of know-how are exchanged under licensing agreements. Nevertheless, from the empirical research done so far, certain common features stand out as characteristic of the product, process, or trademark licensed by American companies. These characteristics relate (a) to the product itself, (b) to intangible assets of the company, and (c) to the role which either the product or process may play in foreign economic and commercial growth.

### A. PRODUCT CHARACTERISTICS

#### 1. *Prior Acceptance of the Product Abroad*

Many firms feel so strongly the necessity of a thorough market test of the product to be manufactured abroad that they license only after successful exporting. While direct sales to foreign countries do provide an idea of the acceptability of the product by customers abroad, they are not an adequate test in all instances. Some firms take as evidence the sales of other companies (either U. S. or foreign), believing that they need merely to introduce a new brand or quality or style variation through a licensee. Others have found that the establishment of an export organization is too costly a way of obtaining a test of the foreign market, while still others have decided that a foreign distribution agency may result in a smaller volume of sales than manufacture and sale abroad, giving the impression that the product would not be readily accepted. In some instances, the lower costs of production abroad have been precisely the difference enabling the market to absorb the product, whereas the costs of production in the United States plus export costs were prohibitive.

Prior acceptance of the *American* product is at times impossible to obtain. It is within the experience of some companies that some products and processes which they develop in their research are suitable for the American market but not the foreign market. The same phenomenon occurs in reverse, with some products and processes fitting better into the economies of the less industrialized areas of the world than into the U. S. market. In fact, it has been found that many products and processes used today in America are too advanced for use in many of the developing countries. Processes and products common in the United States 10 to 25 years ago are often appropriate. Some U. S. companies have found it uneconomical to maintain an American plant producing products solely for the foreign markets, while machines and techniques counted as obsolete in the United States can find profitable use abroad under licensing arrangements.

### 2. *Adequate Sales Volume to Support Foreign Manufacture*

While it may seem unnecessary to observe that one of the requisite characteristics of licensed products is an adequate demand abroad to support manufacture, the point must at least be stated in order to avoid the impression that any product accepted abroad can be successfully licensed for foreign manufacture. For example, firms selling heavy capital equipment have found ready markets for their products, but the volume sold in any one country may be so small that manufacture would be highly unprofitable.

### 3. *Adaptability to Foreign Market Demands*

Some companies have found that an additional important characteristic of their product is that of adaptability to changing needs or different demands abroad. An experience of National Cash Register is illustrative: Egypt has recently entered into the strong surge to nationalism which is sweeping the Middle East and Asia. The drive to independence has been expressed pointedly in the use of native languages, and it has extended into the procedure for record-keeping. The Egyptians have taken pride in using Arabic for keeping records and steadfastly refuse to use more efficient systems. The president of National Cash Register has stated that "Out of respect for this attitude, we are making bookkeeping machines for Egypt which speak mathematical Arabic."[1] A complete re-design of the machine was necessary because of the fact that the Arabic language reads from right to left, and Arabic record-keeping entries are made the same way. Additional complications arose because business uses of Arabic language required 72 characters or variations of characters.

The shift in demand for the National Cash Register product came after the English-language machine had been on the market. Adaptation has been found necessary, however, to get some products into the foreign market initially—for example, different size motors in electrical equipment, different size air conditioning units for the rooms or windows in European or Latin American homes and offices, different size or capacity equipment for automobiles, etc. In several instances, as with NCR, the change has been so significant as to involve a re-invention of the product; such has been the case also in re-designing heating equipment for milder climates and in re-designing power equipment for hydraulic control when electrical current is a problem.

The desirability of adapting the product before writing the licensing agreement is pointed up by the experience of one firm which accepted the licensee's analysis of the foreign market and licensed its American product as it stood. The licensor's

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[1] D. H. Fenn (ed.), *Management Guide to Overseas Operations* (New York: McGraw-Hill, 1957), p. 69.

competitors in the United States held off for a time until a more thorough examination of the market demand could be made. The initial licensor found he had licensed the wrong type of product and had a licensee tooled up to produce an item facing insufficient demand. Other American firms stepped in with the right adaptation and licensed it successfully. In this case, the ideas of the licensee were unreliable; but, in other instances, American licensors have profited from the experience of the licensee and his familiarity with market conditions, and his views on changes required in the product.

### 4. *Assembly and Service Abroad*

Some firms have found that licensing is not prohibited merely because the market abroad may not be adequate to support manufacture by a licensee. If production costs can be kept down by manufacturing all production within the United States, licensees may be established to assemble and service the product. This procedure also retains know-how secrets with the licensor since only sub-assemblies, testing equipment, and assembly techniques are sent to the licensee.

In some instances, the licensee has become proficient enough and the foreign economy sufficiently developed to produce some components abroad. Foreign governments have occasionally insisted that some production be carried on by the licensee or that some of the components be purchased in the country of the licensee. The possibility held out to the licensee that he may be permitted to manufacture a component also has been a stimulus to his efficiency and improvement in his technical skill.

Whether under an agreement permitting only assembling by the licensee or not, some American firms have found that a considerable demand for servicing of their complex products can be met satisfactorily through licensing a foreign firm to provide it. Such a licensee has been found quite capable of acquiring the required skills for servicing, and the arrangement has been less costly than establishment of a direct service agency.

### 5. *High Quality Product*

From evidence gathered to date, there seems to be a general impression that a high-quality American product will support a more profitable licensing arrangement than a poor-quality product. Apparently, foreign buyers expect the American product to be of high quality, and its performance must stand up. In some instances, the only way in which the U. S. company could beat foreign competition was through providing a better product. The experience of MacGregor Instrument Co. is a case in point. This company entered the surgical instrument field in England before the war and has retained its leadership because it provided "a high degree of quality that the other manufacturers could not equal, and the British surgeons were willing to pay a high price for it." The president of the company has remarked that they have been able to hold off the competitive drives of both the Germans and the Japanese because "both of these countries are missing essential ingredients:

> During the war, the German industry remained stagnant and made no technical improvements. Surgery has changed greatly in ten years—even in five years. The instruments the Germans are making now are the same design they turned out before the war, and they are outdated.
>
> The Japanese figured that the way to get into the market would be to cut the price. However, they failed to realize that surgeons are dealing with human lives, and price is not an important factor. Therefore, the Japanese are missing the boat by producing cheap instruments, which are not popular abroad.

Mr. MacGregor has been so impressed with the advantage which quality has given his overseas operations that he lays great stress on making certain that the *licensee* maintains high quality also:

> Product quality, then, is an essential feature of our success—and this holds true of other small business firms such as ours. Once a company finds a manufacturer overseas who is ready to do business and sees eye-to-eye with the American company on quality control, it should give the manufacturer all the help it possibly can —tools, drawings, blueprints, gauges, and complete technical information. The temptation to keep any idea secret *must* be resisted. Here is a place to apply the Rotary Club motto, "He profits most who serves best." By giving every assistance to overseas associates, a company paves the way for a successful business and assures the security of future profits and royalties.[2]

These same observations certainly apply in the pharmaceutical field, in electronics, heat transfer equipment, steel, radio equipment, etc. It may be concluded, then, that low quality merchandise will be more readily produced by foreign firms on their own or that exporters in third countries can take advantage of slipshod methods of production or of low-grade materials, but the American licensor will probably profit more if his produce can stand out in the foreign market as one of high quality.

### 6. *Item Fitting Into the Line of an Established Firm Abroad*

Some of the above product characteristics become less important if the potential licensee already has an established line of products into which the American item will fall and fill an important gap. Though the example is a reverse one involving a German licensor (Braun) and an American licensee (Ronson), the recent introduction of the Ronson electric shaver is illustrative. In the case of Ronson, the firm already had a line of products which would lend itself readily to the introduction of a shaver—which it did not at the time have. This type of product had already been accepted in the U. S. market, and therefore no export test was necessary; in fact, had export been tried under the Braun name, it would undoubtedly have been a failure, for it was Ronson which had a revered trade name. To take advantage of the Ronson prestige in third areas, the Ronson-Braun agreement involves the purchasing by Ronson of some $1,500,000 of Braun-made shavers each year for 10 years for sale under the Ronson label in other countries of the Western Hemisphere.

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[2] Fenn, *op. cit.*, pp. 85-86.

This same situation has doubtless occurred in the radio equipment, television, kitchen appliances, household gadgets, and other lines.

### B. COMPANY INTANGIBLES

American companies have found also that they have assets other than products which may be licensed or which affect the desirability of their products when negotiating with potential licensees.

#### 1. *An Established Reputation Abroad*

In a large number of instances, the American companies have been approached by the foreign company which wishes to obtain a license. The potential licensee's interest has been whetted by the reputation which the American firm has attained either through exports of the product under consideration or of other products in the U. S. line or through its industry standing in the U. S. or third countries.

The American company's existing reputation is highly important in attracting potential licensees also when the licensed asset is know-how rather than a patent or trademark. The reputation of the licensor rests in this instance upon the use of the most advanced techniques, the scope of his research and development program, the extent to which he makes the results of his research known (e.g., through trade journals), the extent to which he provides licensees with the latest techniques, and finally the performance of his licensees in other countries.

If the potential licensee is in a country where no licensees of the American firm presently exist, he will be more eager to bargain if he feels that licensees in other countries have benefited substantially. In other words, the American firm's reputation rests strongly upon the "company it keeps." This is one reason why most licensors are extremely careful in choosing their licensing partners.

#### 2. *A Revered Trademark*

In many countries, American brands are a mark of distinction—carrying a connotation of workmanship without a peer. Being the first on the market and/or the best available product, American names have sometimes been made into a new foreign word; for example, Frigidaire and refrigerator meant the same thing in many foreign languages. Being a mark of quality, the American-named product will generally outsell products of the native country where the difference in price is not substantial. Foreign manufacturers, therefore, seek to be a licensee under American trademarks when these marks have become well established; the American mark means more sales or less sales-resistance and therefore is well worth a royalty payment. Even where the trademark itself is not important, the licensee may find it highly profitable to be able to state that his product is "made under license from ABC Corp., Chicago, Ill., U. S. A." since it will enhance the prestige of his product.

Some companies have found, however, that their mark was not carefully enough chosen for use abroad, for, when first selected, foreign business was not contemplated and the appropriateness of the word abroad was not taken into account. Thus, some marks have a different meaning in a foreign tongue; also the double-meaning or meaning-suggestion of a mark in the United States may not "come through" abroad; for example, association with a famous individual or geographic or industrial area may not stir the foreign buyer. In addition, some companies have found that their name is difficult to pronounce in a different lingual system; if so, the seller may not readily recognize the customer's request. To meet this problem marks or names have had to be spelled differently abroad, such as substituting an "f" in South American countries for the English "ph." Finally, political circumstances alter the mark's value—such as the situation with Japan which caused the Eagle Pencil Company to change its mark from Mikado to Mirado.

Trademarks are often counterfeited abroad, and it may take considerable pains on the part of the American company to prevent such action, especially when laws abroad are loosely drawn or administered. Or, the mark may be readily simulated—e.g., YALF has been found on locks packed similarly to the YALE lock; VYCKS and VICHS have been placed on packages similar to VICKS. Such actions must be guarded against else the value of the mark to the licensee is greatly reduced; yet the cost may be considerable—the following instance is illustrative:

> The manufacturer of a well-known American inhalant is having considerable difficulty in India, where someone is making a virtually identical copy of the inhaler tube, and is peddling it in the bazaars without taking the trouble to put any medication at all inside the tube. Irate customers return the product, which finds its way back to the Indian representative of the American company, who has instructions to replace the empty counterfeit with the genuine article in order to preserve the good will of the trademark.[3]

To protect the value of the mark, not only must the trademark be carefully used by the licensee, but its use by all licensees must be watched over. While it is not likely that two licensees using the same mark for the same product will exist in any *one* country, American companies have licensed several foreign companies in one country to manufacture *different* products and have extended to each the privilege of employing the licensor's mark. Yet, no licensee is going to be willing to pay royalty for use of a mark which he thinks may be depreciated by another licensee, or which he thinks has been so widely and carelessly used as to become a generic word.

Only if the mark is carefully protected through a valid registration, through proper use, and through close control of quality will potential licensees seek to obtain the privilege of using it.

### 3. *A Strong Patent Position*

Many licensors have found that without a strong patent position their bargaining power in negotiating an agreement is weakened, for strong patents form the umbrella under which rights may be extended, markets designated (though not in a positive

[3] *Trademark Management* (New York: The United States Trademark Association, 1955), p. 116.

fashion), and know-how necessary to production protected. The patent also provides a convenient yardstick for setting the duration of the licensing agreement.

While the company's reputation and its trademark depend largely upon actions over which it has considerable control, the strength of its patent position depends only *partly* on its own actions. Its own actions consist initially of the difficult task of deciding which inventions to patent abroad and in what countries and how long to continue paying the fees when protection is slight and no licensing has occurred under the patent.

But, even with diligence and some foresight, it is not easy to obtain adequate protection in some countries. For some companies, patents in their field are expiring or were initially obtained in only a few countries and it is now too late to file; thus, the general patent position is weak. For others, world-wide patent protection would be more suitable, but the cost would be prohibitive not only in filing but in the complex business of maintaining them and preventing infringement, especially where judicial protection is undeveloped. Many a firm has decided to take a weaker patent position on the ground that the chances of using the foreign patents in the future are slight; however, some have found that they have missed a grand opportunity or two.

### 4. *Valuable Know-how and Continuing Research Programs*

Many licensors have found that the principal asset which the licensee wants is know-how. The licensee may want the added protection of a patent or the prestige of a trademark, but without know-how, the patent may be valueless or the trademark depreciated through poor quality production. When patents are weak and competitive products are already available abroad under strong trademarks, it is still possible for American companies to profit from the sale of their Information assets. In some instances, all that the American firm has is its know-how; such is the case in construction of manufacturing or processing plants. For example, the construction of oil processing plants involves building into the plants the production know-how of the constructing firm; this know-how is sometimes licensed on a royalty basis in addition to the construction fees.

Unless the foreign company is interested in a "one-shot" purchase of a given lump of knowledge, he is most likely interested in the continuing research programs of the licensor. He will check on this program through publication of the licensor's developments in trade journals and through the extent to which the licensor himself uses the latest techniques. The licensee, therefore, is interested in the rate of development through the initiation of new inventions and processes.

Licensees are also interested in unpatented and non-secret developments in companies other than the licensor. A service which points out new ideas and techniques to them and even helps them to purchase new equipment is sometimes used to increase the productivity of the licensee. Some licensors, therefore, consider it of utmost importance to make as much known to their licensees as possible about their technical advancements (and those of others which are published). In this way, productivity is raise and and potential licensees are more capable of assessing the desirability of attaching themselves to the licensor. Performance becomes the best advertisement.

### C. FOREIGN ECONOMIC CONDITIONS

Although American businessmen would undoubtedly rather operate abroad without interference from foreign governments, some have taken it as a datum that foreign governments are going to play an important role in the development of most of the countries of the world. These governments are trying both to cut down on heavy drains of foreign exchange and to develop domestic self-sufficiency in the interests of national welfare and security. It has been reported that "any new business coming into England must satisfy the Government authorities that the new enterprise is in the national interest—that is, it must either produce exports or it must introduce into England a new product or thing which will be more efficient and contribute to the national well-being." Some American firms have decided that if they don't license abroad or manufacture there, a competitor at home or abroad will do so; somehow an indigenous industry will develop in those items considered essential—especially military items and in countries where the United States has military aid programs. Once that happens, the chances of continuing U. S. exports of those items are materially diminished. Where goods are clearly essential to a nation's welfare or security, some American companies have considered it intelligent to manufacture the U. S.-type product abroad, directly or under license.

U. S. Government interest in foreign economic or military conditions has itself changed the attractiveness of licensing. There have been several instances in which the U. S. Government has enhanced the returns for both the potential licensor and licensee by placing a substantial order on condition that production would take place in the foreign country. Here, indeed, was a substantial incentive to a licensing deal. Such incentives may be reproduced by those arising in atomic developments. For example, an integral part of the arrangements covering the sale of American reactors abroad is that a substantial part of the equipment is to be made abroad under license. Some American licensors are, therefore, assessing their product and foreign activities in the light of their dovetailing with governmental planning abroad and U. S. interests.

#### 1. *Product Included in the "Private Sector" of Foreign Government Plans*

Many governments have adopted five-year plans or similar projections of desirable economic development, but the economies are not completely blueprinted. Some sectors of the economy are set aside for government operation, others remain under close control, and another is given over to individual determination—the last is often known as the "private sector." Obviously, more freedom of action is given in this area to the individual entrepreneur, and most American licensors apparently would prefer to license if the product or service fell within this sector.

It has, therefore, become a part of product analysis by some companies when considering licensing to examine the economic plans of the country in question to see what sector the item falls into. For example, in India, the private sector includes production in the following industries: iron and steel, aluminum, automobiles, motorcycles, locomotives, industrial machinery, textiles, cement, sugar, paper, chemicals, fertilizers, sewing machines, electrical appliances, plastics, and shoes.

This is not to imply that the private sector is without regulation; rather, it is an area in which the government gives assurances that nationalization will not be imposed and that individual contracts will be upheld. It should be noted that in the case of India there are few *luxury* products which are given the green light. This restriction applies also to licensing but more so to imports. Local manufacture is especially favorable for some "incentive goods" such as soft drinks, liquors, and cosmetics.

Also, the fields in which licensing is permitted are sometimes restricted to those in which the competitive picture will not be altered significantly. Such considerations are not always reflective of mere "lever-pulling" by foreign government officials, for their economies are faced with different and more difficult problems of resource use than is our own.

Some licensors hope and anticipate that the private sector will widen in the future, as more and more experience is gained abroad with American-type capitalism. Some officials assert that so long as the basic customs, traditions, and tastes of the foreigner are respected and the U. S. companies maintain their bent toward production rather than high-profit-rate exploitation of the foreign market, more opportunities for U. S. business abroad *will* be opened up.

### 2. *Product Which Will Expand Exports or Reduce Imports of Foreign Country*

It must not be forgotten that the United States is one of the few countries which does not have to concern itself with its international balance-of-payments position or the potential drain on its foreign exchange reserves. *Other* nations have to be constantly on guard that they do not import more than they export. Because of this situation, governments frequently give greater privilege to production of goods at home which will either substitute for imports or expand exports. In analyzing their product for licensing, a few companies have attempted to determine whether it can make a significant contribution to the balance of payments of the licensee country.

Licensing has been found profitable in the following situation. Suppose that import regulations and currency restrictions make it difficult for a U. S. manufacturer to export to countries B, C, and D and that local manufacture is no solution there; that is, there are no logical candidates for a license and the internal market is not large enough to support production of the commodity. In such a situation, some companies have decided to license the manufacture of the product in country A—even though an export market exists there which is profitable enough—and use it as a base for export to countries B, C, and D. Particularly if country A has a "soft-currency," B, C, and D will have little difficulty in importing from there. For example, French francs, German Deutschemarks, or Italian lire are easier for Latin American countries to purchase with than are dollars. Hence, it is sometimes worthwhile licensing production in country A because it has a drive to export and because it has an easier entry into third markets.

In the case of a process patent, or technical know-how, the same considerations arise. If the licensed asset relates to exportable items or to import competing goods it will probably be received officially with open arms.

### 3. *Product Not Itself Reliant on Extensive Imports for Manufacture*

If production of the licensed product would require the importation of larger amounts of dollar goods, or even imports in general, the license agreement may receive a cold official welcome. The British government has, on occasion, refused to approve licensing agreements because the combination of royalty payments and imported materials would have caused a net drain on foreign exchange reserves.

A product which utilizes more of domestic raw materials or processes, or which extends the degree of manufacture and thereby raises the value of exports of the product, will be much more favorably received than one which does not. Some companies have found it to be just good business to manufacture where they formerly bought raw materials, given the high transportation costs. Also, any process or technique which helps to reduce reliance of the foreign country on imported materials or equipment is usually welcomed abroad.

By the same token, where capital formation is low, licensing of a product or process which helps form domestic capital by inducing private investment or by inducing savings to stay at home will be sought after as a means of accelerating economic growth.

### 4. *Product or Technique Which Will Increase or Maintain Employment, Especially in Depressed Areas*

Raw materials and capital are not the only factors which foreign governments wish to see employed more fully. There are many countries, particularly the underdeveloped areas but also including Italy, which have underemployment or unemployment. "Underemployment" means that labor is redundantly used and that productivity could probably be maintained or increased if fewer laborers were on a given job. For example, it has been estimated that the lack of employment in India is so great that the textile industry maintains 10 employees for every one it really needs. (Parenthetically, low wage rates are of no advantage to an industry in such a situation.)

Some licensors have met a better reception when it was shown that the product or process would reduce unemployment in the foreign country or would help drain off inefficient labor from other pursuits. But if, in the same areas, the product or process would *displace* low-cost labor, it has at times been rejected summarily if not angrily. One corporate official has reported that upon asking an engineer consulting with the American Embassy in Italy whether American small manufacturers would be welcome in Italy, the reply was an emphatic "No," not if they intended to install labor-saving machinery. The engineer added: "In one plant where I did some work we designed a machine that would produce three pieces, where only one had been made before. The development of this machine put five men out of work and I was nearly lynched."[4] Contrarily, the engineer stressed, if American know-how can bring in equipment and processes which will *create* employment, it will be most welcome in Italy as well as in Spain and France.

While there is no general unemployment in Europe, there are pockets of unemployment which threaten the economic health of the nations. For one American firm that established manufacturing facilities in two depressed areas of Scotland, the deciding factor was the availability of trained but unemployed workers. Not only was the manufacturer benefited by his choice but the economy of Scotland was benefited twice by its selection as a location and by the settling of the plant in an economically depressed area. Few would urge that American businessmen turn philanthropic or adopt Keynesian ideas to lift up depressed foreign areas. But, some have found it to their own advantage as a result of low costs to increase economic activity in such areas. The result, a happy coincidence of benefits, is appreciated by foreign governments.

### 5. *Technique or Process Which Saves Skilled Labor*

It is not only or even mainly labor-*using* technology which will be advantageous to foreign countries. There are foreign nations which *do* need labor-using techniques, since they have a relative abundance of labor. But some of these, and others, require labor-*saving* machinery and techniques—particularly if they save *skilled* labor. The relatively skilled laborer is not found in abundance in any nation—not even in the United States. It is partly because U. S. enterprise has found how to build the skill into the machine that American productivity has been increased so greatly. This type of process or know-how will be greatly needed in almost all countries abroad, but especially the newly developing countries.

Some licensors have also found that a licensing arrangement which increases the *number* of skilled labor is more readily accepted. Such a product or process offers diversity of employment and encourages the drive to industrialization which many nations are seeking.

In sum, American licensors have found that the attractiveness of a licensing agreement to foreign firms is directly affected by the acceptability and adaptability of the product to the foreign market, by the intangibles which their companies have to offer along with (or, in the case of a trademark, instead of) the product; and, by the economic plans and conditions of the foreign country affecting the appropriate location for manufacturing, and the role for the product, process, or know-how.

## II. LEGAL UNCERTAINTIES

One of the more pressing problems facing a U. S. company entering into licensing abroad is that of the extent to which the parties to the agreement may restrain the actions of each other, especially in the market. The problem is acute to some corporation officials because of apparently stringent interpretations of the application of the antitrust laws to foreign operations.

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[4] Quoted in Fenn, *op. cit.*, p. 85.

Although the pilot study encompasses several of the legal aspects of foreign licensing, it may be of interest to indicate the response of the companies interviewed and questioned by mail as to one proposal in the legal field aimed at removing some of the uncertainty. This proposal was made in 1955 before a Congressional Committee by Stephen Ladas, in his capacity as Chairman of the Committee on International Protection of Industrial Property of the International Chamber of Commerce. He suggested that it would be desirable for some Government agency (not a prosecuting agency like the Antitrust Division) to be set up where an American business "may get a ruling as to whether or not the kind of agreement it proposes would be legal or not."[5]

In view of the fact that this proposal was formally placed before a Committee of Congress which was set up to determine whether the antitrust laws should be revised, we decided to inquire as to the attitude of companies licensing abroad toward the establishment of such an agency. While the results to date cannot be declared conclusive, the reasons given may be suggestive to those interested. A more definitive study would require not only a larger number of officials to be interviewed or questioned, but it would also require that the proposal should be more closely defined and some of its administrative aspects clarified; it would require, in addition, a more widespread discussion of the proposal and a breakdown of the attitudes of officials as between executive personnel and legal counsel, for their views are often diametrically opposed even within the same company.

Out of the companies so far interviewed and questioned, only a small fraction (less than 5%) stated that they had no opinion or were uninterested in the problem of legal uncertainty and the proposal for a clearing agency; some few questionnaire respondents failed to reply to the question concerning the establishment of the agency and gave no reason for failing to answer. Of the remainder of those interviewed, the majority were emphatic in their response—pro or con. Many of those who stated opposition to the plan had not heard it detailed before, but were immediately opposed from the standpoint that government intervention was itself undesirable.

Out of the entire number of those companies replying to the question, the responses were on the order of 4 opposed to 1 in favor of setting up the agency. There was a much larger number of those opposed who failed to give any reason for their *opposition* in the written questionnaire than of those who indicated *approval* without a stated reason. However, these numbers were an equal percentage of each of the pro and con groups; that is, about 30 per cent of each group gave no reasons for their stand.

The most frequently mentioned reason for support of the establishment of a clearing agency was, obviously, that it might help to remove some of the doubt concerning antitrust interpretations—which, of course, is the basic purpose of the proposal. This purpose seemed so obvious to some that they wondered how anyone could

[5] "A Study of the Antitrust Laws," *Hearings Before the Subcommittee on Antitrust and Monopoly of the Senate Committee on the Judiciary*, 84th Cong., 1st Sess., pt. 4 (Foreign Trade), at 1716 (1955).

be opposed, particularly in principle, though they recognized that the agency's officials might tend to be negativistic in doubtful cases and that past experience with government agencies raised some doubts as to its efficient and realistic administration. While holding the same doubts, another group considered that prevention is easier than cure in the area of antitrust and that it would be less painful to be warned away from a doubtful deal than to enter it only to come under investigation by the Justice Department. Still another group considered that the establishment of a clearing agency would be useful *only* if its clearance could be made binding on the Government, which most respondents argued it could not.

If those supporting the proposal had some doubts as to the strength of their position, those opposing it did not seem to. The most frequent reasons for opposition were that there was already so much interference by Government in business that any more would kill off incentive and that the laws were already specific enough for competent legal counsel to handle. The interference problem was tied up with a general business approach which called for a "hands-off" policy by the Government; in the area of foreign operations, where risks are already magnified, these officials considered that the added uncertainty of the attitude of another government agency would only deter a desirable expansion of foreign business. This view was usually voiced by executive members of the company.

The second major view was expressed mostly by legal counsel; these officials argued that their group was just as competent to interpret the antitrust legislation and decisions as any agency officials who were not themselves given the power to make binding judgments. Since the officials of the clearing agency could only give an advisory opinion, in the light of what they *thought* antitrust decisions meant, and could not give immunity against future changes in court interpretations or against future (unconsidered) contingencies in the operation of the agreement, the lawyers concluded that they would just as soon take their chances with the best private counsel that they could obtain. While executives, in the main, desired either freedom of action or certainty of the legal position, the lawyers emphasized the normal uncertainties of legal aspects of business and the necessity of good judgment but stressed the lack of feasibility of obtaining immunity through clearance.

A corollary of the above view was the opinion that the Department of Justice already has all the authority needed to give advisory opinions on agreements. Some companies have even made it a policy of informally submitting their agreements to members of the Justice Department for an opinion; the reply was frequently not even in writing, but it was satisfactory to the licensor to have an informal view of one of the Department's officials. This practice was employed by only a small fraction of the companies interviewed and apparently by none of those replying to the written questions.

A corollary of the first view, stressing interference, was the opinion that compliance with the procedures which would probably be set up by the agency would require so much delay and corporate expense that negotiation of an agreement would be undesirably protracted. Also, the view that the agency would not likely be "realistic" or "practical" in administration of its authority is a reflection of the "non-interference" position; however, it would seem to permit government "interference" if the agency were more "sympathetic" to business problems and policies and more understanding of the fact that businessmen are not ogres, shysters, or practitioners of fraud. In this vein, some asserted that the Government takes no authority over domestic licensing and should treat foreign licensing similarly. In addition, some argued that no new agency should be set up in view of the need for governmental economy, and others asserted that any such agency would be subject to political influence in its attitude toward business policy.

These views were similar whether the plan envisaged compulsory submission of agreements to the new agency or merely voluntary submission. The pressure would, most agreed, be on the company to submit its agreements so as not to appear to be hiding anything. However, most were more strongly against compulsory use of the clearing agency than against an agency which would review agreements at the volition of the company.

While some argued that domestic and foreign licensing should be treated similarly, there was another group which argued from a different position. One asserted that a more liberal judicial policy was required for foreign operations and that it should be so clearly expressed that any businessman could understand it. They seemed to think that restraints imposed by the Government were already too great and that a more liberal policy toward foreign operations was needed to obtain the expansion which government officials stated was desirable—at least, voiced by the State Department. Some considered that the State Department expressed views in conflict with the actions of the Justice Department and that a clear expression of government policy would aid the businessman immeasurably.

A more precise suggestion was made by some who asserted that in their view there should be no antitrust restraints on the U. S. licensor at all. While it would take considerable review of the antitrust decisions and interpretations to argue this view—time should be taken to do so in a larger study—it may suffice here to indicate that the basis for this view is that foreign business is not justifiably under the antitrust legislation so long as it is not carried out in any direct way within the United States. That is, so long as the business under the control of the agreement is between a foreign licensee and a third party in the second (or a third) country, the jurisdiction of the U. S. courts should not extend to that transaction nor to the agreement covering the distribution of returns from it between the licensor and the licensee.

This last proposal concerning the application of antitrust legislation to foreign business raises a host of problems, some of which we will examine in the pilot report and others which we will only outline, leaving them for a still larger study if warranted.

The above review of the response to one of the questions on legal aspects of licensing abroad covers but one of the several legal problems which we are examining. Others relate to the reasons for exclusivity, the alleged impact of uncertainty on business policy, and the coordination of national policies on the restraint of competition. Still another group of legal problems surrounds the tax treatment of royalties and gains from licensing, and a third covers the treatment of foreign patent and trademark problems through the use of international conventions.

Besides the legal problems of foreign licensing, the pilot report is projected to cover also the basic motives for licensing abroad, a comparison with foreign investment, the problems of negotiation, the terms of agreements, accounting for costs and profitability, U. S. Government licensing and encouragements, and some of the broader theoretical and policy aspects of the transfer of proprietory rights abroad.

## APPENDIX I

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## APPENDIX II

### QUESTIONNAIRE

### ON

### THE RELATION OF AMERICAN PATENTS, TRADEMARKS, AND TECHNIQUES, AND AMERICAN-OWNED FOREIGN PATENTS TO FOREIGN LICENSING

STRICTLY CONFIDENTIAL

Date........................

Name and address of company:

..............................................................................

Legal status of company (corporation, partnership, etc.):

..............................................................................

Name of person completing questionnaire:

..............................................................................

Title or official position:

..............................................................................

FOREIGN LICENSING QUESTIONNAIRE

A. *Extent and Motivation*

1. What percentage of the items which you patented in the United States from 1945 through 1955 did you patent abroad? ........%
   What percentage of your American trademarks are registered abroad? ........%
   What are your reasons for foreign filing or registration? Please rank the following:
   ......protection
   ......possibility of licensing
   ......other (specify) ..........................................................................

2. Do you license foreign firms to use your trademarks? Yes.... No....
   Do you license foreign firms under your foreign patents? Yes.... No....
   Do you extend foreign firms any rights to your technical know-how (including trade secrets)? Yes.... No....
   (a) If yes, what is the percentage of your foreign registered trademarks that are currently licensed to foreign firms? ........%
   What percentage of all your foreign patents have you licensed to foreign firms from 1945 through 1955? ........%
   Which is more important to you as licensor? Please rank:
   ......patents
   ......trademarks
   ......know-how
   Why? (please comment) ..........................................................................
   (b) If you do not engage in any foreign licensing, please explain why:
   ..........................................................................

3. If you license abroad, how long have you been doing so? ..........................................

4. If the number of your foreign licensing agreements has increased since World War II, please rank the following types in order of their increase:
   ......those relating to patents
   ......those relating to trademarks
   ......those covering technical know-how

5. Please rank the following factors as they affected the expansion of your licensing activity:
   ......a policy decision of your company to become more aggressive
   ......a general expansion of commercial activity abroad
   ......increased interest on the part of the potential licensees so that they initiated the expansion
   ......other factors (please specify) ..........................................................................

6. What have been your principal motivations to licensing abroad? Please rank the following where appropriate:
   ......to obtain royalties
   ......to increase profits of foreign subsidiaries
   ......to obtain benefits of cross-licensing (or reciprocal licensing) arrangements
   ......to open up opportunities for obtaining future licenses *from* abroad
   ......to meet currency and trade restrictions abroad
   ......to aid economic development abroad
   ......to obtain other objectives (specify) ..........................................................................

7. Have you decided not to extend a patent or trademark license to particular applicants since 1945? Yes.... No....
   If yes, please rank the relevant criteria as they have applied in the majority of these cases:
   ......inadequate market abroad
   ......broad economic situation in the country of applicant firm (e.g., economic nationalism)
   ......political uncertainty in the country of applicant firm
   ......disagreement over the terms of the license
   ......integrity of executives in applicant firm
   ......reputability of the foreign firm (e.g., credit standing)
   ......U. S. taxes on foreign income
   ......foreign taxes
   ......risk of antitrust violation
   ......other (specify) ..........................................................................

8. In what ways does the U. S. Government encourage your licensing of patents, trademarks, or know-how abroad?....................................................................
   Do you think the U. S. Government extends sufficient encouragement? Yes.... No....
   If no, please comment as to what it might do:......................................
   In what ways have you been encouraged by foreign governments to license abroad?
   ............................................................................

B. *Legal Aspects*

1. Have U. S. antitrust and/or tax laws affected your foreign licensing? Yes.... No....
   If yes, please state whether they have reduced the number of licenses and/or changed the provisions of the agreements and why:..........................................
   Have they affected your licensing in any other way? Yes.... No....
   If yes, please state how and why:..............................................
2. Do you submit your agreements, formally or informally, to U. S. Government officials for an advisory opinion on the provisions? Yes.... No....
   If yes, to whom?..............................................................
   And, do you find these opinions helpful in revising your agreements before completing the negotiations? Always.... Sometimes.... Never....
3. Do you consider it desirable for the U. S. Government to establish an agency, or to provide specific authority to an existing one, to clear foreign licensing agreements with respect to antitrust laws? Yes.... No....
   Why? ..........................................................................
4. Do you submit your agreements to other governments whether or not their law requires prior approval? Yes.... No....
   If yes, what type of provisions are you concerned to get approved (i.e., exclusive, royalty, etc.)? ..........................................................

C. *Nature and Direction*

1. Are you a licens*ee* of any foreign firms? Yes.... No....
   If yes, what is the *ratio* of your current annual receipts from foreign licensees to your current annual payments to foreign licensors? Receipts : Payments ........:.........
2. Do you have financial interests in your licensees abroad? Yes.... No....
   (a) Do you have foreign subsidiaries? Yes.... No....
   Do you license them through formal agreements? Yes.... No.... Why?......
   (b) How many foreign licensing agreements are with wholly owned subsidiaries?...... How many with partially owned subsidiaries?...... How many with firms in which you hold less than a controlling interest?...... How many with firms in which you hold *no* financial interest?......
   (c) If your agreements are *only* with companies where you hold a financial interest, is this situation a result of a policy decision? Yes.... No....
   If yes, why?...................................................................
   (d) If your agreements are *only* with those in which you hold *no* financial interest, is this a result of a policy decision? Yes.... No....
   If yes, why?...................................................................
3. Please list, by countries (or regions), the number of foreign, unexpired licensing agreements you have which extend patent rights, use of trademarks, or access to know-how (including trade-secrets):

*Number* *Country (or region)*

4. Was the issuance of a patent by the U. S. Patent Office, which attests utility and advance in the art of the patented item, considered by the licensee as making the license commercially attractive?

   ......significantly

   ......moderately

   ......not at all

5. Do you have a standard licensing agreement, which may be slightly modified for particular cases? Yes.... No....

6. What is your general practice with reference to the following provisions of licensing agreements?
   (a) Is the duration for a period less than the life of the patent?...... for the life of the patent?...... or over a longer period?......
   In the case of trademarks, what is the usual period?............................
   (b) Is the licensee given access to all relevant know-how? Yes.... No....
   (c) Do the agreements provide for continuing rights to the use of know-how after termination of the agreement? Yes.... No....
   (d) Do licensees have access to all future developments in your research with reference to the licensed products or processes? Yes.... No....
   (e) Does the agreement provide for a return to you of improvements by the licensee in the licensed items? Yes.... No....
   If so, royalty free? Yes.... No....
   (f) Does the agreement provide for supervision and maintenance of quality? Yes.... No..... If yes, how is it accomplished: samples returned?.... foreign inspection?.... other? (specify)..................................................
   (g) Do you extend an exclusive right to manufacture abroad? Yes.... No....; to use? Yes.... No....; to sell?..Yes.... No....
   May the licensee sell outside his own country? Yes.... No....
   Is the licensee given rights under your foreign patents or trademarks in other than his own country? Yes.... No....
   (h) Please check the terms provided concerning compensation: ....down-payment (e.g., in the case of a transfer of know-how); ....fixed payments; ....percentage of licensee's sales; ....guaranteed minimum volume of sales; ....decreasing royalty rate over the life of the agreement; ....maximum royalty payment; ....other (specify) ..............................................................
   (i) Who protects (maintains and works) the foreign patent or trademark? Licensor?.... Licensee?....
   (j) Who defends the foreign rights against infringement? Licensor?.... Licensee?.... Both?....
   (k) Who assumes liability in event of infringements by licensee of another's rights? Licensor?.... Licensee?.... Shared?.... How?.............................
   (l) Do you have an "escape clause" which may be invoked in the event of future government objection to the terms of the agreement Yes.... No....

7. What types of current costs at home and abroad are related to your foreign licensing (e.g., research and development, etc.)?............................................
   (a) What percentage of your gross income in *1946* resulted from foreign licensing?....% from exports?....% from foreign investment?....%
   (b) What percentage of your gross income in *1955* resulted from foreign licensing?....% from exports?....% from foreign investment?....%

8. Do you believe that your foreign licensing has been profitable? Yes.... No....
   (a) What kinds of costs do you actually charge against your receipts from foreign licensing? ..............................................................
   Or do you consider all returns as net profits? Yes.... No....
   (b) Have foreign licensing receipts exceeded such costs annually? Yes.... No....
   (c) Are other additions to income, *related* to licensing, more important in calculating its profitability? Specifically, have your exports increased as a result of licensing, either through sales of components to licensees? (Yes.... No....) or of complementary products in the country of the licensee? (Yes.... No....)

(d) Would you employ a different method of calculating profitability of licensing? Yes.... No....
If yes, please specify:.......................................................

D. *Criticism of Questionnaire*

1. What questions should be asked which we have overlooked?

2. Which questions in the present questionnaire do you consider inappropriate in phrasing or in obtaining useful information? (Please indicate the questions by numbers.)

# Public Attitudes Toward the Patent System*

JAMES N. MOSEL, Principal Investigator

In December, 200 engineering students at The George Washington University were given the self-administered test on "Knowledge of the Patent System." This test, which grew out of interviews conducted on students at the University, aimed at their attitudes toward the patent system. A report of the project is in the first issue of the *Journal.*[1]

Analysis of these self-administered tests will be completed, leading to more revisions of the test.

Later 200 interviews will be done on a cross-section of the Washington population. It is expected that in March we shall have analyzed the findings and have reported on this project.

* This is a research interim report on *Project 6a,* **Public Attitudes Toward Patents, Trademarks, and Copyrights.** Miss Pauline Kartalos is assisting on this project.

[1] PTCJRE, I (June, 1957), pp. 159-167.

# Taxation and Patents

ROBERT B. BANGS, Co-Principal Investigator
JOSEPH P. DRISCOLL, Co-Principal Investigator

## SUMMARY

THIS INTERIM REPORT on an exploratory study deals with the effects of income and property taxes on patents.

The purpose is to pinpoint specific tax problems that involve patents and to gather data on these problems by interviews with corporations and individual inventors. Particular attention is given to the Federal income tax changes involving patents that were legislated in 1954.

The principal such change allows an individual inventor, or an investor in an invention not yet reduced to practice, to sell or license exclusively all substantial rights in a patent and be taxed on the proceeds as a long-term capital gain rather than as ordinary income. This treatment applies even if payment is received as a royalty over the life of the patent with the amount of royalty being conditional on the use or profitability of the patented invention. Before enactment of this provision (Sec. 1235 of the 1954 Internal Revenue Code) professional inventors were denied capital gains treatment and some patent royalties received by individuals were construed as ordinary income for tax purposes. Corporations are not covered under this new rule but may sometimes get capital gains treatment when patents are sold.

The report also deals with tax provisions bearing on research and development outlays because the majority of patents are now owned by corporations and many patented inventions arise from the research activities of corporations. Corporate research outlays are growing rapidly.

Section 174 of the Internal Revenue Code permits research and development costs to be expensed if they are of a laboratory nature. Previously no statutory rule existed and many firms were required to capitalize these outlays in their tax returns. The privilege of expensing research is available both to corporations and to individuals but not to individuals with whom invention is a hobby rather than a business.

In interviews with corporate officers we found most companies currently expense research and development costs wherever possible but have some uncertainty as to just where the limitations of Section 174 lie. Taxation was not considered a major factor in fixing research and development budgets but the effect of Section 174 is clearly to allow profitable corporations to share their research costs with the Federal Treasury on nearly an equal basis.

Because most corporate research is charged to expense, any patents resulting therefrom need not be assigned a high value. Our impression is that

many corporations assign only nominal values to patented inventions developed in their own laboratories.

Taxes also have a bearing on the terms of patent licensing and our interviews indicate a wide variation in licensing practice. Corporations apparently do not insist on exclusive licenses for patents they own, but they may require such a license to protect their investment in a product or process licensed from an outside inventor.

Licensing of foreign patents abroad brings many tax problems because of variation in foreign income tax rules. Although foreign income taxes are creditable against the U. S. tax, some companies avoid foreign tax problems by licensing for a figure net of tax. Income earned by licensing patents abroad is generally on a par with income earned from other business activity in foreign countries. One device to postpone U. S. tax on income from foreign business is to conduct this business through subsidiaries chartered in certain countries having favorable income tax laws.

The report also mentions that some patents may be objects of state and local taxes on intangible property and, when owned by deceased individuals, of estate and inheritance taxation. Valuation is a major element in these problems but analysis of them will require the accumulation of more data.

The entire report is merely a preview of a project still in process. Impressions based on limited interviews may require modification when more material has been gathered.

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THIS IS AN INTERIM REPORT on Project 7a—an exploratory study of the interrelationship between taxation and the processes of creation and use of patented inventions. The project was started in May 1957. Collection of data is not yet complete so this report is merely a preview of the final report to be submitted later.

Our concern in this project is not with patents as actual or potential objects of special taxation,[1] but rather with the effects which income and property taxes have on the manner in which patents come into existence, are transferred and licensed, and are employed as income producing assets.

### PURPOSE AND METHOD OF STUDY

Since this is an exploratory study, its aim is not to produce finished evaluations of the effects of taxation on the patent system and on the financial rewards of

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[1] In certain foreign countries annual fees or taxes are charged to keep patents in force beyond a minimum period. For example, in the United Kingdom, fees begin in the fifth year and rise thereafter. Under this system worthless patents lapse for nonpayment of fees. While this system has certain advantages in restricting the number of patents in force, appraisal of it properly belongs in a study of proposals for patent system reform. For further information on this subject see "Renewal Fees and other Patent Fees in Foreign Countries," 36 *Journal of the Patent Office Society* 827 (Nov. 1954).

inventors, but merely to identify problems and to examine them sufficiently to recommend whether they are deserving of more intensive research effort.

Our method has been to survey the available literature on patents and on taxation, chiefly legal and economic articles, court decisions, and administrative regulations,[2] in order to pinpoint specific tax problems that involve patents, and then to test the generality and troublesomeness of these problems by means of a limited number of depth interviews with business firms and individual inventors.[3] Such a method does not yield significant statistics on which to base reliable estimates as to the magnitude and nature of specific problems; it merely produces impressions and hypotheses that must be tested by more extensive interviewing or by mail questionnaires covering more representative groups. If the present study is extended beyond the exploratory stage, additional interviewing and mail responses will be needed to determine whether our initial impressions are supported or whether new hypotheses should be chosen and tested.

We are also not proposing to develop any recommendations for changing the tax treatment of patent proceeds,[4] but merely to find out in detail how existing tax rules work, whether they appear to bear inequitably or unreasonably on business practice, and whether they are tolerably uniform and certain in their application.

In the process of interviewing corporations about their patent and tax experience, a fairly detailed questionnaire was employed. A copy is appended to this report. In most cases the questionnaire was discussed in an interview with corporate officials and later returned by mail when complete. Completion of this questionnaire generally required cooperative effort by both the patent and tax departments of the respondent corporation. We are grateful to those corporations that returned completed questionnaires. A number of other companies gave us partial information.

Our general impression from the study so far is that there are few really pressing problems in the taxation of patent proceeds (i.e., proceeds from patent ownership) that call for immediate legislative action; but there are a number of areas of uncertainty that need clarifying. The rules applicable to patent proceeds laid down in the codification of Internal Revenue laws in 1954 have helped individual inventors slightly, but have had relatively little effect on corporations who own most U. S. patents. There are enough detailed problems in the application of tax rules to patent proceeds so that additional research should be fruitful.

## THE UNIVERSE OF PATENTS

Roughly 600,000 U. S. patents are currently in force.[5] Of these approximately 60

[2] Patent literature generally devotes little attention to tax problems, while tax literature considers patents only incidentally in relation to broader problems.

[3] About 35 corporations and a small number of individual inventors were interviewed before this report was prepared. Responses, however, were not complete in all cases.

[4] Recommendations made by others have ranged from complete exemption from income tax for patent proceeds realized by individual inventors to full taxation of all patent proceeds as ordinary income.

[5] *Cf.* F. L. Vaughan, *The United States Patent System: Legal and Economic Conflicts in American Patent History* (Norman: University of Oklahoma Press, 1956), p. 299. Mr. Federico's tabulation for the Senate Judiciary Committee shows 586,391 U. S. patents issued in

per cent were initially issued or assigned to corporations. A significant part of the balance has probably passed to corporations through sale or licensing.

Among corporations patent ownership is highly concentrated. While we have no conclusive estimate of this concentration,[6] it is to be found both in large corporations and, regardless of corporate size, in the industries where technological advance is rapid. Our interviews covered corporations ranging from those owning only a single patent to those having several thousand patents in force. Other corporations not interviewed are believed to own even more.

The number of patents owned is, of course, not necessarily significant in view of the enormous range in scope and value of different patented inventions. Some are worthless and will never be put to use. Others are extremely valuable either in reducing costs or in enabling the building of a preferred position in markets for finished products. Some patents may be valuable chiefly as trading stock to obtain access to outside technology through favorable cross-licensing arrangements. These factors and others as well all refer to patent value in the private sense, that is, to the worth of the temporary monopoly privilege which patent ownership conveys. Value in the social sense to the economy at large may be greater or smaller but is generally not amenable to accurate measurement.

### THE VALUE OF A PATENT

A patent as a property right has value because of its potentiality for producing income; its value derives from discounting to the present the expected income stream it is capable of yielding over time. This concept of the economic value of a patent may differ from the accounting values at which patents are carried on the books of corporations, or from the legal values involved in litigation concerning patent rights. Most of the property tax problems that involve patents turn on the question of valuation.

The economic value of a patent is not a unique magnitude—rather it involves a subjective appraisal of future costs, techniques, and prices that bear on the income yielding possibility of a particular piece of intangible property. Often the value of a patent is uncertain—especially before the invention has been used sufficiently to demonstrate its worth. Frequently its value will disappear as a result of other inventions that render it obsolete. When patents are sold or licensed their value is a negotiated price, representing both seller's and buyer's appraisal of potential earning power and also the relative bargaining power of the two parties. Court decisions upholding the validity of patents tend to increase their value.

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the years 1939-55 and therefore presumably in force on December 31, 1955. This excludes foreign patents and also U. S. design patents. *Cf. Distribution of Patents Issued to Corporations (1939-55),* Study No. 3 for Subcommittee on Patents, Trademarks, and Copyrights, December 29, 1956.

[6] Simple statistics of patent ownership are a poor measure of concentration because all patents are not of equal importance. However, Patent Office data show that on December 31, 1955, 38 corporations owned more than 1,000 U. S. patents each and 356 corporations owned between 100 and 1,000 patents each. *Cf.* Study No. 3 for Subcommittee on Patents, Trademarks and Copyrights, December 29, 1956. These data measure ownership at the time patents were issued and take no account of sales by individuals to corporations after issue.

Although all U. S. patents have legal validity for 17 years,[7] their economic life may be much shorter. Many patents are not used until some time after issue; others become obsolete before expiration of their legal life due to rapidly changing technology. On the other hand, the special market position of patented products often is preserved by trademarks, brand names, packaging, etc., well beyond the date when patent protection as such expires.

In emphasizing that the value of a patent depends on its income-producing power, we arrive immediately at the principal bearing which taxation has on patent creation and utilization. It is income taxation, and primarily Federal income taxation, that impinges most directly on the generation and use of patented inventions. Because patents are property, we shall also be concerned with property taxation, primarily at the state and local government levels, and with patents as property transferable by gift or at death and therefore coming within the compass of Federal taxation of transferred wealth. Patents may also be affected by state inheritance taxation.

## INCOME AND CAPITAL GAIN

It is a commonplace that Federal income taxation at the present high rates has numerous effects upon business transactions and upon incentives to produce additional income. Tax policy should aim to minimize interference with normal business practice, dampening incentives to work or to invest no more than necessary in view of revenue needs. While generality in the application of tax rates and rules is usually held to be desirable on equity grounds, our system of income taxation provides for a whole complex of deductions, exemptions, and rate concessions that are designed to yield a workable concept of net income on which to base rates, to encourage certain types of activity, to relieve special hardship cases, and to moderate the impact of high rates on selected types of non-recurring or bunched income.

Because certain accretions to wealth under our tax system are considered sufficiently different from ordinary income to be taxed at reduced rates (the so-called long-term capital gains) there exists a strong inducement for individuals and business firms to undertake to convert ordinary income into capital gain in order to obtain the benefit of these lower rates. Some of the tax problems that involve patents arise from the fact that under some circumstances patents are and under other circumstances they are not "capital assets"; hence their sale or exchange sometimes does and other times does not produce capital gains.

## SECTION 1235

As is well known, some limited Federal income tax concessions in favor of inventors have now been incorporated in our tax laws. Section 1235 of the Internal Revenue Code of 1954 provides that, in the hands of an original inventor, or an investor

[7] Foreign patent rights range from 10 years (Peru) to 20 years (Belgium, Hungary, Spain, Morocco). In some cases the period begins to run with filing the application (Italy, India, Great Britain); in other cases it begins, as in the United States, only with the patent grant. In a few cases (Austria, Czechoslovakia) the period begins with publication of the application, generally somewhere between the dates of the application and the grant.

in an invention not yet reduced to practice,[8] the sale or exclusive licensing of a patent will be subject only to capital gains and not to ordinary income taxation.[9] This provision applies to both U. S. and foreign patents but not to design patents. If a transaction qualifies otherwise under this section, damages for infringement received after the transfer will also qualify as capital gain.

This section is an important concession to inventors because the rate of tax applicable to long-term capital gains is only one-half the rate applicable to a corresponding amount of ordinary income; it is furthermore limited to 25 per cent—far below the maximum bracket rates that may be applied to ordinary income.

As enacted in 1954 this provision was applicable to patent transfers made in taxable years beginning after 1953. However, in 1956 the 1939 Code was amended to extend the force of this provision back to taxable years beginning after May 31, 1950. Hence appropriate patent sales since this date can qualify for capital gains treatment.

This tax concession has been extended only to individuals and not to corporations. The reason is partly inherent in the nature of capital gains taxation and partly that Congress intended, when enacting this section, to provide an incentive only to individual inventors "to contribute to the welfare of the Nation."[10]

It is relevant to inquire why this same privilege of treating patent proceeds as long-term capital gain should not have been extended also to corporations, since they now originate most of the patents and since generally capital gains tax provisions are parallel for both individuals and corporations. There are several possible explanations. Corporations presumably do not need the incentive of favorable tax treatment to spur them to invent new products or processes. Competitive pressure is strong enough. Invention with individuals is frequently a spare-time activity, not a regular part of trade or business as is corporate research and experimentation. Individual income tax rates are progressive so that sudden attainment of a major invention, perhaps after years of work, may produce a big bulge in the inventor's income and subject him to higher rates than if the gain were spread over the entire period of his effort. The corporate rate is basically flat so that bunching of income does not produce a tax penalty. These and similar considerations, such as the fact that corporate patents are only rarely sold, appear to have been material factors in limiting the application of Section 1235 to individuals and partnerships only.

## SITUATION PRIOR TO SECTION 1235

Prior to enactment of this section, transactions in patents followed the general rules separating capital gains from ordinary income. Thus an amateur inventor could get capital gains treatment but a professional could not.

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[8] Provided the investor is neither the employer nor a relative of the inventor.

[9] As originally drafted in the House bill, proceeds from sale of an invention would have been taxable as capital gain only if entirely received within five years. *Cf. Report on HR 8300,* March 9, 1954, p. 280. In some cases this would have applied a more restrictive test than previous court decisions. The Senate version which became law eliminated this limitation and allowed royalty payments received over the entire life of the patent to be taxable as capital gain.

[10] *Report of Senate Finance Committee on the Internal Revenue Code of 1954* (June 18, 1954), p. 439.

The patent of a professional inventor was not accorded capital gains treatment because it was regarded as property held "primarily for sale to customers in the ordinary course of his trade or business,"[11] whereas an amateur inventor was one not engaged in the business of holding such property for sale in the course of his business. In practice this distinction was difficult to draw and frequently led to litigation.[12] However, it was not peculiar to patents but applied to practically the entire range of property.[13] As a result of Section 1235, an individual[14] may qualify for capital gains treatment regardless of the number of patents he has previously sold.

The second problem prior to the enactment of Section 1235 was whether an exclusive license with royalties spread over a period of time was a "sale or exchange" so as to qualify for capital gains treatment. By a long series of court cases, assignment of a patent or the grant of an exclusive license by the inventor came to be considered a "sale or exchange" regardless of whether the consideration was received in a lump sum or in the form of royalty payments conditional on the use or profitability of the invention. The important point was whether all substantial rights in the patent were transferred. If so, the transaction constituted a sale. However, an exclusive license valid only within a limited area was generally not construed as a sale. Non-exclusive licenses, moreover, were not considered sales or exchanges. Hence proceeds from such licenses were taxed as ordinary income.

In 1950, however, the Commissioner of Internal Revenue sought, by the issuance of Mimeograph 6490, to reinterpret these court cases and to construe all royalty income from patents as ordinary income.[15] Section 1235 was enacted partly to "obviate the uncertainty caused by this mimeograph."[16]

Section 1235, as already noted, does not apply to corporations. In the case of a sale or exclusive licensing of a patent owned by a corporation, the capital gains analysis depends upon the same circumstances which were relevant for individuals prior to the 1954 Code, that is, whether the corporation was holding the patent for sale in the course of its business, and whether the method of transfer or licensing constituted a "sale or exchange." The court decisions under the 1939 Code and the

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11 *Internal Revenue Code of 1939,* Section 117(j); now Section 1231(b) of 1954 Code.

12 Numerous tax cases have turned on classification of an inventor as amateur or professional. Generally the number of inventions produced and the time devoted to invention were important considerations in these cases.

13 Certain types of property, however, such as copyrights, literary, musical, or artistic compositions in the hands of their creators, were denied capital gains treatment under all circumstances. Section 117(a)(1)(c), 1939 Code; now Section 1221(3), 1954 Code. Although securities and real estate are capital assets in the hands of investors, dealers in such property must pay ordinary income tax rates.

14 Section 1235 is also applicable to a group of individuals acting through a partnership.

15 This mimeograph provided that where "the assignee or licensee agrees to pay . . . an amount measured by a fixed percentage of the selling price . . . or amounts per unit based on units manufactured or sold . . .or any other method measured by production, sale or use . . . or amounts payable periodically over a period generally coterminous with the transferee's use of the patent, such agreement, for income tax purposes, is to be regarded as providing for the payment of royalties taxable as ordinary income." In this action Internal Revenue withdrew its acquiescence to the Tax Court Decision in the *Edward C. Myers* case (6T.C. 258) in which Myers sold a patent to Goodrich Rubber Co., and received an annual royalty of 5 per cent of sales. The Court held this to be sale of a capital asset and the proceeds taxable as capital gain.

16 *Report of Senate Finance Committee on the Internal Revenue Code of 1954,* p. 439.

Commissioner's position in Mimeograph 6490 continue to be applicable for this purpose.

One set of tax problems for consideration therefore involves the different tax treatment of patent rights held by individuals and corporations and whether this will have any long-run effect on the methods of creating and holding patents.

Another set of tax problems relates to research and development—the process in which many patents are born. Let us notice some of these briefly.

### RESEARCH AND DEVELOPMENT

The process of invention in the United States has changed considerably since our patent system first became effective. The system was designed primarily with the thought of guaranteeing to an individual a definite period during which he might monopolize the use of his invention in return for making a public disclosure of his technique or product.

To an increasing extent, patents today result not from the activities of individual inventors, but from organized group processes of research and experimentation financed by business firms and non-profit organizations. Between 1921 and 1938 the proportion of patents issued to corporations rose from 28 to 60 per cent, but since 1938 no further increase has occurred. The percentage issued to corporations has ranged from a low of less than 55 per cent in 1950 to a high of more than 64 per cent in 1946 and has averaged 58.5 per cent for the 17-year period 1939-1955.

Business firms in most industries are today spending increasing sums on research and experimentation designed to improve their products and processes and to strengthen their competitive positions in a world of rapidly changing technology.

In 1950 there were nearly 3,000 industrial research laboratories in the United States employing more than 72,000 professional people.[17] In the 30 years prior to 1950 these research organizations increased sevenfold in number and about nineteenfold in total employment. Since 1950, growth has been even more rapid. In 1956 there were more than 4,800 industrial research laboratories operated by more than 4,000 companies.

A number of estimates of the magnitude and rate of growth of industrial research outlays have been made[18]— but these all suffer, in our opinion, from want of a generally understood and consistently applied definition of what research and development include.[19] It is difficult to get accurate measurement without such a definition

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[17] See *Industrial Research Laboratories of the United States,* 1950 edition. Bulletin No. 120 of the National Research Council.

[18] For example a Harvard Business School study placed outlay for all research by industrial firms in 1951 at $2.5 billion. The most commonly mentioned estimate of research outlay is that of the National Science Foundation for 1953-54. This put industrial research at nearly $3.7 billion of which $1.3 billion was financed by the Federal Government.

[19] For example, the Harvard study defined research and development as activity in the physical, biological, and related engineering sciences devoted to finding new knowledge, applying existing knowledge to creation of new products or processes, or improving present products or processes. It included laboratory work, design and operation of pilot plants, writing product formulas and specifications, designing special equipment and structures and preparing operating manuals. It excluded market and economic research, legal work in connection with patent applications and litigation, quality control, and minor adaptations of products for individual customers.

and it is also difficult to get consistency in the application of tax rules when research and development may mean quite different things to different companies.

The present high rate of Federal income tax is sometimes described as an important spur to invention in that it allows profitable business corporations to share the cost of research and development work with the Federal Government on roughly a 50-50 basis. Some incentive to obtain tax savings by investing in innovation undoubtedly does exist. We have attempted to measure this by questioning business firms about their research programs. Before examining their replies, however, it may be well to notice the general tax status of research and development costs.

## SECTION 174

The tax status of research and development costs has not changed very much in recent years in spite of the fact that the 1954 Code devoted a special section to this problem for the first time.

Prior to 1954, there was no special statutory rule covering research and development costs. They might be deducted from taxable income if considered to be ordinary and necessary costs of doing business, but frequently the Internal Revenue Service looked with disfavor on such deductions and took the position that the outlay should be capitalized. This led to difficulties where there was no definite period over which such capitalized expenditures could logically be amortized, with the results that amortizations had to be more or less arbitrary. Gradually administrative practice changed in the direction of allowing development costs to be expensed.

The leading expression of this more liberal attitude occurred when the Commissioner of Internal Revenue, in testimony before the Joint Committee on Internal Revenue Taxation on April 4, 1952, stated:

> It is the policy of the Bureau, where the taxpayer under its established method of accounting has adopted the practice of charging to expense research and development costs, to allow such costs as deductions in computing net income. Such costs, however, may include only such expenditures as would normally be considered to represent research and development costs in the experimental or laboratory sense.

Taxpayer efforts to rely on this statement in the courts have been unsuccessful because it lacks the status of a statute or implementing regulations.

Section 174 of the 1954 Code presumably has removed the ambiguity in tax status of research costs by providing specifically for the expensing of these costs in cases where these outlays do not result in the construction or acquisition of depreciable property. If they do yield such property it is to be depreciated over its useful life in the manner of other wasting assets. Thus the cost of setting up a research laboratory cannot be expensed nor can general-purpose equipment used for research purposes.

Section 174 also provides the taxpayer with an option in cases where he wishes to capitalize research and development outlays but where there is no ascertainable useful life. In these cases the costs may be prorated over an arbitrary period of not less than five years, beginning when benefits from the outlay begin to be realized.

This option is one not beneficial to most taxpayers and one of which only rare advantage will be taken. In general, only a business that is currently running at a loss, or that expects its income to grow rapidly, or that forecasts tax rates will be appreciably higher in the future than at present, will secure an advantage by using this option. Profitable businesses will generally be better off to take development costs currently as deductions. We have found in our interviews to date no case in which this option to capitalize research costs had been taken. On the contrary (and as might be expected) most business firms having established or regular research and development programs treat as much as possible of these outlays as current expense and as a deduction from taxable income.

## GROWING DEPENDENCE ON RESEARCH

In the course of our interviews with business firms, we found (as expected) that most of the larger corporations had well-organized programs of research and development and spent considerable sums of money, in millions or in some cases tens of millions of dollars per year, on this activity.

Research outlay is related to company size. Only about one-third of small manufacturing companies, with less than 500 employees, support research whereas virtually 100 per cent of the largest companies do. However, where research is supported, the outlay in relation to sales is generally higher for small than for larger companies. Research costs are highest in the technically oriented industries such as chemicals, drugs, aircraft, electronics, instruments, etc.

We made some effort to discover how budgets for research and development work were determined and whether tax considerations played any appreciable role in this determination. The results so far are somewhat inconclusive, but indicate that tax calculations and tax benefits are probably not a major factor at the present time.

Research and development budgets are fixed in various ways, often as part of the over-all corporate process of budgeting income and outgo. In some cases a certain proportion of sales or expected profit will be tentatively earmarked for research and development and taken up if feasible projects are in view. In other cases projects are worked up in terms of expected benefits and costs and submitted to management. The most promising projects are then selected and the budget is built up in terms of specific work to be undertaken and its costs. About 70 per cent of all research organizations operate on financial budgets of which about 80 per cent are prepared annually.[20]

An important consideration in budgeting for research and development is always the firm's competitive position and its desire to diversify its output or to move into new markets not already served. There is abundant evidence that, with few exceptions, progressive management today recognizes the need for continual product

[20] R. N. Anthony, *Management Controls in Industrial Research Organizations* (Cambridge, Mass.: Harvard University Press, 1952). Based on a survey of nearly 500 research organizations in 1950.

and process improvement and for spending substantial sums on research to keep the business progressive and growing.[21]

Most firms we talked with denied that taxes were an important factor in fixing the amount of their research and development outlays; however, a number of firms recognized that in deducting such costs they were in effect splitting their research and development costs with the Federal treasury.

When questioned specifically about their attitude toward research and development during the period when the excess profits tax was in effect, a number of firms indicated that the high marginal rates of the excess profits tax did operate as a strong inducement to employ additional funds for development purposes. It is perhaps not going too far to suggest that the advantage of investing in the future of the business through research, which became apparent to many during the period of the excess profits tax, has carried over somewhat and serves in part to explain the upward trend of research and development outlays during recent years.

PRACTICE IN ACCOUNTING FOR RESEARCH OUTLAY

Some ambiguities in the tax treatment of research costs still persist in spite of the enactment of Section 174. The regulations covering this section indicate that these outlays will be deductible only when in the laboratory sense; this is the same general standard the Revenue Service sought to apply before 1954. Just what this means in individual applications is not entirely clear.[22] Several firms reported to us that, although in general their objective is to expense all of research and development work that they can, they are not sure just where the limit of deductibility is or should be drawn and at what point they will or ought to be required to capitalize. We found a number of corporate situations in which deductions for research and development had been questioned; these cases appear to have been settled in most instances on a case-by-case basis rather than by the application of any general rules or firm principles.

It is obvious that, in view of the very nature of research and development work, it is extremely difficult for tax officials and courts to apply a uniform standard in all cases. For example, it is hard for revenue agents not having detailed technical knowledge about the research program of a particular industry or company to know where development in the laboratory sense stops and investment in improved facilities begins. There is clearly an area here that can be productive of considerable unevenness in the application of tax rules, and also productive of litigation.

Drawing a line is especially troublesome where development work takes the form of setting up pilot plants or making trial runs of new products. Insofar as these investments do not turn out to be successful, it perhaps matters little whether they are expensed in the first instance or capitalized and written off later when abandoned

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21 Some companies have probably been oversold on the potential benefits of research and have had difficulty developing measures to gauge the results of a research. *Cf.* A. N. Rubenstein, "Setting Criteria for R and D," *Harvard Business Review* (January-February, 1957), pp. 95-104.

22 *Cf.* H. P. Swanson, "Tax Treatment of Research and Experimentation Expenditures," *Taxes, the Tax Magazine* (August, 1956), pp. 541-548.

or determined to be valueless. On the other hand, when experiments are successful, it is often difficult to draw a clear line between development and production outlay. In many cases, however, this may not be too important since both types of cost are deductible. The question is over what period the deduction may be taken.

The prohibition on expensing research and development costs that result in depreciable property has generally been extended also to the cost of securing patent protection; thus the courts have usually held that legal and filing fees applicable to a specific patent are not deductible but must be capitalized and written off over the life of the patent. In the case of relatively large corporations that maintain patent departments to protect their rights to innovation, this has frequently involved capitalizing some portion of the costs of operating these departments.

In examining the bearing of tax rules on patents, we have been interested in how companies valued their patents for balance sheet or other accounting purposes. When patents result from research programs that have been expensed, there is no need to assign a high value to the patent. In general, it would appear that many patents belonging to corporations are either carried at nominal values or at values which reflect only the specific legal costs of securing the patent. As a general rule only in cases where patents have been purchased will they be valued at anything like an estimate of the present worth of their future earnings; then they are often written down as rapidly as possible in the interest of conservative accounting. All this is understandable in view of the fact that it is generally more advantageous to expense research and development costs as they occur and not to capitalize these outlays in specific patents that may result.

The deduction for research and development is available to unincorporated business as well as to corporations, and is also open to individuals, provided such expense is incurred in connection with a trade or business. However, hobby losses are not deductible although patents may sometimes result from hobby activities. In practice, development cost deductions are more readily available to corporations than to individual inventors. The occasional inventor may have to capitalize many of the expenses incurred before he can obtain a patent and to offset these against the proceeds he can obtain from sale or licensing of the patent.

For information on the correspondence between tax rules and research practice we inquired specifically as to whether there was any reasonable expectation that patents would result from specific research and development activities and whether the capital costs of a patentable invention could be ascertained with reasonable accuracy. The answers so far obtained in general were that the results of research could not be predicted in terms of the specific patents that would arise. Moreover, the problem of accounting for specific inventions in terms of allocating to them their appropriate share of general research costs, or even tracing specific inventions to more than a general background of research, was considered to be impractical.

Corporate practice differs considerably in the extent to which results of research and development are incorporated in patents. We found a number of companies that make a practice of patenting almost any improved product or process that results from their research and development activity. Often this is done for so-called defensive purposes, that is, to protect exclusive rights in the technique without knowing exactly how the innovation will be finally put to use. We found other companies that patent very little but prefer to keep the bulk of their research results simply in the form of technical knowledge within the company or, in some cases, as trade secrets. Presumably in these cases it is the ease with which innovation could be copied if a disclosure were made and also the expected difficulty of protecting themselves against such infringements that motivate firms not to take advantage of the patent system.

Our tentative findings with regard to research and development are, therefore, that:

1. Progressive firms are spending increasing sums on this activity and are expensing the outlay for tax purposes,

2. Some uncertainty exists as to precisely where the limit of deductibility as to research costs lies in practice and just which outlays must be capitalized,

3. Expensing of development costs frequently means patents developed by research are given only nominal values, and

4. Individual inventors have the same legal but not the same practical right to expense research as do corporations.

Most of the tax problems that involve patents arise when these rights are sold or licensed. For this reason it is important to notice the variations in terms and conditions of licensing, and the practices of patent owners with regard to licensing.

## POLICY AND PRACTICE WITH RESPECT TO LICENSING

We inquired in some detail from corporations in the course of our interviews as to their policies with respect to licensing the patents they owned and the financial terms on which these licensing arrangements were customarily made. We also covered in this connection terms and conditions on which corporations licensed patents owned by others for their own use—either from individual inventors or from other corporations.

As might be expected, practice showed a wide variation; this is illustrative of the range in value of different patents. Some companies make a practice of licensing their patents freely (that is, without limit though not without cost) to other companies whether competitors or not. Others are much more restrictive in the owned patents they release for use. In general, the more rapid the advance of technology in a particular industry, the greater appears to be the willingness to make patents and related technical information broadly available.

Most companies expressed little preference for exclusive as opposed to non-exclusive licensing arrangements so far as patents they own are concerned. Sometimes exclusive licenses that are valid only within restricted areas are given. Frequently only one license will be issued in a foreign country although the firm may be willing to license others if the demand for the process or product appears.

Similarly, when licensing the patents of others for their own use, corporations may or may not prefer an exclusive licensing arrangement—but generally not for tax reasons. In many cases when licensing the proceeds of an outside inventor, the corporation may insist on an exclusive arrangement in order to protect the investment it must make in applying the process or rearranging its productive facilities and schedules to accommodate the new product. Many inventors were willing to grant such exclusive licenses even before Section 1235 became effective because these represented either the only or the best terms on which their inventions could be commercially exploited.

While many corporations apparently have a firm policy with respect to willingness or unwillingness to license patents, none we contacted had a standard pricing policy for this activity. As might be expected, their concern is rather to make the best individual financial deal they can for a particular patent. This is standard monopolistic pricing policy and again illustrates the extreme range in value possessed by different patents.

We did not inquire too closely about the financial arrangements for licensing particular patents because of the understandable reluctance of management to reveal this information. We were told, however, that royalty arrangements frequently involved a sliding scale of charges based on production, and commonly specified minimum requirements necessary to maintain the license in force. Lump sum payments were uncommon in intercorporate licensing but were more common in dealing with patents of individual inventors.

Frequently patents are licensed in groups with license fees based on the whole package and not allocable to individual patents in the group.

### LICENSING FROM INDIVIDUAL INVENTORS

We were at some pains to discover whether individual inventors are now more willing to grant exclusive license arrangements in order to get the more favorable tax treatment available under Section 1235. This motivation has undoubtedly appeared in some cases but it is probably less important than might appear at first glance to be the case. In many instances the exclusive license represents the best deal an inventor can make, irrespective of tax considerations. In other cases his financial needs may dictate an outright sale if it is impractical to use the patent himself.

Our purpose in making this inquiry was to determine, if possible, whether inventors now feel obliged, for tax reasons, to dispose of patents in a different manner than they did prior to 1954. In general, it does not appear that much change has taken place, or that rights which ought to be held in the inventor's own best interest are now being given up for tax reasons; but we need to gather more information before being sure of this conclusion.

Royalty arrangements frequently anticipate that the useful life of a patent will be shorter than its legal life; thus the period of royalty payments may be only three to five years rather than the full 17 a new patent has to run. In some cases royalty-free use may be allowed after a certain aggregate of royalty payments has been made—regardless of the time elapsed. These cases are mentioned simply to illustrate that it is difficult to find a consistent pattern in licensing or royalty arrangements, due again to the diversity in economic life and value of different patents.

FOREIGN LICENSING

When foreign patent rights derived from a U. S. patent are licensed for use in foreign countries many difficult tax problems can arise. In general, however, these do not differ from the tax problems that are present when any type of income is earned in foreign operations. Income tax rates and rules may diffffer considerably in foreign countries from those in force within the United States. In general, however, any foreign income taxes paid are creditable against the U. S. tax and in addition a number of treaties between the United States and other countries, designed to reduce double taxation, are in force. There are, moreover, some special peculiarities of the U. S. and foreign income tax laws that may be utilized to effect considerable tax savings. These provisions do not relate for the most part specifically to income from patents.

In most cases patents are licensed abroad only after the U. S. firm owning the rights has already built up a considerable market for its product by export sales. In none of our interviews was the licensing of patent rights found to be the first source of income earned abroad. What this means is that usually business firms had accumulated experience with foreign taxes before they licensed their patent rights; consequently they took into account the impact of these taxes in agreeing on terms for the licensing.

In several instances we found firms that licensed their patents abroad for a consideration net of income tax. This does not by any means appear to be the standard practice, however, and in most instances the license fees are gross income exactly like sales proceeds or earnings from direct investment.

An important technique for tax saving when a business has extensive foreign operations is to conduct these wholly or in part through a foreign-based company. A foreign-based company in this sense is one chartered in a foreign country so selected as to provide a more favorable income tax environment than in the United States. Several countries levy no tax on income from sources outside the country, although they may tax income originating in the country in which the corporation is chartered. Foreign-based companies are in effect holding companies for foreign activities designed to reduce the tax burden on income from foreign sources.

In our interviews we have found so far no examples of foreign-based companies established for the sole or primary purpose of licensing patent rights, although companies with whom we talked did in some cases employ these foreign holding companies in their over-all overseas operations. In most cases, patent licensing was an incidental feature of their overseas activities rather than a primary source of income.

The advantage of a foreign-based company is that it allows the accumulation of income without U. S. tax until the income is brought home in the form of dividends from the foreign holding company. It also allows in some cases losses in one foreign country to be set off against profits in another, which is not possible when the foreign subsidiaries are branches of a U. S. parent company. Increasing use of foreign-based corporations can be expected as American business expands its activities abroad, especially where this activity takes the form of direct investment in subsidiary enterprises.

We found no cases in which foreign patent rights owned by American corporations were sold outright and believe such transactions are comparatively rare in normal practice. Exclusive licenses may be given, but generally these are terminable if the licensee fails to meet specified conditions, such as the number of patented items to be produced within a given period or the minimum aggregate royalty to be paid. This checks with our other findings that corporations generally do not dispose of patent rights unless the sale is incidental to disposal of a part of the business, with the patent rights included along with other assets.

### PATENTS OWNED BY FOREIGNERS

When an American company licenses for its own use the U. S. patents owned by foreigners, either individuals or corporations, it becomes obligated to withhold tax on any royalty income paid to such patent owners. The tax status of these recipients depends on whether they are residing in or doing business in the United States and may be affected by treaty provisions and some rather technical rules. However, the company paying the royalty is simply the withholding agent and is not responsible for the eventual tax settlement between the patent owner and the U. S. Government. The withholding rate is 30 per cent, but we need not consider this within the group of tax problems of primary interest to American inventors and American corporations.

### STATE AND LOCAL TAX PROBLEMS

Our project plans contemplate gathering and analyzing as much useful material as possible about the state and local tax problems of patent owners and users. However, because of the large number of different tax jurisdictions involved and the differences in tax provisions from one state to another, we have not yet accumulated enough interview material to be able to generalize very well about the nature of these problems. From what limited material we have, however, it does not appear that these problems are particularly difficult in relation to patent proceeds.

At present, 36 states levy income taxes on corporations while more than 40 tax income of individuals. These taxes use either flat or mildly graduated rates, ranging in most cases up to a maximum not in excess of 5 per cent. In addition, most states have property taxes, although less than half the states tap intangible property in these taxes. Moreover, the taxes on intangibles are generally limited to bank deposits, securities, and other commonly held intangible assets. Only rarely would patents be included in the group of intangibles subject to tax. Intangible property tax rates are generally quite low, although there is a good deal of variation from state to state in this respect.

Most state income taxes are limited to individuals or corporations resident in the state or to income derived from sources within the state. With regard to capital gains, there is no uniformity; about half the states having income taxes exclude capital gains from the tax base while the remainder for the most part tax these gains at ordinary income rates and not at special reduced rates as in the Federal law. This fairly well rules out any special problems so far as patent transfers are concerned.

Some problems do exist with regard to situs of intangible property. For example, where the home office of a company is in one state but it operates branch plants in several additional states and these plants use various patented inventions owned by the corporation, as well as perhaps some licensed from outside, the location of the intangible property represented by the patents may be a matter of some uncertainty. This is not a major problem, however, because in the few cases where patents are reached by intangible property taxes, the book valuation is usually accepted without question. We have already noted that book values of patents tend to reflect the real economic value of these rights only very imperfectly.

There is at present a trend among state governments toward lessening dependence on property taxes in favor of the local governments, and toward increasing dependence on sales and income taxes. Along with this trend is to be found another one toward adapting state income tax rules more closely to those of the Federal Government. This is an administrative convenience since the Federal Government and many states now exchange information about returns of individual taxpayers as a mutual enforcement measure.

We hope to develop in our final report some specific instances of state and local tax problems that have troubled owners and users of patent rights. Further discussion of these problems, however, must be deferred until our final report.

## ESTATE AND INHERITANCE TAX PROBLEMS

An occasional situation will arise in which an individual inventor may own enough patent rights at the time of his decease, and have a sufficiently large estate, so that these rights become subject to Federal estate taxation. The problem in these cases is nearly always one of valuation which may be difficult if the patent has not been sold or licensed.

In general the Federal estate tax applies to all property transferred at death in excess of $60,000 plus permissible deductions. Up to one-half the gross estate may be passed to a surviving spouse tax free. Valuation for the tax is the fair market value at the date of death or an optionally later valuation date.

A number of estate tax problems, such as ownership of closely held securities and other property not commanding a ready market, turn primarily on valuation. If patent rights are part of an otherwise taxable estate this merely adds another valuation difficulty.

Since the Federal estate tax is a general excise on the privilege of transferring property, there would seem to be no equitable reason why special classes of property such as patents should be exempt. Moreover, there are no incentive questions connected with an estate tax, although the mere existence of the tax provides an incentive for individuals possessed of substantial accumulations of property to dispose of this property during life or to form trusts so that the property may pass to heirs with minimum loss through successive estate taxations. However, the subject of estate planning and the tax consequences of various plans for transmitting property is a subject in itself and one we do not propose here to enter. It is sufficient to note that patent assets owned by individuals may be affected by estate taxes and by the death taxation of states, whether assessed on estate or inheritance principles.

# APPENDIX I

## RESEARCH PROJECT 7A—TAXATION OF PATENTS
## PRELIMINARY INTERVIEW QUESTIONNAIRE FOR CORPORATIONS

(Replies will be kept strictly CONFIDENTIAL.)

I. *General Background Information*

1. Name and title of person interviewed..............................................

2. Date of interview..............................................................

3. Name of company..............................................................

4. Address ........................................................................

5. Nature of business.............................................................

6. Number of employees...........................................................

7. Approximate rank in industry..................................................

8. Extent of patent ownership and use:
   - (a) Number of patents owned by company........................................
   - (b) Of these how many do you consider important?.............................
     On what basis?.................................................................
   - (c) Number of patents licensed from others.....................................
     To others......................................................................
   - (d) Number of patents actually used in operations..............................
   - (e) Number owned defensively..................................................
   - (f) Of all the patents actually used by your company how many are on

     1. Products ....................................................................

     2. Processes ...................................................................

     3. Designs .....................................................................

9. Financial data
   - (a) Volume of annual sales for 1956 or last fiscal year (give dates) $.................
   - (b) Can you estimate what percentage of your sales are of patented products?..........
     If so, what is the percentage?.................................................
   - (c) Can you estimate to what extent your operations are dependent on patented processes or equipment?..........................................................
     If so how would you describe this dependence?..................................
   - (d) Amount of annual royalties received on patents licensed to others $...............
   - (e) Amount of annual royalties paid to others for use of patents $....................

II. *Research and Development Expenditures*

1. How do you define research and development cost?....................................

2. Amount of R&D budget (for 1956 or last fiscal year) $...............................

3. (a) How is your R&D budget determined? (Indicate whether based on percentage of sales, percentage of expected profit, cost of specific projects, competitive situation, desire to expand or diversify, or other factors.)..............................
   (b) To what extent are Federal and State income taxes a factor in this determination?
   ..........................................................................
   (c) Have you any comments on the relationship of excess profits tax to R&D expenses?
   ..........................................................................

4. What has been trend of your R&D budget in recent years? Has it risen faster or slower than sales? If so, why?.........................................................

5. (a) What percentage of your R&D budget is contracted out to private firms?..........
   (b) What percentage to universities and foundations?...........................
   (c) What factors influence you in contracting out research and development work as opposed to doing it yourself?...............................................

6. (a) What percentage of your R&D budget results in patents?......................
   (b) Does this proportion vary greatly from year to year?.........................
   (c) Is it your practice to patent all new ideas that qualify?........................
   If not, why?..........................................................

7. (a) Do you in your accounting expense or capitalize R&D expenditures or use a combination of methods? (Describe items capitalized.)............................
   (b) Have you made any changes in accounting treatment of R&D expenses since the 1954 Internal Revenue Code? (Describe.)....................................

8. (a) On new machinery or pilot plants, do you allocate costs between R&D and cost of equipment?.......................................................
   (b) What is the basis of allocation?...........................................

9. What special problems have you encountered in tax or accounting treatment of R&D outlays? (Describe in detail.)..................................................

II. *Methods of Utilizing Patents*

1. Of the patents owned but not used by you, how many do you
   (a) Sell outright? ........................................................
   (b) License to others on a non-exclusive basis?.....................................
   License on an exclusive arrangement?............................................

2. Has you company ever claimed capital gains treatment on proceeds from patents not directly related to your business?...............................................
   Have you made this claim on gains
   (a) From outright sale of patents?..............................................
   (b) From exclusive licenses where payments were related to productivity, use, or life of the patent?........................................................
   (c) When you license patents to others
      (i) Is payment received as a lump sum......; a fixed amount per year......; a variable annual amount based on sales or use?......
      (ii) Is a minimum payment specified?.........................................
      (iii) What happens if the minimum is not satisfied?..........................
      (iv) Describe other terms relevant to tax treatment..........................

3. What other tax problems have you encountered in the treatment of proceeds from patents? ..................................................................

4. Do you have any views as to desirable changes in the tax treatment of patent proceeds?....
   ..........................................................................

IV. *Foreign Licensing of Patents*

1. (a) Do you license or otherwise use your U. S. patents in foreign countries or obtain foreign patents derived from your U. S. patents?..............................
   (b) What percentage of your patents are used internationally?......................
      (1) Regularly ..........................................................
      (2) Occasionally .......................................................
   (c) What percentage of this use is with subsidiary companies?.......................

2. What arrangements do you make with foreign concerns for use of patents owned by you?
   (a) Outright sale of patents..........................................................
   (b) Non-exclusive license ..........................................................
   (c) Exclusive license..................................................................
   (d) Describe other terms.............................................................

3. What arrangements do you make for technical assistance?............................

4. What is the amount of income received by you from foreign licensing of patents? $........ Per cent of total income?..........................................................

5. Give information on the amount of taxes withheld in or paid to foreign countries on income derived from your patents.

| *Country* | *Income* | *Amount of tax or per cent of income paid as tax* |
|---|---|---|
| ...................... | ...................... | .............................. |
| ...................... | ...................... | .............................. |

6. Are such foreign taxes taken as a credit against U. S. income tax?....................

7. Do your license agreements require that royalties or payments be made net of foreign taxes? ..........................................................................
   What difficulties have you encountered with such provisions?.......................
   ................................................................................
   Describe by countries:.............................................................

8. Have you used foreign based companies for licensing of patents abroad? (Describe arrangements.) .......................................................................

9. Are royalties from foreign countries in which you operate subsidiaries taxed at a lower rate than dividends? If so, what effect has this had on your financial arrangements with subsidiaries? ...................................................................

10. What problems have you encountered in repatriating income from patent use in foreign countries? .......................................................................
    What do you do with blocked balances?...........................................

11. If you use U. S. patents owned by foreigners in the United States, describe licensing arrangements generally and whether you withhold U. S. taxes on payments to foreign owners ..........................................................................

12. Describe any tax problems you have encountered in licensing or sale of U. S. patents abroad ..........................................................................
    What suggestions or views do you have on taxation of patents in international commerce?
    ................................................................................

V. *Other Tax Problems*

1. Describe any problems you may have encountered in the application of state income taxes to proceeds from utilization of patents. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

2. To what extent are your patents taxable as business property in states in which you operate? . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   (a) Give information by states if possible: . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   (b) How are your patents valued for this purpose? . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

3. What opinions or views do you have on state taxation of patents or patent income? . . . . . . . .

4. Please advise which if any of the questions are inappropriate in your opinion, or what other questions should be added. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

REMARKS: (Use additional sheets if necessary.)

# The Role of Patents in Executive Decisions

JESSE W. MARKHAM, Principal Investigator*

SEVERAL MONTHS HAVE TRANSPIRED since the publication of the staff report on the basic exploratory study, Project 2a,[1] and the edited transcript of its discussion at the First Public Conference.[2] Based on this exploratory study and the comments by the discussants at the Conference, a project is now contemplated along the lines suggested in the staff report which will give special emphasis to the effect the patent system has on decisions relating to research, development, and production within the firm. That is, case studies will be aimed at isolating the effects of the patent system on business decisions. This is in accord with our findings that decisions to undertake research and to patent the results of research must be viewed as part of a firm's over-all market strategy.

It is planned to base the study on the case method since it is believed to be the research method most suited to this type of exploration. By this it is understood that the study will encompass a selected number of firms. A starting point in the selection will be a review of lists already compiled, especially Mr. P. J. Federico's list[3] and the list of 200 compiled by the National Science Foundation.[4] In this connection Mr. James S. Worley[5] is presently engaged in ranking firms which are high in expenditures on research. He is classifying such firms according to the level of concentration in the industry in which they fall, the absolute and relative size of firms, etc. His results will be consulted before a final list is agreed upon for the proposed project.

A number of interviews, perhaps employing an interview questionnaire even less directed to specific aspects of the patent system than that used in the exploratory study, will be made to assist in uncovering the values that firms believe they obtain from the patent system, and to shed light on the interaction of decisions to patent with those on other aspects of firm strategy. In addition, as the staff report suggests, these interviews will assist in the selection of those firms warranting further intensive analysis.

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* The project proposed in this note will be organized along lines similar to that of the basic exploratory study, Project 2a; that is, one or two, possibly three, researchers working closely with each other with the Principal Investigator in charge.

[1] "The Value of the American Patent System: An Inquiry Into Possible Approaches to Its Measurement," the PTCJRE, I (June 1957), pp. 20-56.

[2] *Conference Supplement* to the PTCJRE, I (1957), pp. 108-128.

[3] "Distribution of Patents Issued to Corporations (1939-1955)." Study of the Subcommittee on Patents, Trademarks, and Copyrights of the Committee on the Judiciary, U.S. Senate, 84th Congress, 2nd Session, Pursuant to S.Res. 167, Study No. 3 (Washington, D. C.: Government Printing Office, 1956).

[4] *Science and Engineering in American Industry*—Report on a 1953-1954 Survey. National Science Studies. Prepared for the National Science Foundation by the U.S. Department of Labor Bureau of Labor Statistics (Washington, D. C.: U.S. Government Printing Office, 1956).

[5] Mr. Worley, research associate on the completed Project 2a, is now at Princeton on full time research under a Danforth Fellowship.

# CONTRIBUTED ARTICLES

Individuals are invited to contribute articles for publication. The following articles in this section have been selected for publication in this issue.

## The National Inventors Council and the Inventor

JOHN C. GREEN*

AMERICA'S SECURITY IN A WORLD IN WHICH TECHNOLOGY is rocketing forward at a breath-taking pace depends to a large degree on how fast we can invent new weapons and better military equipment. The inventions we need will not come exclusively from our elaborate research laboratories; some of them will spring from the minds of single individuals with only meager equipment to work with. In our history, private citizens, from Colt who whittled from wood the model for the first revolver on down to the World War II inventor of the magnetic mine detector and the individuals today who are conquering new defense problems, have given us some of our more important military devices.

To capitalize upon the creative thinking of our citizens, the United States since 1940 has had an industry-government organization specifically designed to serve as an "open door in Washington" for inventive ideas of possible use to our military agencies. This is the National Inventors Council.

Since its establishment the Council has received thousands of ideas from the public. During World War II some 208,975 inventions and ideas were evaluated, and 13,887 interviews were held with inventors. Of these, 8,615 ideas were of sufficient value to be given extensive study, while more than 5,000 were sent to the Armed Services for review. Technical experts in the services selected 757 for additional investigation, development and testing. Between World War II and June 30, 1952, the Council received an additional 35,395 suggestions of which 2,648 were deemed promising. Many more have been received since, and some of them are now undergoing evaluation. The full story on inventions put into production probably will never be known, because the Council could not follow the ideas through the development and testing programs once they had been referred to the proper military offices.

The idea for the National Inventors Council was first proposed in 1940 by Lawrence Langner, an international patent expert. Mr. Langner was aware that the government was then engaged in a number of official research projects, but he felt strongly that there should be an agency to screen the ideas of civilians and present

* Mr. Green, Executive Director of the National Inventors Council, Department of Commerce, is a Consultant to the Foundation. In this article he surfaces some of the problems of the NIC with respect to inventions for defense. See Foundation report on page 185 of this issue.

them to the proper military agency. As a patent expert, he was familiar with the many important devices of warfare invented by independent inventors, and he foresaw rightly that creative civilians would make a substantial contribution to our national defense should we become engaged in the war then in progress in Europe. With the assistance of the late Dr. Thomas Midgley, inventor of Ethyl gasoline, and Conway P. Coe, then Commissioner of Patents, Mr. Langner's proposal was presented to the Secretary of Commerce. In the fall of 1940, with the approval of the President and the strong support of the military, the Secretary established the Council within the Department of Commerce. Dr. Charles F. Kettering of the General Motors Research Corporation, one of the nation's foremost inventors, was appointed chairman and still serves in that capacity.

Membership of the Council includes more than a score of distinguished inventors and scientists, patent experts, science editors, the Chiefs of Research of the Army, Navy, and Air Force, and the Commissioner of Patents. These members serve without pay. A paid administrative staff is located within the Office of Technical Services of the Department of Commerce.

The Council gathers technical problems from the military agencies and publishes them for the information of private inventors. When an individual thinks he has a solution to one of them, he submits his proposal which is evaluated by the Council and, if considered promising, turned over to the interested military agency for further study. This system not only reduces red tape and gives the inventor official representation in Washington, but also assures that the idea is examined by the agency most likely to be interested.

Through this system the Armed Forces acquired some of their most effective devices in World War II, including the magnetic mine detector, signaling mirrors for downed aviators, and an improved battery to power walkie-talkie radios in the tropics where normal battery life is severely limited. The mine detector was invented by a Miami electrician for a neighbor who wanted to look for pirates' gold along the coast of Florida. Turned over to the Council, it sped up the Allied victory in North Africa by several months and perhaps saved more lives in World War II than any other single device. A California garage mechanic, who was also a Scoutmaster, designed the signaling mirrors for his Scouts. Used by downed airmen to focus the rays of the sun on passing planes, the device resulted in the rescue of many flyers.

While inventions are submitted more or less continuously, the greatest impetus, of course, comes in national emergencies. During the 12-month period after the fighting began in Korea, the number of suggestions received by the Council skyrocketed to 15,344 as compared with only 3,202 in the preceding 12 months. One of these ideas illustrates the contribution of America's women. A housewife developed a disposable surgical gown made of a special type of paper. It eliminates the need for cumbersome laundry and sterilization procedures in field hospitals.

Another post-Korean invention which shows promise is a portable compact heat-exchanger designed to use the waste heat from internal combustion engines for preheating other engines, providing hot water for men in the field, and for heating small spaces.

In peace or war the military is working toward more adequate defense of the nation, and each step forward brings on new technical problems. In troubled times like the present, the problems abound. The Council has just published a new list of some 387 devices and ideas wanted by the military. This list includes puzzlers in the fields of aeronautics, missiles and space travel, electronics, chemistry, metallurgy, instrumentation, automotive engineering, mechanics, medicine, nutrition and packaging.

As demonstrated by the new problem list, one area of increasing interest is the Arctic where men and weapons must function at temperatures as low as 65° below zero. Ideas are needed for a portable device to keep individual soldiers warm, new vehicles which will be at home on snow or ice, ways to convert ordinary auto batters for sub-zero use, and a fast method of moving supplies up glaciers.

Guided missiles and nuclear weapons have opened an entire range of new problems. Warning that "bridges can be destroyed too quickly" in modern warfare, the military is asking for some radical new means of getting men and equipment across gaps in a hurry. Also needed is a plan for extinguishing massive atomic fires.

Less spectacular developments also are needed such as heat-resistant paints, engine preservatives, substitutes for water and oils used in hydraulic systems, foul-proof spark ignition systems, substitutes for some of the commonly-used metals, improved flares and flash cartridges, a rapid means of loading and unloading aircraft, a spark-proof forklift truck, an all-weather fuse for projectiles, and a host of similar items.

Undoubtedly some of these problems will be solved in the near future as a result of publication of this list for inventors. There may be the germ of an idea in the back of someone's mind which already is the solution to one of these problems. Now that the list has been assembled and published, one part of the Council's job is completed. The task remaining with regard to this particular list is to receive ideas and inventions, evaluate them, and turn the worthy ones over to the military for final evaluation. This, in essence, is the limit of the Council's authority. There are many things which have been asked of the Council by inventors which this agency is not empowered to do, such as obtaining patents for the inventors, negotiating financial arrangements, or providing funds for further research and development.

The only government agency which is authorized to grant patents is the U. S. Patent Office. The Council has no authority to help an inventor in securing a patent, but the Armed Services occasionally offer assistance in return for free use of an invention believed to be of value to the national defense. However, all material submitted to the Council is held in strict confidence, and all possible safeguards are imposed to protect an inventor's rights. In addition, each proposal is automatically stamped with the date and hour it is received by the Council. Since a proposal becomes a part of permanent government records, it is always available as evidence in any subsequent controversy over priority of inventorship.

The Council also has no authority to offer payment or to pay an inventor. If a proposal submitted to the Council is adopted by the Armed Services, the branch which uses the idea has the authority to negotiate with the inventor for the right to use his invention.

Neither has the Council any funds with which to enter into research and development work, nor can it recommend to any other government agency that such funds be granted to an inventor. If an invention shows promise, it is possible that one of the Armed Services research groups will undertake the necessary development work.

Sometimes the Council is approached with a product that is commercially available which the submitter wishes to propose to the military services. The Council can act only on original ideas for devices not yet in production; the Armed Services have purchasing branches which handle the procurement of supplies.

But when an original idea is presented, it will be evaluated and passed on to the proper military agency in the least possible time. The record of the Council speaks for itself—many money- and life-saving ideas have been adopted by the military through the Council. In times such as we are living in today, the Council's work will continue to be as vital to our national security as it was in World War II and Korea.

# Governmental Patent Administration, Policy and Organization*

CAPT. GEORGE N. ROBILLARD, USN†

SUMMARY

RESEARCH CONDUCTED BY and for the Armed Services has resulted in a technical and scientific revolution in military weapons, aircraft, ships, propulsion means, communications and practically everything necessary to support the Armed Forces. The level of research and development now being conducted will unquestionably last for many years and may be increased in the future. The extensive research and development being conducted has resulted in an "inventive era," for "inventions" are the inevitable result of research and development. As the Government is in the same position as its citizens with respect to inventions it is essential that inventions arising out of government research and development be patented, if for no other reason, than to prevent paying twice for the same thing.

In recent years there has been a decided effort on the part of the administration to place agencies on a businesslike basis. An outstanding exception has been the field of patents and related matters. This discussion is submitted in an effort to show that patent policy, administration, and organization should be directed toward placing patents and related matters on a business basis.

## I—PATENT ADMINISTRATION V. PATENT LAW

THE PROBLEMS OF GOVERNMENT PATENTS and related matters, prior to World War II, did not have the significance they have today. Governmental research and development was not at a high level and the Armed Forces relied primarily upon improvements made by independent contractors. The United States did not have an armaments industry. As a result, the administration and business ends of the patent problem were relatively minor and all matters relating to patents were placed in the Offices of the Judge Advocate Generals of the Army and the Navy because the legal aspects presented the greater problem. The natural outcome of this placement has resulted in the erroneous view that all matters pertaining to this field are legal. This has led to misunderstanding and confusion.

Today the patent programs of the three Services are still conducted primarily by patent lawyers who, as the program grew, took over the administration and

* Opinions expressed herein are personal and do not purport to reflect the views of the Department of the Navy or of any other government agency.

† Capt. Robillard is the Assistant Chief of Naval Research (Patents) Office of Naval Research —Department of the Navy.

management aspects and in most instances serve in the double capacity of administrator and lawyer.

An analysis of the functions performed with respect to patents and related matters show that most are now in non-legal fields. However, the legal functions which are performed are unique and a recognized specialty in the field of law.

The foregoing has been pointed out to emphasize that this discussion is directed to the "administrative and business" aspects of this problem as distinguished from the legal aspects. Obviously some references must be made to the legal aspects in this discussion.

## II—POLICY AND ADMINISTRATIVE PROBLEMS RE PATENTS AND RELATED MATTERS

As will be more specifically shown in subsequent parts of this paper, policy and administration of patents and related matters have a direct bearing on the Armed Services research and development program. The following are indicative of some of the phases of the problem:

### *Policy*

a) Policy with respect to division of rights in inventions made by Armed Services research and development contractors;[1]

b) Policy with respect to rights in technical information developed under Armed Services sponsored research and development contracts;[1]

c) Policy with respect to division of rights in and to inventions arising from Armed Services employees;[2]

d) Policy with respect to settlement of claims arising from unauthorized use of inventions by the Armed Services;[3]

e) Policy with respect to adoption of inventions made by independent inventors;

f) Policy with respect to royalty payments by the Armed Services;

g) Policy with respect to legislative proposals affecting patents and related matters;

h) Policy with respect to the interchange of patents and related matters with other countries.[4]

### *Administration*

a) Administration of patent provisions in contracts;[1]

b) Administration of problems arising under the Patent Secrecy Act;[5]

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[1] Armed Services Procurement Regulation.

[2] Executive Order 10096 of January 23, 1950, and Administrative Orders 4 and 5 of the Chairman of the Government Patents Board.

[3] 28 U.S.C. 1498. (The original statute enacted in 1910 established jurisdiction in the Court of Claims for unauthorized use of patented inventions by the United States. This was extended by amendment in 1918 to include "made by or for the United States" in order to prevent the running of inventions against contractors manufacturing for the United States.)

[4] 22 U.S.C. 1668 (Mutual Defense Assistance Act). (The bilaterals with the NATO countries all of which have been published by the Department of State.)

[5] 35 U.S.C. 181-188 (Secrecy Act).

c) Administration of the patent soliciting programs;

d) Coordination of inventions with research and development programs;

e) Administration under interchange agreements.

### III—PURPOSE OF RESEARCH AND DEVELOPMENT

Research and development conducted by the Armed Services is directed towards one end result, namely, *to provide that which will permit the Services to carry out their assigned mission, the defense of the United States.*

The Armed Services are interested in inventions or technical information per se arising out of research and development only to the extent that the inventions and technical information are useful in carrying out their assigned mission.

However, inventions and technical information are the inevitable result of research and development. They are a by-product and their importance has not been fully appreciated except by those directly concerned. The utilization of this by-product can add greatly to the success of a research and development program or detract from it.

At present patents are obtained on patentable inventions arising under research and development and to which the Government has title. This is done for one purpose only—to prevent others from patenting the same invention. Thereafter, as the Supreme Court has said, the patent becomes a document in the dead hand of Government. This is due to the failure to utilize the patents to their full value.

If full utilization is made and our policy so directed, then inventions and technical information can be used

a) To reduce the cost of research and development;

b) To place the United States in a bargaining position relative to rights in foreign countries;

c) As an incentive to retain in Government competent technical personnel;

d) As an incentive to retain competent contractors.

### IV—MILITARY V. CIVILIAN IMPLICATIONS RE INVENTIONS, PATENTS AND RELATED MATTERS

The research and development program of the Armed Services is directed towards military ends, and it follows that the administration of this problem falls within the military sphere.

The military aspects of the problem were recognized by the Congress as early as 1918. In that year legislation was enacted which necessitated a patent owner bringing suit in the Court of Claims when products made "for the Government" incorporated a patented invention. The primary purpose of this legislation was to prevent the running of an injunction which would stop the flow of military equipment to the Government.

At present substantially all the research and development being conducted by or for the Armed Services is in a classified category. Thus almost every action taken in the patent field is subject to "security control." This control obviously and necessarily interferes with normal commercial relationships which might otherwise be established between manufacturers in this country and manufacturers abroad. United States manufacturers are not permitted to transfer classified information (even when proprietary to them) to a foreign government or foreign manufacturer without clearance from the Armed Services. This is absolutely essential because of the military aspect of the problem. In the United States great numbers of inventions for which applications have been filed in the Patent Office are placed under secrecy and this places further restrictions upon the owners. Coupled with all of the foregoing is the possibility of increased liability to the United States because of the actions taken. Because of this not only is the placing of an invention under secrecy essential for military purposes and a burden to the military, but it is equally essential that the military remove secrecy when no longer required in order to reduce possible liability to the United States. Obviously the placing of inventions under secrecy and removal therefrom are military problems.

It is only when the matter involved is of a non-classified nature that the patent laws take over without being subject to other restrictions. From this it can readily be seen that the *real control is the subject matter involved,* not the patent laws.

## V—NON-UTILIZATION OF GOVERNMENT-OWNED PATENTS

### *United States*

The present policy of the United States Government is in effect to "dedicate" all patents to the public. The legality of this is questionable, but it is an accomplished fact. As a result the only reason for the Government's obtaining patents is to preclude someone else from obtaining patents on the same invention. "Dedication" to the public is not stated in so many words but is accomplished on the basis of granting a royalty-free, non-exclusive license to anyone, though few ever bother about obtaining a license.[6] In dedicating patents to the public it becomes immediately apparent that unless the Government is making use of the inventions the only ones who will use them are those into whose line of endeavor the invention falls. Obviously, one is not going to exploit an invention knowing that once it has been developed anyone may step in and copy. Thus, dedication to the public fails to carry out the purpose expressed in the Constitution for granting patents—namely, to *promote the useful arts.*

Dedication to the public also removes from the Armed Services a valuable asset. This asset is the obtaining of revenue to offset research and development costs, and as a counter claim when patents are asserted against the Government. The

[6] Publications of the Office of the Chairman, Government Patents Board entitled "Government Owned Inventions for Free Use" (Undated). (The Attorney General, the late Honorable Harlan F. Stone in 34 Op. Atty. G. 320 held that a Government patent was public property and there was no authority in law to dispose of it by assignment or the granting of an exclusive license. However, he held that non-exclusive, non-transferable and revocable licenses could be granted. Subsequent Attorney General decisions have watered down this opinion to the point of holding that a license in the public interest was sufficient consideration and thus in effect "dedication to the public" has resulted.)

extent to which the United States should use this asset can be debated and great objections would unquestionably be raised by industry against exploitation of government-owned patents. There is, however, at least one use which should be made, namely to reduce costs to the United States. This can best be stated by an example.

The United States, we will assume, is the owner of patents on a vacuum tube. "A" manufactures a tube which infringes the United States-owned patent, but has improved upon it and obtained patents on the improvement. The United States manufactures the improved tubes and becomes an unauthorized user of "A's" invention. "A" files a claim and the United States may not use its patents as an offset, because "A" has a license thereunder. This is excellent business for "A" but poor for the United States.

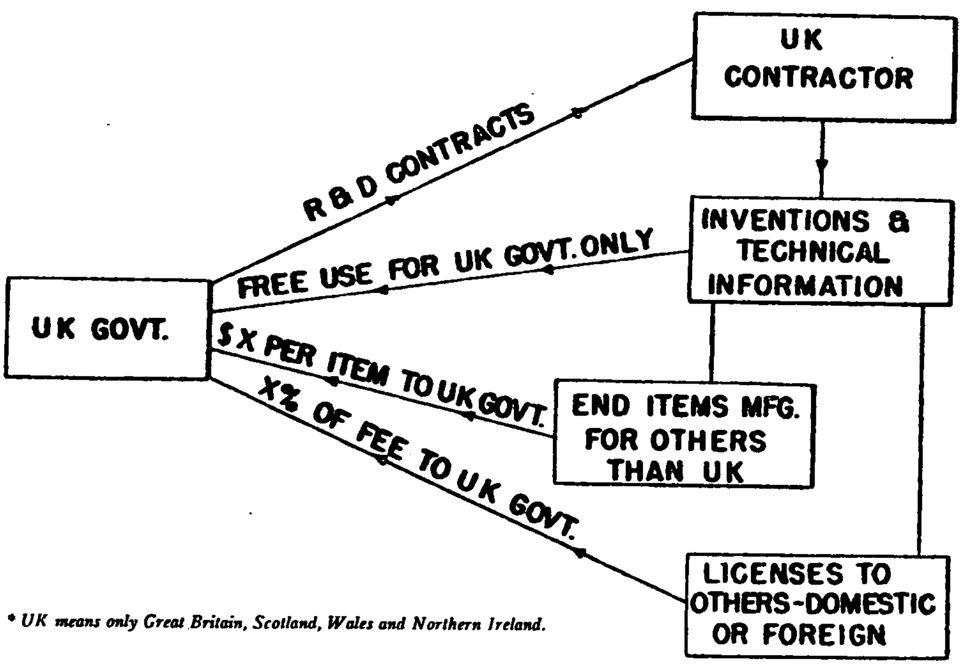
*Patents in United Kingdom*

By contrast the United Kingdom has placed patents on inventions developed under government-sponsored research on a business basis.

At present the United Kingdom has established the following three corporations for the exploitation of patents:

a) Power Jets, Inc., for the exploitation of patented inventions, technical information and know-how, pertaining to gas turbines;[7]

U K* RESEARCH COST RECOVERY PROGRAM




* *UK means only Great Britain, Scotland, Wales and Northern Ireland.*

[7] Established April, 1944—Power Jets (Research & Development) Ltd.

b) United Kingdom Atomic Energy Authority for the exploitation of patented inventions, technical information and know-how, relating to the nuclear field,[8] and

c) The National Research and Development Corporation for exploiting patented inventions, technical information and know-how, in any field not covered by the first two.[9]

In addition to obtaining a royalty return on inventions made either at government laboratories or under government-sponsored research and development the United Kingdom also obtains a return on research and development funds which it expends for research and development. This is done through contractor sales of the end product to anyone other than the Government of the United Kingdom by requiring a certain percentage of the sale price to be refunded to the United Kingdom Treasury. The other members of the Commonwealth are not excluded. This policy is exemplified by the preceding chart.

Pointing out that the members of the Commonwealth are not excluded emphasizes what the British consider to be a sound business arrangement, and as a result, except when representations have been made on a diplomatic level, purchases made on offshore procurement have not been excluded from the policy.

There has been at least one instance under the United Kingdom policy where equipment manufactured in Great Britain under the offshore procurement program was returned to the British Government at no cost to it. The equipment had originally been developed under a United Kingdom research and development contract, and the manufacturer was obligated to pay to the British Government a certain percentage of the purchase price. In this instance the United Kingdom not only received the equipment which had been fully paid for by the United States Government but in addition received a part of the purchase price.

Another example which may be given is that of the Vickers Viscount which was developed under governmental research and development funds. This plane has had unusual commercial success and thousands of pounds of the purchase price of each plane is refunded to the United Kingdom Government. The exact amount is not known but it is understood that the entire research and development funds has been repaid and the United Kingdom Government is now making a profit.

The importance placed upon patents by the United Kingdom Government is further shown by the fact that if the Government has a valuable invention which it cannot develop under the auspices of one of the three corporations mentioned above, the invention will be assigned to a private United Kingdom contractor for development. The private contractor regains all rights other than a license to the British Government, and even though the contractor expends his own money in developing the invention, the British Government still obtains a refund on any royalties the assignee may collect from others for the use of it, including royalties collected from the United States.

Let it be made clear that nothing said in this discussion is intended to be a criticism of the British policy of placing patents and technical information on a business

[8] Established August 1, 1954.

[9] Established 1948.

basis. In many instances criticism may be made of the effect upon the United States not because of United Kingdom policy but because of the United States' lack of policy. Some relief has been obtained under the patent bilateral agreements discussed below but the relief is far from complete. The real problem, however, is not whether we should continue to seek relief from the British policy but whether the United States should establish a policy putting the United States on an equal basis.

### *France*

In this country the picture is different from that in the United Kingdom. France has several corporations in which the Government owns all of the stock. It is the position of the French Government that such corporations are not "Government Corporations" inasmuch as the Government is *only* a stockholder.

The outstanding example from the Defense view is SNECMA, the National Society for the Study and Manufacture of Aviation Motors. In a sense SNECMA compares with Power Jets of England but in addition to being a research organization it is also a manufacturer. SNECMA obtains patents just as does any other corporation and it grants licenses under these patents. There is no direct flow of royalties into the French Treasury, but royalties collected by SNECMA reduce the appropriations required from the Government for the support of the company.

### *Holland*

Holland likewise does not have corporations comparable to those established by Great Britain. It does have the wholly owned government corporations such as the State Mines which controls the output from the Dutch owned mines and further controls many patents for ore processing and the like.

The Dutch Government is also the sole owner of the stock of the Dutch National Bank, which in turn is the owner or controlling stockholder of many manufacturing corporations. Although the Government does, through the bank, have control of such corporations, they are considered to be independent business enterprises. Nevertheless, it can readily be seen that indirectly the inventions owned by such corporations arise from government funds.

### *Germany*

Prior to World War II Germany had one of the finest patent systems of the world and was extremely patent conscious. There is every reason to believe that Germany will once again utilize patents and will adopt one of the many means utilized by the other European countries or the United Kingdom for avoiding so-called "government" ownership.

### *Other European Countries*

Belgium, like Holland and France, is the controlling stockholder in many corporations, as, for example, Sabena. In Italy substantially all corporations such as Finn Mechanica are controlled by the Government and generally through the holding of stock. Nevertheless, in every instance patents issued to such corporations are not government-owned and can be asserted against all.

### VI—FOREIGN PATENTING

#### *United States*

The United States does not generally patent its government-owned inventions outside of the United States. This policy is due in part to recommendations made by the Department of Defense five or six years ago that foreign patenting was not necessary. Radical changes have taken place since then, particularly with relation to our programs in foreign countries. In the negotiation of the patent bilateral agreements (which will be discussed more fully below) the United States representative was always at a disadvantage because there was little to offer in exchange for rights from foreign governments. With the United States patents dedicated to the public, control at home was lost; and without foreign patents, control abroad was nonexistent.

At present the United States does have arrangements for the filing of applications in Canada and in Great Britain but only when the Canadian and United Kingdom governments are of the opinion that they will be utilizing the invention and that it is necessary to obtain patent coverage from a "protective" point of view. This is a limited program.

Another disadvantage in not patenting inventions abroad is the fact that in great areas we now have our inventions in classified categories and therefore publication may not be made. As a result, under the laws of most of the foreign countries if another files on the same invention in that country, even at a date subsequent to the filing in this country, a valid patent would issue to the second comer. In view of this we may well be building up a liability which may be far greater than the expense involved in maintaining a patent position abroad.

#### *United Kingdom*

In contrast to our policy the United Kingdom has a very active program of obtaining patents in foreign countries. The patents are not obtained by the Government but by one of the three corporations mentioned above, or by a contractor to whom the invention has been assigned.

The result of this program is that Power Jets probably dominates the gas turbine field in every country having a patent system. In this particular instance the settlement of a claim against the United States for infringement of Power Jets patents, the United States Government paid $3,200,000.[10]

The National Research and Development Corporation is very active patent-wise; as a matter of fact one of its primary functions is its role as a patent-holding corporation. It is known that this corporation has many United States licensees in the computer field, and the United States is probably bearing a share of the

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[10] License agreement entered into by Power Jets (Research & Development) Ltd. and United States of America on 1 June 1951.

royalties. Very recently a United States research contractor stated that an interference had been declared in the Patent Office between an application for a patent by the contractor and one by the National Research and Development Corporation of Great Britain pertaining to a television picture tube in which the Department of Defense has great interest. If the interference is decided in favor of NRDC and a patent issued to it, peace under the patent will be required if we are to use the tube, and again the United Kingdom Government will be on the collecting end.

More important may be the activity of the Nuclear Corporation. Because of United States laws with respect to atomic energy the United Kingdom Corporation is restricted in the patents it may obtain here but it is not restricted in the filing of patent applications either in the United Kingdom or on the continent. This corporation may well establish a world-wide domination in the nuclear field through patents, just as Power Jets has in the gas turbine field.

### *Other European Countries*

The other European countries do not have as readily recognizable plans as that of the United Kingdom for foreign filing. Obviously, wholly owned corporations such as SNECMA, Finn Mechanica, and Sabena obtain foreign patents and at any time the United States must pay under them, the foreign government benefits.

## VII—INTERNATIONAL MATTERS

### *Offshore Procurement Program*

Under our offshore procurement program the United States contracts for the manufacture of equipment and materials, the acquisition of which may constitute infringement of patents. To date we have not had any great difficulties, but difficulties may be expected.

In order to understand the possibilities it is necessary to visualize the situation. This can best be done by imagining the situation in the United States if each state issued patents as they once did. Under such a system if an automobile were manufactured and patented in New Jersey by one but patented in New York by another, then taking the automobile into New York would constitute an infringement of the New York-held patent. This situation holds abroad. Each country has its own patent system and the patents on the same invention may well have different owners in each of the countries. Thus, the moving of equipment manufactured under a patent in a first country to a second country could constitute infringement in the second if the patent owner in the second is different from that in the first. Moreover, European nations recognize and respect restrictive license clauses whereby equipment manufactured in one country may not be "exported" to another. Indicative of this is the fact that the United States was required to pay "Bofors" an export fee for guns made for the United States in one country for use in another.

In 1954 the United States Representative to the Technical Property Committees submitted to the Ambassador of NATO a proposed multilateral agreement on patents and related matters. This agreement was forwarded to the Department of State and Department of Defense, but no action has been taken on it. The agreement was drafted with a view to assuring freedom of action in Europe with respect to patents and related matters.

Such an agreement is necessary. Great Britain is the only country in Europe which has statutes comparable to ours whereby manufacturing by or for the Government may not be enjoined. In the absence of an agreement it is doubtful whether "by or for the Government" even in the United Kingdom can be extended to United States contracting.

Many argue that we may always defend or prevent infringement actions on the basis of sovereign immunity. This is extremely doubtful in view of the policy of our Department of State which a few years ago informed the Department of Justice that it would no longer adhere to the classic theory of sovereign immunity but to the more liberal theory of granting an immunity to a sovereign only when a sovereign function was involved.[11] It is extremely doubtful whether, in view of this shift of policy in the United States, we can expect sovereign immunity abroad since foreign governments, generally, do not consider "business transactions" by sovereigns as "sovereign acts." Moreover, European governments have been buying and selling arms for centuries and think of them as merely another commodity.

### *NATO*

There has been discussion of late of broadening NATO into the economic fields. If this is accomplished, patent matters will become more complex.

At present NATO has one stated patent policy; namely, that an invention made by a NATO employee belongs to NATO. This raises obvious questions. What happens when an invention is made by a member of a NATO technical committee and the member is not an employee of NATO? These technical committees have available to them tremendous amounts of information supplied by the United States Government. They also have information before them supplied by other governments. Experience abroad shows that the information supplied by foreign governments to the committees is either wholly Government-owned or the foreign government has contracted with the owner for the use of it.

Another question: If NATO comes into possession of an invention, what could it do with it? Where would it be patented and who would have title?

The NATO Security Agreement also has provisions covering patents and related matters. This portion of the agreement has been given only lip service by the United States because it is in conflict with United States laws. This is a most undesirable situation.

### *Mutual Defense Weapons Program*

Under the Mutual Defense Weapons Program the United States contributes towards research and development being conducted under foreign government sponsorship. Unless there has been a recent change, the United States Government

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[11] Letter of May 19, 1952, from the Acting Legal Adviser for the Secretary of State to the Attorney General.

receives substantially nothing in return in the way of rights in and to inventions arising under the R and D. On the other hand, under the existing United Kingdom policy the United Kingdom Government receives a royalty-free license under inventions and know-how and a kickback on any (1) end items sold, or (2) licenses granted on patents and technical information, to other than the British Government. Thus, if the "X" Company manufactures an electronic device under a United Kingdom Government research and development contract to which the United States has contributed funds and then the United States decides to purchase one of the devices, it pays the full price to the contractor and a portion of this price goes back to the United Kingdom Treasury.

The foregoing probably applies in all of the other countries for in most of them many of the contractors engaged in government work are wholly owned government corporations.

*The Bilateral Agreements*

The United States now has bilateral patent agreements with all of its NATO partners. These agreements are based on the Military Defense Assistance Agreements wherein it was agreed to agree in the future on patent matters. The agreements for the most part are platitudes although it may be said that they are statements of United States Government policy. So far as can be determined the broad statements of policy contained therein are not all followed by the Department of Defense.

One of the intents of these agreements was to expedite the flow of technical information between the countries, with the country that originally received the information assuming initial payment to the owner if the owner was damaged as a result of the flow of such information. In order to provide a legal basis for this, the 1951 Mutual Security Act was amended to give the owner the right to bring suit against the United States for damages.

The greatest interchange of information now exists between the United States and the United Kingdom. When the Department of Defense cannot obtain consent of the owner, the Government is so informed and told to negotiate directly with the owner. Obviously the owners will not consent to a disclosure of their information to the United Kingdom, even for "evaluation purposes," without a contract covering every contingency. The reasons are obvious because the contractor is faced with the necessity, should he be damaged, of sueing a foreign government. The United States contractor must of necessity have a contract upon which to predicate suit.

The United States-United Kingdom patent bilateral was specifically drafted on the basis of a transmittal of information whether or not the United States had the consent of the owner. The United Kingdom agreed to negotiate a settlement with the United States if the owner were successful in establishing damages against the United States. Thus it will be seen that one of the most important provisions of the United States-United Kingdom agreement was thwarted by the present policy.

The patent bilaterals have one other weakness—they establish a situation comparable to a wheel without a rim. The United States is the hub and the bilaterals are the spokes, but the rim is lacking since each NATO country does not have an agreement with the other, only with the United States. The necessity of a multilateral agreement becomes apparent.

### *Relief Under Patent Bilaterals*

The patent bilaterals have given the United States some relief. In all instances the United States received a royalty-free license under inventions owned by the other member to the agreement if the inventions could be identified. This is meaningful in Great Britain where it is possible to identify government-owned patents but lacks meaning elsewhere. The United States now has a royalty-free license under patents owned by Power Jets and by the National Research and Development Corporation to the extent that neither is obligated to pay a third party.

However, in instances where patented inventions originating within the government are assigned to United Kingdom corporations, the United States does not have a royalty-free license. Discussions are under way to obtain a royalty-free license to the extent of any monies flowing back to the British Treasury.

## VIII—DIVISION OF RIGHTS IN AND TO INVENTIONS

### *Contractors*

The present policy followed by the United States for a division of rights in and to inventions and use of technical information is one which results in constant and continuous battling between the Government and its contractors.[12] It is doubtful whether there is any other subject upon which more time is spent. There are arguments over terminology, over what constitutes a proprietary right, over what constitutes technical information, etc. A great deal of this controversy could be solved by adopting the United Kingdom government policy. Under the usual United Kingdom research contract the Government leaves all rights to technical information and inventions with the contractor when the latter is also a producer, the United Kingdom sharing in any funds the contractor receives from the sale of end products, or the licensing of others to use the technical information and inventions generated under the contractor.

At present we leave all foreign rights with our contractors. According to recent testimony on the Hill, one aviation company received $5 million in royalties for establishing a second source in Italy, the second source being financed by offshore procurement funds. In such an instance the United States would have substantially reduced its bill if it followed the United Kingdom policy of sharing in research and development profits.

### *Employee Inventions*

Here again the United States should adopt a policy of not taking title to employee inventions. A world-wide license for governmental use is all that is required under

[12] The Office of the Attorney General has repeatedly urged that the United States take title to any patents issued on inventions arising under Government-sponsored research. It has maintained this position since the issuance of the Attorney General's Report in 1947 and was most recently restated in the Attorney General's Report to the Congress on November 9, 1956.

present governmental policy. By leaving title with the inventor the exploitation of the invention within the United States might be risked by private capital as well as the exploitation of the invention abroad. At least we would be adhering closer to the constitutional provision of "promoting the useful arts."

## IX—GOVERNMENT UNAUTHORIZED USE OF INVENTIONS

### *United States*

Under United States law the remedy of a patent owner is by action against the Government under 28 U.S.C. 1498. This Act was originally passed in 1910 to provide patent owners with a remedy against the United States when the infringing device was made by the United States. Prior to this the patent owner had to sue a government employee in the courts but they gradually came to the conclusion that the employee was an agent so the patent owner was left without a remedy.

In 1918 the statute was amended to provide suit if anything was made by or for the Government; thus the statute, originally purely jurisdictional, was broadened to prevent the running of an injunction against a contractor manufacturing for the Government.

In keeping with the present policy of Government not being involved in business it seems to follow that the statutes should be amended to retain the 1910 provision and additionally only a provision to prevent the running of an injunction against a contractor manufacturing for the Government. In this way the patent owners would follow the usual remedies under the patent laws. It is fully recognized that contractors would probably demand an indemnity clause from the Government but it is submitted that in the long run this would save the Government money.

### *United Kingdom*

In the United Kingdom the situation is comparable to the United States except that in all instances royalties may not be collected on anything manufactured for the Government. If "A" contracts with "B" and "B" sells to the Government, "A" does not collect under the contract for sales to the Government. He must either settle with the Government or bring suit against it. In other words the United Kingdom Government cannot be bound for the payment of royalties under a contract between private parties.

### *Other Countries*

The law in Canada is substantially the same as that in the United States. As for the European countries there does not seem to be any clear-cut law on the matter. In most of these countries there is sufficient authority in the Departments to permit settlement or acquisition and as a result few, if any, cases ever go to litigation.

## X—CLAIM SETTLEMENT[13]

Although authority exists within the Department of Defense for the settlement

[13] 10 U.S.C. 2386 and 10 U.S.C. 7210 (Claims settlement).

of claims for unauthorized use of inventions there is considerable difficulty in administering it. This is due primarily to a weakness in the law. In arriving at a claim settlement appropriated funds are used if a settlement is reached and in accordance with many rulings, both with the Court of Claims and the Comptroller General, a settlement cannot be made if there is any "legal doubt" on the subject. As a result it is necessary to resolve all doubts in favor of the Government and force the claimant into the Court of Claims.

Another weakness is the fact that appropriations which may be used for the settlement of claims are those which were obtained for appropriations of that which induced the infringing or unauthorized use. Thus it is necessary to determine whether or not funds will be available before a determination can be made on settlement. It is equally possible to conduct an extensive investigation and then find that no funds are available. Likewise, although funds may be obtained for settlement of past infringement no guarantee can be given that funds will be available for the payment of a future license. Moreover, such payments add to the cost of materials, making it much more difficult for the Bureaus to estimate their costs.

It is obvious that any claim settlement affects the procurement of materials with the result that those who must procure are generally opposed to a settlement because it hurts their appropriation. The only cure would be to isolate claim settlements and royalty payments from all procurement matters.

## XI—ROYALTY PAYMENTS

One of the most difficult, if not impossible, tasks in the administration of patents is to determine what royalties are being paid, and to whom. Although the procurement regulations call for the submission of royalty reports they are difficult to police, and even though the royalty reports are received it is not possible to determine their accuracy. In most instances the determination of what royalties shall be paid must initially be made by the contracting officer negotiating the contract. At present, if a contractor is obligated to pay royalties to a third party, then the Government must recognize the existing contract. We do not have a Royalty Adjustment Act and even if such royalties are considered to be excessive there is little that can be done about it if the technical personnel determine that the equipment is essential to the needs of the Navy. Here again the only solution and the only way we will ever know exactly what is being paid out in royalties (and this includes payments for technical information which many do not consider to be royalties in the strict sense of the word) is by centralizing all royalty payments under one administration. Only in this way would it ever be possible to know whether royalties are being paid under valid patents. Obviously, in instances where the contractor is already bound by an agreement we must find ways and means of of relieving him of his contractual obligation to the third party, such as by the reenactment of the Royalty Adjustment Act.[14]

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[14] Royalty Adjustment Act (35 U.S.C. 89-96)—Expired.

## XII—ORGANIZATION

### *Army, Navy, Air Force*

At present the three Services are well organized to handle patent problems. The only Service which has an over-all patent organization is the Navy.[15] The Army has a division in the Office of the Judge Advocate General and each of the material bureaus likewise have patent sections although final responsibility in legal matters resides in the Judge Advocate General. The Air Force has approximately the same type of organization as the Army.

### *Department of Defense*

The Department of Defense does not have any organization which coordinates patent matters. The Assistant Secretary for Logistics has a patent adviser (part time) with respect to matters falling in the procurement field. The Office of the Assistant Secretary for International Security Affairs, which is deeply involved in the international aspects, has assigned one man part time to the problems. Other matters generally find their way into the Office of General Counsel. The manner in which patent matters cut across most all fields of the Department of Defense may best be shown by identifying the office and what patent problems relate to it. Obviously what is applicable to the Department of Defense is equally so to the three Services.

Assistant Secretary (International Security Affairs)
All international aspects such as the patent bilaterals, proposed multi-laterals and interchanges with foreign governments.

Assistant Secretary (Legislation and Public Affairs)
All legislation relating to these problems.

Assistant Secretary (Manpower, Personnel and Research)
Division of rights in and to inventions made by government employees from an incentive viewpoint.

Assistant Secretary (Supply and Logistics)
In conjunction with Assistant Secretary (R&D) and Assistant Secretary (Engineering).
Division of rights in and to inventions made by contractors and technical information problems.

Assistant Secretary (Research and Development)
Programming of patent programs with research and development.

Assistant Secretary (Engineering)
Programming of patent programs with production.

Joint Chiefs of Staff
All military security problems.

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[15] 10 U.S.C. 5151(a), (3) (Office of Naval Research).

### XIII—RESTATEMENT

There was no intention to document or present a technical study of this complex problem. The intent is to show that the problem exists and the areas in which it exists. The problem of patents and technical information is one which has been repeatedly before the Secretaries and also the Congress. It is a problem upon which the Attorney General repeatedly dwells. It is a problem in which the Comptroller General is interested. It is a problem in which all government employees in the technical field are interested. It is one with which government contractors are vitally concerned; it is one which affects our relationships with foreign countries, and it is one which has never received the attention it deserves.

### XIV—RECOMMENDATION

Although many specific recommendations could be made, the obvious recommendation is that the problem be recognized and a proper assignment be made to place patent administration, policy and organization on a businesslike basis.

# STUDENT PAPERS

The Foundation's first seminar and lecture series[1] on the patent, trademark, copyright and related systems established jointly with The George Washington University Law School, was conducted by Executive-Director Harris this past spring. The following members of the Foundation's Research Staff served as discussion leaders: Dr. Irving H. Siegel, Dr. Barkev S. Sanders, Dr. Joseph Rossman, Mr. George E. Frost, Professor James N. Mosel, and Dr. J. N. Behrman.

Among the objectives of the seminar and lecture series are the stimulation of student interest and the initiation of a source of publishable student material. It is planned to include publishable contributions from students in future issues of the *Journal*. By making available the best papers, students will receive an incentive and our readers will appreciate the evidence of scholarly development in the fields of interest.

# Problems of Confidential Disclosures with Particular Reference To Large Corporations—Submitted Ideas

WILLIAM L ERICSON

### SUMMARY

AN INVESTIGATION of legal problems and risks confronted by corporations, particularly large corporations, in connection with the receipt of unsolicited business suggestions and inventions from independent submitters; review of conventional policies generally adopted by corporations to meet these problems and risks; proposal of a new policy; and preliminary consideration of a proposal to establish an agency in the Patent Office to assist in the exchange of such material.

## I. NATURE AND OCCURRENCE OF THE PROBLEM

CORPORATIONS, particularly those of relatively large size, receive large numbers of submissions from the general public of business schemes, advertising plans, and purported inventions. A large majority of these are not adopted because of a lack

[1] See PTCJRE, I, (June 1957), p. 16. See also the note on annotated bibliographies of student papers on page 000 of this issue.

of commercial feasibility, of applicability to business plans of the recipient, or of practicality. However, a small portion prove to be of value, and are adopted.[1] An additional number are involuntarily "adopted" as the result of a parallel development within the company.[2] A further group of submitted ideas appear to be within the public domain; these comprise subject matter which has been previously disclosed to the public without present reservation of individual rights in publications or expired patents, or which is entirely obvious to all who may give consideration to a particular problem, or a matter of common knowledge.[3] Ideas in the latter group are frequently adopted as a matter of course, without regard for submissions, on the reasonable presumption that no claims to pre-emption by an individual should arise.

The small proportion of submissions which are adopted raise very serious problems of liability of the recipient. It may not be overly charitable to suppose that corporate interests are willing to pay a reasonable remuneration for novel submissions which prove to be valuable.[4] However, serious problems for the corporate patent attorney arise in connection with submissions which fall within the remaining categories described above, and for which compensation is not considered appropriate or justifiable by the corporate interest. Submitters are uniformly of the persuasion that their ideas are of great potential value and are endowed with basic novelty, and are predisposed to skepticism when informed that an idea is old, or has been developed independently by the recipient. They are quick to assume, in such situations, that they have been unfairly dealt with on unequal bargaining terms. Juries seem to be inclined to be in sympathy with this viewpoint, which may be a critical factor in a case involving conflicting evidence of words and acts between the parties.

Cases presently to be discussed will indicate the extreme risk of liability of a recipient who appears to make use of a confidential disclosure to his benefit.[5] Under these circumstances, corporate policy in dealing with such matter is extremely critical, and should be based on a careful weighing of the value of the few usable ideas received, as against the risks involved. Perhaps it is desirable from the standpoint of the public interest to encourage such disclosures; whether the individual corporation wishes to do so, however, will depend largely on experience.[6]

Actions for recovery in these situations are primarily within the jurisdiction of state courts, and unanimity and even consistency in the treatment accorded them is notably lacking. This fact produces further discomfiture on the part of recipients and tends to induce a highly protective policy which discourages submissions. The

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1 Address by George S. Hastings, Patent Counsel, American Machine & Foundry Co., Practicing Law Institute Meeting, June, 1956.

2 See, *e.g.*, Liggett & Myers Tobacco Co. v. Meyer, 101 Ind. App. 420, 194 N.E. 206 (App. Ct. of Ind. 1935). There is always a doubt in such cases as to the actual source which prompted the utilization by the recipient of the idea.

3 See, *e.g.*, Smoley v. New Jersey Zinc Co., 106 F.2d 314, (3d Cir. 1939); Masline v. New York, New Haven & Hartford R. R., 95 Conn. 702, 112 Atl. 639 (1921).

4 Lee, *Submission of Ideas—A Possible Solution*, 29 J. PAT. OFF. SOC'Y 895 (1947).

5 See Sec. II, A-E *post*, and cases there cited.

6 Hastings, *supra* note 1.

basic difficulty in this area lies in the wide variety of legal theories of action on which recovery may be based; these include express and implied-in-fact contracts, quasi-contract, breach of confidence, and possibly tort for conversion of property.[7] If the public interest demands the encouragement of submissions by individuals to corporations, it might greatly further such interest to promote uniform legislation in the states, with the purpose of limiting recovery to a single definite theory. Uniformity of treatment might promote more favorable policies of corporate interests toward outside submissions; it would render their legal position less hazy, and therefore obviate the extremely protective policies now commonly in effect.

## II. BASIS OF LIABILITY—THEORIES OF RECOVERY

### A. GENERALLY

A mere gratuitous submission without reservation of rights cannot impose an obligation to compensate the submitter; there must be something more done or said by the parties to establish a liability.[8] However, an obligation may be inferred from words or acts of the parties implying agreement to treat the submission as confidential matter, or to compensate in the event of use.[9]

An obligation may be inferred from mere use alone, under a quasi-contractual or tort theory, even though the recipient has avoided a direct agreement of any sort or has expressly denied any agreement.[10]

### B. EXPRESS CONTRACT—CONTRACT IMPLIED IN FACT

The critical question under this theory of action is one of fact revolving about the reasonable understanding of the parties as to whether the information is offered gratuitously, or whether a reasonable compensation in the event of use may be expected.[11] If the contract is express, the fact issues are readily resolved, unless there is an additional question in connection with the novelty of the idea or its value to recipient, which may represent a failure of consideration.[12] Although the

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[7] Brown, *Liability in Submission of Ideas Cases*, 29 J. PAT. OFF. SOC'Y 161 (1947). For a case on the last-mentioned theory, see Belt v. Hamilton Nat. Bank, 108 F. Supp. 689, 95 U.S.P.Q. 311 (D.C.D.C. 1952), *aff'd* 210 F.2d 706, 99 U.S.P.Q. 388 (D.C. Cir. 1953).

[8] Grombach Productions v. Waring, 293 N.Y. 609, 59 N.E.2d 425 (1944); Bristol v. Equitable Life Assur. Society, 132 N.Y. 264, 267, 30 N.E. 506, 507 (1892); Rodriguez v. Western Union Tel. Co., 259 App. Div. 224, 18 N.Y.S.2d 759 (1940), *aff'd* 285 N.Y. 667, 34 N.E.2d 375 (1941); Lueddecke v. Chevrolet Motor Co., 70 F.2d 345 (8th Cir. 1934).

[9] Brown, *op. cit., supra* note 7; Liggett & Myers Tobacco Co. v. Meyer, *supra* note 2.

[10] The essential ingredient, as will be seen from consideration of the specific theories of recovery available, is use to the benefit of the recipient.

[11] WILLISTON, CONTRACTS (rev. ed. 1937) §§ 36 and 91: "It is a question of fact if services are accepted whether a reasonable man in the position of the parties would understand that they are offered in return for a fair compensation, or would rather suppose either that they are offered gratuitously, or if not, that the recipient may think so. . . . The question is purely one of fact, but with the burden always on the party who alleges a contract and seeks to enforce it, to prove its existence. . . .Circumstances vary in every case, and there should not be any attempt to build up varieties of legal presumptions to meet them. . . . Where the offeree takes or retains possession of property which has been offered to him such taking or retention in the absence of other circumstances is an acceptance."

[12] Detailed consideration of the effects of the novelty concept will be discussed hereinafter.

burden of proof is on the plaintiff,[13] conflicting evidence is usually involved, and a jury's sympathies are apt to be with the plaintiff.[14]

C. CONTRACT IMPLIED IN LAW—QUASI CONTRACT

This theory of action is based upon receipt and use of an idea which proves to be of value to the recipient, a value which he should not in justice receive without compensation.[15]

The implication of benefit to the recipient is that the matter submitted must not have been known previously to him; it does not necessarily follow that novelty as to the remainder of the world is a requirement, since the recipient might not have ready access to such information, and would at all events have to exert his facilities to discover it.[16]

The circumstances must indicate that the information was not furnished without an expectation of recompense. A strong presumption arises in most cases in favor of an expectation of payment of reasonable value, in the absence of some expression to the contrary.[17]

D. BREACH OF TRUST AND CONFIDENCE

An equitable theory of action based on unjust enrichment resulting from breach

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[13] WILLISTON, CONTRACTS (Rev. ed. 1937), § 3.

[14] For examples of the application of this theory see: Yadkoe v. Fields, 151 P.2d 906, 63 U.S.P.Q. 103 (Cal. Dist. Ct. App. 1944); Soule v. Bon Ami Co. 195 N.Y. Supp. 574 (1922), *aff'd* 235 N.Y. 609, 139 N.E. 754 (1923); Masline v. New York, New Haven & Hartford R. R., *supra* note 3; Johnston v. Twentieth Century Fox Film Corp., 187 P.2d 474, 76 U.S.P.Q. 131 (Cal. 1947); Martin Stamping & Stove Co. v. Manley, 69 So.2d 671 (Ala. 1953); Carneval v. William Morris Agency, Inc., 124 N.Y.S.2d 319 (S. Ct. N.Y.C. 1953); Woodruff v. New State Ice Co., 197 F.2d 36 (10th Cir. 1952); High v. Trade Union Courier Pub. Corp., 69 N.Y.S.2d 526, 71 U.S.P.Q. 283 (S. Ct. N.Y.C. 1946).

[15] Matarese v. Moore-McCormack Lines, Inc., 158 F.2d 631, 71 U.S.P.Q. 311 (2nd Cir. 1946). The court stated, at 634, that the doctrine of quasi-contract "applies to situations where . . . there is no legal contract, but where the person sought to be charged is in possession of money or property which in good conscience of justice he should not retain, but should deliver to another . . . Where this is true the courts impose a duty to refund the money of the use value of the property to the person to whom in good conscience it should belong. . . . The doctrine is applicable to a situation where, as here, the product of an inventor's brain is knowingly received and used by another to his own great benefit without compensating the inventor." Citing Miller v. Schloss, 218 N.Y. 400, 407, 113 N.E. 337 (1916); Byxbie v. Wood, 24 N.Y. 607, 610 (1862); White v. Continental Nat. Bank, 64 N.Y. 316 (1876); Oneida County v. First Citizens Bank & Trust Co., 264 App. Div. 212, 35 N.Y.S.2d 782 (1942); Bristol v. Equitable Life Assur. Soc., *supra* note 8; Pullman's Palace Car Co. v. Central Transp. Co., 171 U.S. 138, 152 (1898); 1 WILLISTON CONTRACTS (Rev. ed. V, 1937) § 3, RESTATEMENT, RESTITUTION, § I(a) (1937).

[16] See Telechron Inc. v. Parissi, 120 F. Supp. 235 (N.D.N.Y. 1954), *aff'd* 229 F.2d 440 (2nd Cir., 1956), in which no recovery was granted because the defendant was able to show a lack of novelty as to himself. It should be noted to the lay reader that the expression "novelty as to the world," which frequently appears in this paper, is a term of art referring only to the U. S. public at large.

[17] For examples of the application of this theory, see; Liggett & Myers Tobacco Co. v. Meyer, *supra* note 2, in which a statement accompanying the submission that "I trust that this idea will be of sufficient value as to merit a reasonable charge therefor" was sufficient evidence of an expectation of compensation; Nash v. Alaska Airlines Inc., 94 F. Supp. 428, 88 U.S.P.Q. 85 (S.D.N.Y., 1950); Howard J. Ryan & Assoc. v. Century Brewing Ass'n., 195 Wash. 600, 55 P.2d 1053 (1936); Filtex Corp. v. Amen Atiyeh, 216 F.2d 443, (9th Cir. 1954).

of a confidential relationship, this theory is basically similar in practice to a quasi-contract theory, although it relies on the establishment of a confidential relationship in connection with the disclosure. The theory probably requires, as the basis of recovery, manufacture and sale of articles incorporating the disclosed matter, rather than mere use;[18] or alternatively, some form of disclosure to third parties. An example of the latter is an attempt by the recipient to procure a patent on the subject-matter.[19]

#### E. TORT, IN THE NATURE OF CONVERSION OF AN IDEA AS PROPERTY

Traditionally, there can be no property right in mere ideas, but only against disclosure improperly obtained by another, for example, breach of confidential disclosure.[20] However, some courts have appeared to adopt a theory of recovery based on property rights in ideas. The case of *Belt v. Hamilton Nat. Bank,*[21] in the District Court for the District of Columbia, stated that there is a property right in ideas which are novel and are reduced to concrete form, even though they are neither patentable nor copyrightable, and allowed recovery for "wrongful appropriation" of a scheme for a radio program. The Court of Appeals for the Second Circuit has also indicated, by way of dicta, that an action in tort presumably for property conversion, might be maintained.[22] Although this theory of action is not well supported by precedent, there is not any basis for an assumption that it might not appear in any case in which the court was seeking for some basis of recovery. However, the theory of action is apparently limited to novel ideas, in concrete form.[23]

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[18] Hoeltke v. C. M. Kemp Mfg. Co., 80 F2d 912,922,26 U.S.P.Q. 114 (4th Cir. 1935) *cert. denied,* 298 U.S. 673 (1936) set forth the general basis in this language: "Where, in advance of the granting of a patent, an invention is disclosed to one who, in breech of the confidence thus reposed, manufactures and sells articles embodying the invention, such person should be liable for the profits and damages resulting therefrom, not under the patent statutes, but upon the principle that equity will not permit one to unjustly enrich himself at the expense of another." Citing Booth v. Stutz Motor Car Co., 56 F.2d 962 (7th Cir., 1932).

[19] For examples, see Mayer v. Hochman, 98 N.Y.S.2d 724, (S. Ct. N.Y.C. 1950); Filtex Corp. v. Amen Atiyeh, *supra* note 17; for cases involving patent issuance to the submitter subsequent to confidential disclosure, see Ackermans v. General Motors Corp., 202 F.2d 642 (4th Cir. 1953), *reversing* 108 F. Supp. 368 (D. Md. 1952), *cert. denied* 345 U.S. 996; Schreyer v. Casco Products Corp., 190 F.2d 921 (2nd Cir., 1951); for other examples of the application of theory, see: McKinzie v. Cline, 252 P. 564 (S. Ct. Oregon 1953); Smith v. Dravo Corp., 203 F.2d 369 (7th Cir. 1953); Shellmar Products Co. v. Allen-Qualley Co., 36 F.2d 623,4 U.S.P.Q. 63 (7th Cir. 1929), 87 F.2d 104 (7th Cir. 1937); and for examples of cases not granting recovery, see Berry v. Glidden Co., 92 F. Supp. 909 (S.D. N.Y. 1950), lack of novelty; Martin v. Wyeth, Inc., 96 F. Supp. 689,696 (D. Md. 1951), *aff'd* 193 F.2d 58 (4th Cir., 1951), prior publication.

[20] Franke v. Wiltschek, 209 F.2d 493,495,99 U.S.P.Q. 431 (2d Cir., 1953), "Plaintiffs . . . cannot assert, a property right in their development such as would entitle them to exclusive enjoyment against the world. Theirs is not a patent, but a trade secret." Williamson v. New York Central R. R., 258 App. Div. 226,16 N.Y.S.2d 217 (1939). "The letters between the parties . . . merely contain an abstract idea which may not be made the subject of property right in the absence of . . . an express contract prior to disclosure."

[21] 108 F. Supp. 689, 95 U.S.P.Q. 311 (D.C.D.C. 1952), *aff'd* 210 F.2d 706, 99 U.S.P.Q. 388 (D.C. Cir. 1953)

[22] Telechron Inc. v. Parissi, 197 F.2d 757,761,93 U.S.P.Q. 492 (2nd Cir., 1952), footnote 9, citing RESTATEMENT, TORTS § 757(b), comment (j).

[23] John W. Shaw Adv. Co. v. Ford Motor Co., 112 F. Supp. 121 (N.D. Ill. 1953).

### F. EFFECTS OF THE THEORY OF ACTION UPON WHICH RECOVERY IS BASED

#### 1. *Available Defenses*

The defenses available vary somewhat among ex contractu, ex delicto, and equitable theories of recovery. Inasmuch as the cases are generally within the operation of state laws, there may be a great deal of variation in the statutes of limitation applicable to ex contractu and ex delicto theories. Furthermore, if an equitable action is used, the doctrine of laches may apply, which may permit a different period for recovery in proper circumstances. Usually, the period of the statute of limitations will be longest in the case of a contract in writing. Another defense, which may be available in a case involving an oral contract, is the Statute of Frauds.

#### 2. *Available Remedies*

Under a contract theory, profits are an inappropriate measure of damages, which must be based upon the terms of the contract. In the event these have not been made express, the "reasonable understanding of the parties" may be looked to, which may be the reasonable value to the recipient of the matter supplied. Punitive damages or injunction are generally inappropriate.

Similarly, profits, punitive damages, and injunction are generally inappropriate in an action based on a quasi-contract theory, in which the measure of damages is quantum meruit or quantum valebat.[24]

However, when an action is based on a tort theory, or on an equitable theory such as breach of confidential disclosure, damages may represent punitive measures, and may include the profits of the recipient. He may have the burden of proof to separate profits arising from the submitted matter from other profits, and to show allowable costs. In equity, injunction against further use may also be available in a proper case. These may represent severe penalties where the defendant is a manufacturer who has invested heavily in the development of a product incorporating the submitted matter.[25]

## III. EFFECTS OF THE NOVELTY CONCEPT

### THE DEGREE OF NOVELTY NECESSARY FOR RECOVERY

In general, some degree of novelty and originality is required for recovery. This requirement is intended to prevent fraud and to avoid the establishment of a limited monopoly as between the parties by means of the disclosure, under delusions of confidence, of an idea in the public domain.[26] Although the degree of novelty need

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[24] Liggett & Myers Tobacco Co. v. Meyer, *supra* note 2; Nash v. Alaska Airlines Inc., *supra* note 17.

[25] Hastings, *supra* note 1. It was indicated that the average cost and time, in the experience of the American Machine & Foundry Company, for carrying a machine from conception to the stage of commercial production, were $500,000 and 55 months, respectively.

[26] Smoley v. New Jersey Zinc Co., *supra* note 3. "If the rule were not so restricted it is obvious that by disclosing an idea under delusions of confidence, the person making the disclosure could thereafter prevent the confidante from subsequently making use of it, even though the idea was well known prior to the date of the disclosure, and open to the use of all others in the world." Also see Flanigan v. Ditto, Inc., 84 F.2d 490, 495 (7th Cir. 1936), 91 F.2d 1 (1937); Masland v. E. I. du Pont de Nemours Powder Co., 224 F. 689 (3d Cir. 1915), *rev'd on other grounds* 224 U.S. 100 (1917), which advanced the proposition that one may not create a duty not to use an old idea by making a confidential disclosure of it.

not be that required for patentability[27] there is disagreement as to whether novelty as to the world at large, or merely novelty as to the recipient, is the proper standard.[28] The great majority of the cases hold that novelty as to the recipient is the minimum requirement.[29] If a contract theory is advanced, there may be a failure of consideration where the information was previously known to the recipient;[30] however, some cases have held that where there is an express contract providing for payment in consideration of the making of a disclosure, even this modest requirement need not be met.[31] Similarly, novelty as to the recipient seems adequate to establish a benefit conferred upon him by the submitter, under a quasi-contractual theory. Where an equitable theory such as breach of trust is employed, it would seem logical to require novelty as to the world, since the necessary confidential relationship is otherwise a fiction and a delusion.[32] However, the defendant may be said to have waived his right to the free use of knowledge in the public domain by his acceptance of a disclosure in confidence.[33] Where a tort theory is applied, in the nature of conversion of property, it would seem that no property right should accrue unless the matter is novel as to the world.[34]

Aside from the question of whether the subject matter must be novel as against the world, or only as against the recipient, it is well settled that it must not be obvious to anyone who considers the problem, or a matter of common knowledge.[35]

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[27] A. O. Smith Corp. v. Petroleum Iron Works Co., 73 F.2d 531, 538, 24 U.S.P.Q. 183 (6th Cir. 1935).

[28] Brown, *Liability in Submission of Ideas Cases,* 29 J. PAT. OFF. SOC'Y 161 (1947). Also see note 16, *supra.*

[29] Masline v. New York, New Haven & Hartford R. R., *supra* note 3: "When information is proffered as the consideration for a contract, it is necessarily implied, is indeed of the essence of the proffer, that the information shall be new to the one to whom it is proffered. A statement to one of what he already knows is not as to him information, but merely a statement of fact already known. The imparting of information in a situation like this must involve an active process resulting in arousing or suggesting ideas or notions not before existent in the mind of the recipient; otherwise it is not information in the true sense of the term, although it may be a statement of fact." In this case, recovery was denied on an express agreement to pay for valuable information, because plaintiff merely suggested that defendant sell advertising space on its equipment, stations and rights-of-way. Also see Franke v. Wiltschek, *supra* note 20; Larson v. General Motors Corp., 148 F.2d 319 (2nd Cir. 1945); for an interesting analogy drawn between a contract of sale of information in the public domain, and the granting of a patent for a "lost art," based on language of Gayler v. Wilder, 51 U.S. 476 (1850), see Falk, *Originality or Novelty in Cases of Misappropriation of Ideas,* 33 J. PAT. OFF. SOC'Y 888 (1951).

[30] Soule v. Bon Ami Co., *supra* note 14; Masline v. New York, New Haven & Hartford R. R., *supra* note 3.

[31] Brunner v. Stix, Baer & Fuller Co., 352 Mo. 1225, 181 S.W.2d 643 (1944); High v. Trade Union Courier Pub. Co., *supra* note 14.

[32] See Martin v. Wyeth, Inc., 193 F.2d 58 (4th Cir. 1951).

[33] See Falk, *Originality or Novelty in Cases of Misappropriation of Ideas, supra* note 29, for a discussion of this problem; also see Schavoir v. American Rebonded Leather Co., 133 Atl. 582, 104 Conn. 472 (1926), in which defendant was estopped from asserting lack of novelty on the basis of a prior patent to another, on this theory; Shellmar Products Co. v. Allen-Qualley Co., *supra* note 19.

[34] Belt v. Hamilton Nat'l Bank, *supra* note 21; Telechron v. Parissi *supra* note 22.

[35] See Soule v. Bon Ami Co., *supra* note 14, in which defendant had promised to pay for valuable information as to how it could increase its profits, and plaintiff suggested that it could raise prices without loss of sales. In denying recovery, the court said that "it was not valuable information in the sense that it was new or novel. It merely informed the defendant that by the adoption of an idea known to every person . . . increased profits would result." Also see cases cited note 29 *supra.*

It seems to be further required that the subject matter be in concrete rather than in abstract form.[36]

It is clear, however, that a discovery by the recipient that the idea is contained in prior art, after he has made an agreement to pay, is no bar to recovery.[37] On the other hand, the soundest defense available appears to be a showing that the matter was known to the defendant prior to the disclosure by the submitter.[38] Therefore, the importance of maintaining witnessed and dated records of intra-company developments, even as to matters clearly not subject to patent or copyright, cannot be overemphasized as a matter of defensive policy for corporate interests. The defendant in such cases must show "clear and convincing" proof to establish prior knowledge in himself.[39]

## IV. EFFECT OF PATENT ISSUANCE AFTER A CONFIDENTIAL DISCLOSURE

The question may arise, where a patent issues to a submitter after a confidential disclosure has been made and adopted by the recipient, whether the confidential relationship dissolves; if so, the recipient should be free, as a member of the public, to use matter disclosed but not claimed in the patent, or to use the entire disclosure in the event the patent is declared invalid.[40]

The cases seem to hold that there is a dissolution of a confidential relationship upon the issuance of a patent, on the theory that the public interest in knowledge in the public domain is so inviolable that one may not impair his right as a member of the public by contract, and may not estop himself from asserting this right.[41]

One writer has attempted to analogize this question to the estoppel of a licensee or an assignor to assert the invalidity of a patent; the inquiry, however, sheds little light on the problem, because the courts have almost uniformly upheld this estoppel.[42]

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[36] Williamson v. New York Central R. R., *supra* note 20; Thomas v. R. J. Reynolds Tobacco Co., 350 Pa. 262, 38 A. 2d 61 (1944); Belt v. Hamilton Nat'l Bank, *supra* note 21; Plus Promotions, Inc. v. RCA Mfg. Co., 49 F. Supp. 116 (S.D.N.Y. 1943); for adverse comment, see Brown, *Liability in Submission of Ideas Cases, supra* note 7.

[37] Shellmar Products Co. v. Allen-Qualley Co., *supra* note 19.

[38] Berry v. Glidden Co., *supra* note 19; Thomas v. R. J. Reynolds Tobacco Co., *supra* note 36; de Filippis v. Chrysler Corp., 159 F.2d 478,72 U.S.P.Q. 288, (2d Cir., 1947), *cert. denied* 331 U.S. 848.

[39] See Hoeltke v. C. M. Kemp Mfg. Co., *supra* note 18, at 923, in which the court, by analogy to the burden of proof required to establish prior knowledge and use as a defense in a patent infringement suit, indicated that the rule that the proof must be clear and convincing "should be applied against one who admittedly receives a disclosure from an inventor, proceeds thereafter to manufacture articles of similar character, and, when called to account, makes answer that he was using his own ideas and not the ideas imparted to him."

[40] Brown, *supra* note 7.

[41] Conmar Products Corp. v. Universal Slide Fastener Co., 172 F.2d 150,155 (2d Cir., 1949); Picard v. United Aircraft Corp., 128 F.2d 632 (2d Cir., 1942); Hoeltke v. C. M. Kemp Mfg. Co., *supra* note 18; but see A. O. Smith Corp. v. Petroleum Iron Works Co., *supra* note 27, in the 6th Circuit; Shellmar Products Co. v. Allen-Qualley Co., *supra* note 19, in the 7th Circuit.

[42] Falk, *Originality or Novelty in Cases of Misappropriation of Ideas, supra* note 29. The author points to the case of Scott Paper Co. v. Marcalus Co. 326 U.S. 249 (1945), where the assignor of a patent was held not estopped to contest validity on the basis of an expired patent, on the theory that he could not by contract deprive the public of the benefit of his free use of the material, for which the public had paid in full by the grant of a patent. But he further

## V. DEFENSIVE POLICIES FOR CORPORATIONS

### A. GENERAL CONCLUSIONS OF LAW

If the conversion of property theory may be safely disregarded, there must be established an express, implied, or quasi-contract to compensate for a submitted idea, or to treat the submission as confidential. There must also be proof of use to the benefit of the recipient (or detriment to the submitter), in order to establish liability. Novelty as to the world is not always necessary, if the idea is novel and valuable to the receiver, and is adopted and used by him to his benefit, as a result of the submission. It is not entirely clear that the idea may not be in abstract form. A contract may be inferred from the circumstances, and this will usually be done in the absence of an express negation; however, an express claim of reward or injunction to secrecy in the submission will more definitely provide a basis for liability. Since a jury is usually involved, which is in sympathy with the submitter, and the evidence usually involves contradictory statements of acts and words, prejudice may be critical in the outcome. A complete defense is prior knowledge of the recipient; but the burden of proof is stringent, being similar to that required for showing of prior use in patent cases. Also, if the idea would be obvious to anyone who considered the problem, or if it has been previously disclosed to the public by the submitter, as by a prior patent issuance, no recovery is available. However, a prior patent application seems to have little effect. Where a confidential disclosure is made before issuance, liability continues at least until issuance, but probably ceases (on this basis) thereafter.

### B. CONVENTIONAL DEFENSE POLICY

The policy exercised by most large corporations today is highly protective, perhaps to a point far beyond normal business risks.[43] The general approach is to secure an express, signed agreement which provides, principally, that there is no confidential relationship established by the submission, that the recipient makes no agreement to hold the matter in confidence, and that the recipient makes no offer to compensate the submitter except as its own judgment dictates. Supplementary provisions may include the following: The recipient is not required to give the submission any consideration other than to the extent it is merited in the judgment of the recipient; the submitter relies solely on his rights under the patent laws; the recipient may purchase all rights to the idea for a specified sum; and the recipient shall not waive its right to contest the validity of any patent on the subject matter.

This policy may be difficult to effectuate, since the receipt of unsolicited disclosures without prior negotiation may be impossible to avoid. Unless the corporation can prevent its employees from receiving oral disclosures, and can avoid open-

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points out that cases before and after Scott v. Marcalus have upheld licensee estoppel, citing: Westinghouse Elec. Mfg. Co. v. Formica Insulation Co., 266 U.S. 342 (1924); Reynolds Metals Co. v. Skinner, 166 F.2d 66 (6th Cir. 1948); Automatic Radio Mfg. Co. v. Hazeltone Research, Inc., 176 F.2d 799 (1st Cir. 1949), *aff'd* 339 U.S. 827 (1950).

[43] See Small, "How to Submit Inventions & Ideas to Large Corporations," *The Chemist* (May 1955), p. 32, for a collection of policy statements by a number of corporations. Also see *Corporate Protective Devices in the Acquisition of Ideas*, 65 HARV. L. REV. 673 (1952).

ing its mail, receipt of numerous confidential submissions is bound to occur.[44] Furthermore, the apparently unequal bargaining positions of the parties might render such an agreement ineffectual in an equity proceeding.

Such policy is directly opposed to the protection desired by the submitter. It is apt to embitter independent inventors, thereby discouraging the submission of desirable as well as useless ideas.[45] For the same reason it may create adverse publicity for the corporation pursuing it.

### C. "NOVELTY CONTRACT" POLICY

One writer[46] has suggested an alternative policy which might afford a high degree of protection without discouraging the submission of ideas. This is based on two attitudes: one held by the submitter that his idea is novel; the other by the recipient who, although desirous of receiving new ideas, is convinced that the vast majority of submitted ideas are not novel as to the world. Therefore, he suggests that the recipient immediately offer an express contract to reimburse the submitter for the reasonable value of his idea, with two conditions precedent to this liability: (1) that the idea is used by recipient, and (2) that the idea is novel.[47] In the majority of cases, there would be no serious problem, for the submitter would readily make such an agreement, and the recipient who wished to use the idea and could show the submitter an anticipating reference would have little difficulty in avoiding suits. If an action were brought, the issue would be clear-cut and relatively simple: a determination of novelty. This proposal seems much more desirable than the conventional overprotection policy, which is apparently based on

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[44] Many corporations establish an office to receive and segregate submissions in order to keep them from the development personnel of the corporation, to provide for cases in which proof of independent development by the latter would be necessary.

[45] See *Hearings before the Subcommittee on Patents, Trademarks, and Copyrights of the Senate Committee on the Judiciary,* 84th Cong., 1st Sess. (1955), for testimony of several inventors about the defensive measures taken by corporations as to submitted ideas.

Charles C. James, at 311, states that after developing an invention, and "thereby destroying himself mentally and physically" the inventor submits his idea to a corporation, and "Then comes the unhappy ending . . . (he) receives a batch of 'come-on letters' . . . (and) a very cleverly written form enclosed for the inventor to sign and return, (which reads) 'No obligation of any kind is assumed by, or may be implied against .................., . . . unless and until we have entered into a formal written contract. . . .'

"The accompanying letter is very solicitous about the inventor's protection and even suggests that he consult his attorney, knowing as they do that the average attorney . . . has had little experience battling such cases with big corporation attorneys, that in reality the form affords them the kind of protection they are seeking in case they wish to indulge in the well-known technique of legal confiscation, unless they can buy it for a song.

". . . why let a condition continue that forces the inventor to throw up the sponge in desperation and seek a livelihood at something at which he is utterly unsuited."

A. G. Thomas, at 351: "A large number of companies today will give an inventor no consideration unless he signs papers relieving them of much responsibility which should be theirs. This applies particularly to a confidential relationship."

He further states that some of the forms "are so inclusive that they, in effect, leave the corporation free to do pretty much as it pleases. In some cases they have no resemblance to fair play."

[46] Lee, *Submission of Ideas—A Possible Solution, supra* note 4.

[47] See Report of the Committee on Inventors, Section of Patent, Trademark and Copyright Law, American Bar Ass'n, 31, 32 (1955), for a similar proposal in which, however, novelty only as to the recipient would be required.

a well-founded distrust of the courts in these cases, and which discourages submissions and injures public relations, without affording greater protection. The proposal, while offering a lesser degree of protection on its face, would afford a real basis of protection, based on a simple and straightforward issue. The suggestion is therefore advocated by the author. It has not been adopted to any great extent in the 10 years since it was set forth, but this may be because it has not come to the attention of corporate counsel generally, or because of the general highly cautious attitude which has been induced in corporations by past unhappy experience with litigation of this kind.

This type of contract, as proposed, would afford protection to the recipient as to subject matter of which he himself was unaware, if it lacked novelty as to the world. On the other hand, he would still be able to defend by a documentary showing that he himself was previously aware of the idea, as by his own prior origination. It would appear also to preclude the possibility of waiver by him of his right as a member of the public to make use of unclaimed matter after a patent issuance covering the subject matter of the confidential disclosure.

A variation in this type of contract might be made where corporate policy dictated another overbalancing consideration. In order to avoid possible bitterness on the part of inventors in cases of prior development by the recipient, where the submitter feels emotionally that the evidence of prior development has been falsely prepared,[48] such a corporation might provide for a standard fee to be paid where there was lack of novelty of this kind. It would be difficult to justify such a payment on theoretical grounds of legal or moral liability; the only logical justification for it would be "Advertising Cost" or "Good-Will." However, it is conceivable that such a policy would be more than repaid by future submissions.

Another consideration, based on the generally suspicious attitude of inventors toward corporate motives, speaks strongly against the adoption of such a policy. It seems realistic to suppose that many inventors would interpret such an offer as an admission that their disclosures were of tremendous value, and that the corporation was trying to deceive and cheat them. The effects of such a reaction on public relations need not be labored to become apparent.

### D. THIRD-PARTY INTERMEDIARY APPROACHES

It has been suggested[49] that a department could be opened in the Patent Office which could act as a third-party intermediary for the exchange of information and confidential disclosures, for more effective commercialization of inventions in an ethical atmosphere. It may be that some such arrangement could be worked out, which could bring individual ideas to practical utilization without unnecessary litigation.

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[48] See *Hearings, supra* note 44, at 353, for a concession to corporate honesty by an inventor, A. G. Thomas. "In fairness I should say that there are two sides to the question; the corporations claiming that they are sometimes already working on ideas submitted to them and this is probably true at times." (Underlining supplied.)

[49] S. Rep. No. 1464, *Review of the American Patent System,* 84th Cong. 2d Sess., at 13; *Hearings, supra* note 44, at 352. The American Bar Association has proposed that provision be made for receipt by the Patent Office of sealed disclosures from inventors for the purpose of establishing the conception date; see Report of the Committee on Inventors, *supra* note 46.

It might thus be possible to eliminate the suspicion and distrust on the part of the inventor, and the hypercautious fear of legal implication on the part of corporations, which, at present, characterize most exchanges of this kind. The value to the furtherance of the useful arts which could result, if this desideratum could be achieved, can hardly be overestimated.

However, other considerations raise serious doubts as to the advisability of establishing such an agency. In order to afford effective assurance that the "pirating" feared by inventors, and the spurious claims which are feared by corporations, could not threaten the interests of the parties, it would seem necessary that such a "third-party intermediary" have power to arbitrate disputes as to matters of actual use, novelty, and evaluation of submissions. It is questionable whether corporate interests would be willing, by participation in such a program, to submit themselves to an administrative arbitration procedure in matters involving such great potential risks. In the face of the facts that courts have themselves appeared to be prejudiced in these matters, and that judicial procedure is relatively expensive, it is nevertheless well to remember the dangers inherent in any abandonment of the judicial process.

This proposal needs further study by those who believe it offers a solution to the problems of confidential disclosure. There is a possibility that it is a "Pandora's Box." Pending further study, it might be well to approach this proposal with caution.

## APPENDIX I

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# NOTES

## Annual Public Conference

The 1958 Annual Public Conference of The Patent, Trademark, and Copyright Foundation will be held June 19 and 20 at the Sheraton-Park Hotel in Washington, D. C. This second conference[1] will provide an opportunity to explore the findings resulting from the Foundation's projects. It is hoped that a large representation from our members and interested publics will attend the Conference so they might contribute to the development of the projects and participate in the stimulating and productive exchanges and contacts of the Conference.

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[1] See the 1957 *Conference Supplement* to the PTCJRE for an edited transcript of the proceedings of the first public conference of the Foundation.

## The Kettering Award

S. Chesterfield Oppenheim, Professor of Law at the University of Michigan, will receive the first "Charles F. Kettering Award for Meritorious Work in Patent, Trademark, and Copyright Research and Education," it was announced this month.

The award, which will be presented annually by The Patent, Trademark, and Copyright Foundation, is given for outstanding work in the field of patent, trademark, copyright, and related areas. Dr. Kettering, in whose honor the award is named, is a member of the Advisory Council of the Foundation.

As the recipient, Professor Oppenheim will receive an honorarium and an appropriate citation. The presentation will be made at the second Annual Public Conference of the Foundation, to be held June 19 and 20, 1958, at the Sheraton-Park Hotel in Washington.

Professor Oppenheim has had a distinguished career in legal research and education. He was among those primarily responsible for the University's undertaking the establishment of the Foundation, and currently serves it as the Adviser on Research. He is the author of numerous articles and books, including *Cases on Trade Regulations; Cases on Federal Antitrust Laws;* and *Unfair Trade Practices—Cases, Comments, and Materials.* He is Editor-in-Chief of the Trade Regulation Law Series, and has served as Chairman of the Advisory Council on the U. S. Marketing Laws Survey and as Co-chairman of the Attorney General's National Committee to Study Antitrust Laws. In 1951, he was awarded the Jefferson Medal by the New Jersey Patent Law Association.

Professor Oppenheim received the A.B. (summa cum laude) and M.A. degrees from Columbia University, and the degrees of Juris Doctor and Doctor of Juridical Science from the University of Michigan. Prior to joining the faculty of the Law School of The George Washington University in 1927, he was an instructor in economics and teaching and research assistant to the Dean of the Law School of the University of Michigan. He remained at George Washington as Professor of Law until 1952, when he returned to the University of Michigan in his present position. He is a member of Phi Beta Kappa, Order of the Coif, the Association of American Law Schools, and the New York State, Michigan, District of Columbia, American, and Federal Bar Associations.

Dr. Kettering is one of the six nationally known leaders in research who were named Honorary Members of the Foundation during its inception, and he aided in its formal establishment in 1954. Named in 1955 as "Industrialist of the Year" by the Society of Industrial Realtors, Dr. Kettering, now Chairman of the Board of the Charles F. Kettering Foundation, is usually considered the man primarily responsible for the modern American automobile.

Final selection of Professor Oppenheim to receive the first Kettering award was made by a seven-man Board of Review of the Foundation: Dr. Kettering; Cloyd H. Marvin, President of the University; O. S. Colclough, Director of the Foundation and Dean of Faculties of the University; L. James Harris, Executive Director of the Foundation; Lawrence R. Hafstad, Chairman of the Foundation's Advisory Council and Vice President in Charge of Research of General Motors Corporation; John C. Green, Executive Director of the National Inventors' Council, Department of Commerce, representing the Research Staff of the Foundation; and Fulton B. Flick, of Brown, Critchlow, Flick, and Peckham in Pittsburgh, Pennsylvania, representing the Foundation's National and Area Committees.

## "In Memoriam" Program

An "In Memoriam" program of the Foundation has recently been established. The purpose of this program is to provide a means to honor the memory of persons who had been active in the fields of the Foundation's interests. The names of these persons will be listed in the "In Memoriam" section of an issue of the *Bulletin* of the Foundation and the *Journal*. In addition, provision has been made for contributions or bequests to be received and administered, in the name of deceased persons, as a Fund for the general purposes of the Foundation or as a Special Fund, earmarked for certain projects or specific purposes within the general purposes of the Foundation, such as Student Research Assistantships. Those who are interested in obtaining further information are invited to write to the Foundation.

# The Next Issue

The third regular issue of the *Journal,* Vol. 2, No. 1, is scheduled for publication in the next few weeks and will include the following: research project interim reports—"The Non-Use of Patented Inventions" (Project 1a, *Patent Utilization*), Barkev S. Sanders, Joseph Rossman, and L. James Harris, and "The Concrete Block Making Machine Industry" (Project 4a, *Effects of Certain Antitrust Decrees Involving Patents as a Major Factor*), George E. Frost, S. Chesterfield Oppenheim, and Neil F. Twomey; contributed articles—"Three Major Trademark Problems in the United States" by Francis C. Browne and "Advantages and Disadvantages of Foreign Licensing" by J. N. Behrman; student paper—"Certain Aspects of the Non-Use of Patents" by Irving M. Freedman.

In the next issue there will be a new section, "Annotated Bibliographies," which lists, primarily, recently published or reported material (such as books, pamphlets, periodicals, etc.) which has been found of interest to the members of the Staff of the Foundation. Also included will be an annotated bibliography of student papers that has been compiled from the Foundation's first seminar and lecture series of the patent, trademark, and copyright and related systems established jointly with The George Washington University Law School.

# IN MEMORIAM

**To honor the memories of persons who were active in the fields of patents, trademarks, copyrights and related systems**

DAVID A. FOX

(1904-1956)

of Lines, Spooner & Quarles

*by Marathon Foundation*

# INDEX* TO VOLUME 1, 1957



* In addition to titles of contributors, names of authors, and conference participants, the index includes references to persons serving the Foundation in various capacities or who played a role in the Foundation's history.

Bold numbers in the index refer to pages in the 1957 Conference Supplement of the *Journal*.

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# The Patent, Trade-Mark, and Copyright Journal of Research and Education

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## EDITORIAL COMMITTEE

# THE PROCEEDINGS

of

# THE FIRST PUBLIC CONFERENCE

of

# The Patent, Trade-Mark, and Copyright Foundation

The George Washington University
Washington 6, D.C.

# The Patent, Trade-Mark, and Copyright Journal of Research and Education

VOLUME 1 | 1957 | CONFERENCE SUPPLEMENT

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*One of three case studies comprising Project 3a, "Effect of Patents on the Creation and Growth of Small Industrial Units."

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## The Proceedings of the Conference (*Continued*)



## Appendices to the Proceedings



THE PATENT, TRADE-MARK, AND COPYRIGHT JOURNAL OF RESEARCH AND EDUCATION is published periodically by The Patent, Trade-Mark, and Copyright Foundation of The George Washington University. In addition to the regular issues of the *Journal*, supplements are published from time to time by the Foundation. $3.50 per regular issue. Supplements, $3.00 per copy. Printed by The Williams Printing Company, Richmond, Virginia.

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# FOREWORD

ONE OF THE BASIC REASONS for the establishment of The Patent, Trade-Mark, and Copyright Foundation was to provide a means of conveying to the citizenry of the country information required for a factual and intelligent comprehension of the patent and related systems. It is performing this task not only in educational programs of individual instruction and lectures, but also by making available pamphlets, annual bulletins, and *The Patent, Trade-Mark, and Copyright Journal of Research and Education* to the general public. Progress reports and newsletters on the work of the Foundation are distributed periodically to the members and donors.

A major medium of communication for the work of the Foundation, *The Patent, Trade-Mark and Copyright Journal of Research and Education,* made its first appearance in June of 1957. The purposes and objectives of this *Journal* are set forth in the Foreword to the first issue as follows:

> *The Patent, Trade-Mark, and Copyright Journal of Research and Education* is (1) devoted to the publication of scientific research regarding the principles, the facts, and the practical operations of the patent, trade-mark, copyright and related systems of the United States and other countries; (2) calculated efficiently to educate and inform across broad fields the general reader and those with special interests from business, industry, the sciences and the professions with respect to the functioning of these systems; and (3) dedicated to convey to these publics the relation of the systems to industrial and social progress.

The first issue of the *Journal* announced the First Public Conference, another major medium of communication for the work of the Foundation. The purpose of the Conference was to discuss the staff reports published in the *Journal,* unpublished reports completed by the date of the Conference, and the work of the Foundation in general.

The Conference was held June 13 and 14, 1957, at the Shoreham Hotel in Washington, D. C. Experts from disciplines pertinent to the subject matter of the various projects discussed the reports.

The Conference, which was eminently successful, provided a broad and representative perspective and furnished a constructive atmosphere in which were explored the nature and significance of the findings of the Foundation's projects. In this atmosphere of give and take, those in attendance had an unusual opportunity for commenting on the work of the Foundation and making suggestions for future study. Key representatives from the fields of commerce, education, science, manufacturing, labor, finance, and the professions were present.

The proceedings of the First Public Conference are published in this supplement to *The Patent, Trade-Mark, and Copyright Journal of Research and Education.* This *Supplement* provides those who attended the Conference a record of the proceedings and serves as a valuable reference source for those who did not attend.

The *Conference Supplement* to the *Journal* contains (1) a summary; (2) an edited transcript of the proceedings, which includes research developed by the Staff of the Foundation up to the date of the Conference, comments on this research by qualified discussants, and, questions from the floor and answers; and (3) appendices to the proceedings.

When discussants were invited to participate in the Conference they were, of course, assured that they would be free to make whatever remarks they wished either as individuals or as members of the organization with which they were associated. Their remarks accordingly include both comments bearing directly on the staff reports and on various aspects of the patent and related systems.

# A Summary of the Proceedings

## I. THURSDAY SESSIONS

WILLARD C. ASBURY, Vice President of Esso Research and Engineering Company, was moderator of the Thursday sessions of The First Public Conference of The Patent, Trade-Mark, and Copyright Foundation of The George Washington University. Mr. Asbury introduced Dr. Cloyd H. Marvin, President of the University, who welcomed the participants of the Conference and discussed the reasons the University undertook the establishment of the Foundation, under whose auspices this First Public Conference was being held.

A "Presentation and Discussion of The Patent, Trade-Mark, and Copyright Foundation" was given by Professor S. Chesterfield Oppenheim, Director O. S. Colclough, and Executive-Director L. James Harris. They pointed out the original motivations that inspired the creation of the Foundation as well as the problems of its organization. Professor Oppenheim presented his recollections relating to the initial conception of the Foundation, and Director Colclough explained the reasons for the Conference. Executive-Director Harris related some of the practical problems encountered in the establishment of the Foundation.

Four Foundation research projects, as summarized below, were presented during the Thursday sessions. The luncheon on that day honored the National Directors and the Area Committee Members of the Foundation. The guest speaker at the dinner Thursday evening honoring the Advisory Council of the Foundation was Mr. Frank A. Howard, President of Sloan-Kettering Institute for Cancer Research and a member of the Board of Trustees of The George Washington University. Mr. Howard recounted, from the viewpoint of the industrial executive, the antitrust conflicts the oil industry has experienced as it advanced through four major stages of gasoline technology. He showed how the patent system actually worked in making technical and economic progress in that industry and how that industry has been affected by the antitrust conflicts. To reduce uncertainty and conflict, and in view of the success certain agencies of the government have had in counciliating issues between industrial companies and representatives of governmental agencies charged with antitrust responsibilities, Mr. Howard suggests the establishment of a unit in the Department of Commerce to undertake the task of conciliation in the patent-antitrust area.

### EFFECTS OF CERTAIN ANTITRUST DECREES INVOLVING PATENTS AS A MAJOR FACTOR (Project 4a).

Report presented by S. Chesterfield Oppenheim and George E. Frost.

*Discussants:* V. H. Doane, of Burns, Doane, Benedict & Irons, Washington, D. C.
Alfred E. Kahn, *Professor of Economics*, Cornell University.
Jerrold G. Van Cise, of Cahill, Gordon, Reindel & Ohl, New York.

The principal point developed on presentation of the report of the "Effects of Antitrust Decrees Involving Patents As a Major Factor" was that in the concrete block machine case—which has been studied in detail—the compulsory licensing provisions of the decree do not appear to have significantly altered the status of Besser Company as the largest concern in the industry, although several firms—all of limited current significance—have relied on the decree in entering the industry. Vernon H. Doane, Esq., commented that, although there were some practical effects of the compulsory licensing decree provisions, they were very small, one reason being the intervening decision adverse to the main patents involved. Professor Alfred E. Kahn cautioned against drawing generalizations from specific case studies; noted the problem of the individual inventor in the concrete block situation; the apparent limited importance of patents in the concrete block industry, and the impossibility of a decree directed to compulsory licensing significantly affecting an industry where patents are of little importance. Finally, Jerrold G. Van Cise, Esq., by way of comment pointed out that his experience is that compulsory license decree provisions destroy the value of the patents, whether they are "royalty free" or not.

## PATENT AND OTHER FACTORS IN THE FUTURE ORGANIZATION OF THE STEEL INDUSTRY[1]

Report presented by Irving H. Siegel and Robert M. Weidenhammer.

*Discussants:* H. B. McCoy, *Administrator,* Business and Defense Services Administration, Department of Commerce.

Arthur Steele, *Vice President,* and Clyde McKinley, *Director of Research,* Air Products, Inc.

Howard Turner, *Vice President for Research,* Jones and Laughlin Steel Corporation.

Dr. Weidenhammer reported that the iron and steel industry, which has recently undergone a change in attitude toward research, will probably develop a new basic technology in coming decades. Policies with respect to patent licensing and to sale or rental of equipment will apparently not affect significantly the rate or extent of adoption of fundamental changes in production methods. Although the adoption of "capital-saving" techniques will apparently not alter the degree of integration or the distribution of firms by size, new opportunities for "small business" are arising in industries serving iron and steel producers (*e.g.,* oxygen-generating equipment).

Mr. McCoy commented on the roles of patents and research and pointed to a new area worthy of study: the metallurgical implications of atomic energy development. Mr. Steele reviewed the growth of oxygen use in steelmaking, stressing the critical role of the patented liquid oxygen pump in the development of Air Products Company. Dr. Turner commented on the three primary methods singled out by Dr. Weidenhammer (*i.e.,* direct ore reduction, oxygen applications to steelmaking, and continuous casting); noted the importance of instrumentation progress; and helped explain the reputed backwardness of steel industry research by citing the impracticality of experimentation with costly, full-scale equipment.

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[1]One of three case studies comprising Project 3a, "Effect of Patents on the Creation and Growth of Small Industrial Units."

PATENT UTILIZATION (Project 1a).

Report presented by Joseph Rossman and Barkev S. Sanders.

*Discussants:* W. Duane Evans, *Assistant Commissioner,* The Bureau of Labor Statistics, Department of Labor.
P. J. Federico, *Examiner-in-Chief,* Board of Appeals, Patent Office.
Jacob Perlman, *Acting Head,* Office of Special Studies, National Science Foundation.

Dr. Rossman, the Principal Investigator of this project, stressed the importance of patent utilization. He also stressed the absence of prior studies in this area.

Dr. Sanders described the selection for the utilization study of a 2 per cent probability sample of all the patents issued by the United States Patent Office in 1938, 1948, and 1952. He then gave the highlights of a preliminary manual tabulation of questionnaires in this sample completed by inventors and assignees of assigned and unassigned patents.

He showed that about 50 per cent of the patents issued were in use or had been used previously. On the basis of assignee responses 32 per cent were in current use, 19 per cent had been used in the past and 8 per cent were about to be used. For unassigned patents the percentages were not radically different.

Dr. Sanders indicated that extensive analysis of the returns has demonstrated the consistency of these percentages. This leads to the belief that the pattern of use would not differ materially in a 100 per cent return of the questionnaires.

Data were presented on reasons given by inventors and assignees as to why patents are not in current use. In general, the reasons given by inventors of assigned patents and the assignees for non-use were analogous. But these reasons were basically different from the reasons given by inventors of unassigned patents.

Finally, some tabular analysis was presented relating to the age of the inventors in the sample. Inventors of assigned patents were relatively younger and had on the average four years more of schooling than inventors of unassigned patents.

A comprehensive and rather lengthy typescript which included basic data and a detailed analysis of the internal consistency of the sample of completed questionnaires had been made available to the discussants.

Mr. Federico reviewed the unsatisfactory past efforts in determining the proportion of patents used and commented favorably on the employment of small random statistical samples. Dr. Evans pointed out the soundness of the study and indicated that he would be more concerned with difference among respondents in interpreting the terms in the questionnaire than in the sampling variability due to sample size. Dr. Perlman also found the study of much value and urged its continuation and expansion.

The first question from the floor dealt with the quality of the patent system. Dr. Rossman replied to this question and pointed out that it must be judged on the basis of fact and our preliminary findings are very encouraging in regard to use. Another queried the adequacy of the sample. The answer given by Dr. Sanders was that it was adequate within the predesignated zone of sampling variability. Another asked if in the survey any determination was made as to whether the subject matter of the patent was used in fact as distinguished from opinion. Dr. Sanders replied that this could be ascertained only by a more intensive follow-up of respondents to see what they meant by the term "use," and further analysis of the completed questionnaires dealing with the extent of use.

### PATENT AND OTHER FACTORS IN THE DEVELOPMENT OF FIRMS IN THE CUSTOM HEAT-TREATING INDUSTRY.[2]

Report presented by Irving H. Siegel and Nathan Belfer.

*Discussants:* Carl L. Ipsen, *Executive Vice President,* Industrial Heating Equipment Association.
Herbert R. Herington, *Assistant Secretary,* Metal Treating Institute.
W. Brown Morton, Jr., of Pennie, Edmonds, Morton, Barrows & Taylor, New York.

Dr. Siegel, speaking for Dr. Belfer, dwelt principally on the replies of custom heat-treaters to a questionnaire, but also touched on the patent interest of equipment makers and the trade-mark interest of material suppliers. The questionnaire, prepared and distributed with the aid of the Metal Treating Institute, drew a light response. The replies indicated limited patent activity by firms on their own account, somewhat greater use of patented processes, common alteration of equipment after purchase, and extensive reliance upon "know-how." Mr. Ipsen recounted the patent history of heat-treating furnaces. Mr. Herington discussed the history of the questionnaire, the difficulty of determining the size of the custom heat-treating industry, and the importance of know-how. He then submitted, as a proposed supplement to Dr. Belfer's report, a technical statement prepared by Mr. Knerr on the nature of heat-treating. Mr. Morton differed with the view taken in Dr. Belfer's paper, preferring to emphasize litigation as a test of the significance of patents. He defined use of a patent not in terms of application of the subject matter but as the exercise of the "power to exclude." According to this criterion, he concluded that patents have little effect on the custom heat-treating industry.

## II. FRIDAY SESSION

Director of the Foundation, O. S. Colclough, was moderator of the Friday session of the Conference. A fifth research project report was presented, followed by brief progress reports on other projects not yet ready for panel review. In the general discussion period following the presentation of the progress reports, Commissioner of Patents Robert C. Watson stated his belief that the work being done by the Foundation was vital, and General Semmes congratulated the officers of the Foundation on the research program. Mr. Virgil E. Woodcock commended the factual and objective nature of the Foundation's research. Mr. Jo Baily Brown stated his belief that this is the first study of the patent system from a university point of view and his satisfaction that it is being carried out by objective researchers. He stressed the effect of economic change on the role of patents and told the Conference that the Foundation will be most effective by informing the public and giving it a background for sound decision-making.

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[2]See footnote 1.

He spoke of the difficulties connected with the Foundation's research and called on patent lawyers to interest themselves in and advise the companies they represent to support this important task.

In the period devoted to "Present Status and Future Prospect," which concluded the Conference, two points were made. First, Professor Oppenheim expressed hope for the development of a group of patent specialists from the various disciplines. Second, Executive-Director Harris stressed the breadth of the developing educational program of the Foundation.

THE VALUE OF THE AMERICAN PATENT SYSTEM: AN INQUIRY INTO POSSIBLE APPROACHES TO ITS MEASUREMENT (Project 2a).

Report presented by Jesse W. Markham and James S. Worley.

*Discussants:* Gerhard Colm, *Chief Economist,* National Planning Association; *Professorial Lecturer in Economics,* The George Washington University.
Robert F. Lanzillotti, Research Associate, Brookings Institution.
Philip L. Young, *Secretary,* Esso Research and Engineering Company.

Dr. Markham and Mr. Worley, who reported on Project 2a, presented their findings in two parts: (1) the problems posed by methodology and the state of available data; and (2) the particular difficulty involved when one attempts to get at an aggregative measure of the value of the patent system by relating the patent system to technological change, and in turn relating technological change to national income size and levels. Their principal recommendation was that studies be initiated which would seek to ascertain the impact of the patent system on businessmen's decisions. This, they concluded, is where the effect of the patent system comes to rest, but where data are sorely needed.

The discussants generally commended the investigators' approach and supported the conclusions reached. Dr. Colm felt that the investigators should probably have set out in explicit terms why the problem of measuring the patent system needed attention. Dr. Markham answered that, while the need for the inquiry had been considered by the investigators as obvious, he would state the need broadly as follows: the literature on the patent system seemed to make sweeping assertions in condemnation and in support of the patent system, but that these assertions could not be supported by facts. A study that documents this has considerable merit. Dr. Lanzillotti asked if it were not true that in a world of large corporate research units the patent system may not, in its present form, serve its original purpose. Dr. Markham conceded the possibility of this, but stated that the study had uncovered no evidence that corporations needed less or different incentives to encourage research than non-corporate entities. Dr. Colm pointed out, in response to a question by Mr. Whitney asking whether or not the present tax structure slowed down expansion, that corporations probably spend more on research under existing tax laws because the government in effect pays for 52 per cent of the costs. Mr. Ball asked Mr. Worley whether he had considered the effect of a patent system on nations which had recently adopted such a system. Mr. Worley stated that he had, but that the problems posed by the time dimension and the difficulties of isolating a society from the effects of a patent system in other societies precluded this approach. Dr. Lanzillotti noted the omission of any detailed analysis of patent abuses. Dr. Markham responded that this omission had been made on purpose because the matter of patent abuses had been fully covered elsewhere and in any case was an administrative rather than a methodological problem. Other related questions raised from the floor were answered by the investigators and discussants. In conclusion, Dean Colclough pointed out that the recommendations made by the investigators for Project 2a were consistent with the program the Foundation now has under way.

*Brief Progress Reports on Foundation Projects:*

RELATION OF AMERICAN PATENTS, TRADE-MARKS, AND TECHNIQUES AND AMERICAN-OWNED FOREIGN PATENTS TO FOREIGN LICENSING (Project 5a):

J. N. Behrman.

Dr. Behrman stated that licensing abroad of American-held patents, trade-marks, and techniques is a rapidly expanding practice of U.S. businesses. He said that they have found that licensing is a technique for meeting increasing restrictions on trade and payments, of gaining additional profits from these proprietary items, and of extending the benefits of the American competitive system to other countries.

He indicated that the present study of this segment of international business and legal practice is an attempt to obtain information on the motivations of companies engaged in licensing, on the legal and economic and governmental problems faced, and on the nature and extent of licensing. Such information is not readily available in published sources. The Foundation has found it necessary to embark on an extensive interview and questionnaire approach.

In addition to gathering information concerning the broad picture, the Foundation staff is analyzing some of the basic economic, legal, and negotiating problems of licensing.

PUBLIC ATTITUDES TOWARD PATENTS, TRADE-MARKS, AND COPYRIGHTS (Project 6a):

James N. Mosel.

Professor Mosel reported that this project is a preliminary study of the content of public attitudes toward the patent system, the areas of ignorance and knowledge that exist, and the ways people come to acquire their attitudes and information about the system. The purpose of the project is to provide guidance for a public information program. He gave early results which suggest that with many people misconceptions are common, attitudes are perpetually fluid and open to change, and that one of the main sources of attitude and information is other people rather than what is learned from mass media.

### ATTITUDES OF AMERICAN INVENTORS TOWARD DEFENSE INVENTION (Project 6b):

James N. Mosel.

Professor Mosel said this project, conducted under an agreement with the National Inventors Council, seeks to uncover the major incentives and deterrents which affect inventing for national defense. Since the main data collection is still in process, no results can be reported at this time. He presented the conceptual framework for attacking the research problem, and described the research plan now being implemented.

### PATENT AND OTHER FACTORS IN THE GROWTH OF THE ELECTRONICS INDUSTRY IN THE BOSTON AREA:[3]

Weldon Welfling.

Dr. Welfling reported on the progress of his study of the electronics industry in the Boston area. He offered some tentative findings on motives for patenting, attitude toward the patent, and use of patents.

### THE TAXATION OF PATENTS (Project 7a):

Robert Bangs and Joseph P. Driscoll.

Dr. Robert Bangs and Mr. Joseph Driscoll previewed an exploratory study that the Foundation is undertaking on the relation of taxation to patents. Dr. Bangs described the scope and methods of the project and commented on the tax treatment of business research and development outlays from which many patents today arise. Mr. Driscoll discussed the tax concessions in the 1954 Code, particularly the one in favor of individual inventors who transfer substantially all their rights.

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[3]See footnote 1.

# The Proceedings of the Conference

## Thursday Morning Session

## June 13, 1957

The conference was convened at 9:35 A.M., Willard C. Asbury, Moderator, presiding.

MR. ASBURY: Gentlemen, we'd like to open the conference this morning. I will introduce myself by saying that I'm a substitute here. My name is Bill Asbury, and I'm from the Esso Research, and Engineering Company. I'm taking the place of Dr. Barker of the Research Corporation, who had another job that he couldn't avoid.

So we're going to start right off now, and Dr. Marvin, the president of the George Washington University, is going to give us a few words of welcome here. I think there is no detailed introduction necessary. He's well known to all of you, and he has served as the president of this university for over 30 years.

Dr. Marvin. [Applause]

DR. CLOYD H. MARVIN: Chairman Asbury, Dean Colclough—I don't know whether to call him the Dean of Faculties this morning or the Director of the Patent, Trade-Mark, and Copyright Foundation—and Gentlemen of the Conference: The University feels that it is good to have you here, and it hopes when you shall have completed your attendance that you will think too that it is good to have been here.

One of the basic trusts of a university is to protect the developing creative mind of the nation that society might advance in worth. To implement this creation, we are jealous of freedom of thinking, freedom of speech, and the protection of ideas which individuals create.

Commerce and industry as elements of society accept their part too in the implementation of the same social trust through our systems of patents, of trade-marks and of copyrights.

So it is altogether appropriate that representatives of the University and of commerce and industry should plan together to develop and encourage invention for social betterment.

After full consideration of the need for this coming together, which was brought home through our environmental and teaching experience at The George Washington University, we felt a need for gathering and disseminating knowledge concerning the patent and trade-mark principles, and the impact of operation of the patent system and related systems upon the commercial, the industrial and the social structure of our nation and of the various nations of the world.

About five or six years ago, our university leaders began to talk about our responsibilities in this area of creative thinking. And three years ago the Board of Trustees, upon the recommendation of many of you, created the Patent, Trade-Mark and Copyright Foundation, in which you are partners, and through which you hope to get help to keep faith with those ideals to which we are all dedicated.

We are glad you are here to aid us with your advice. In being thus helpful to each other, we shall go forward in a creative way for the good of our nation.

Again, I am glad on behalf of The George Washington University to welcome you. We mainly hope your attendance upon these conferences will be profitable to you and that it will help show the Foundation the way and the means by which it should undertake to develop the creative ideas and protect those that are necessary for the advancement that we would have in our society. [Applause]

MR. ASBURY: Thank you, Dr. Marvin.

We're going to ask Professor Oppenheim to take over next. I think you all know him. He has done a tremendous amount of work in this field already. As you know, he's professor of law at the University of Michigan, and he did a monumental job with the Attorney General's National Committee to Study the Antitrust Laws.

Now, he is going to talk to us about the origins and motivations of the Foundation. And I might say that he had an awful lot to do with starting this Foundation, and I really feel that he's one of the major sparkplugs in this Foundation.

Professor.

[Applause]

## PRESENTATION AND DISCUSSION OF THE PATENT, TRADE-MARK, AND COPYRIGHT FOUNDATION

PROFESSOR S. CHESTERFIELD OPPENHEIM: Mr. Chairman, Members of the Conference: What were the original motivations and the concepts in the creation of the Foundation under whose auspices this first public conference is being held? It was my privilege to have shared in the thinking that preceded the establishment of the Foundation. I have been asked to give you some recollections of the background ideas from which the Foundation philosophy was formulated.

It should be said at the outset that there had been some prior attempts to discover the means of coordinating and conducting systematic research on the patent system through an organization devoted to that end. No institutional development evolves without some inflow of the ideas of many minds. Yet this acknowledgment does not, I believe, conflict with what the Foundation may fairly claim as novel concepts that directly gave inception to its research and educational objectives. These concepts are threefold.

First, primary emphasis upon empirical research, coordinated with the disciplines of the various physical and social sciences, as the basis for factual findings and conclusions.

Second, an enterprise under the auspices of a university as a warranty of free and independent inquiry.

And, third, research and education in the fields of the Foundation integrated with the university's facilities for instruction and training as well as dissemination to the general citizenry of published materials on all phases of the patent and related systems.

I shall comment on each of these concepts in the order named.

One idea that dominated the initial thinking was the urgent need for substituting factual information for mere opinion evidence. It was recognized that the patent laws and the patent system had been almost invariably approached from the standpoint of their history and a set of basic, a priori premises from which stemmed abstract generalizations and logical deductions. This approach, sometimes characterized as an "old art of evaluation," left a wide gulf between theory and fact, between reasoning and actual functioning.

In this respect, the Foundation was originally conceived as a means of filling this gap in order that assumptions and divergent viewpoints may be tested in the light of empirical data. In this "new art of evaluation" of the patent system the Foundation found one of its taproots.

A second ruling idea was that this enterprise should be under the aegis of a university as a nonprofit research and educational program. This may be rightfully claimed, I hope, as a novel approach. There had been no previous organized and systematic effort in any university for probing into the breadth and depth of the patent system as an institutional organ of our technological, economic and social life.

Vesting in the Board of Trustees of this University complete discretion to carry out the Foundation objectives set forth in its Declaration of Trust gave the seal of assurance that this work would be carried on, and I quote from the Declaration of Trust, "without regard to, and independently of, the special interests of any group or body politic, whether political, legal, social, or economic."

This is the Foundation's guarantee of inquiry unhindered by partisanship and preconceptions.

A third predominating idea was that a university offered an ideal meeting ground for integrating the disciplines of the physical and social sciences that impinge upon the Foundation's fields of study. It was contemplated that the facilities of the university would provide the channels of research and education in curriculum, instruction and training from which would flow a broadened knowledge and understanding of the industrial and intellectual creations of the systems encompassed by the Foundation's explorations.

Cognate to this was the hope that other educational institutions at the elementary, high school, and university levels might utilize the fruits of the Foundation's work. This, it was further thought, would widely diffuse and convey through publications and other media of communication a sound comprehension of the fundamentals and facts of the systems in all walks of life among the citizenry of this country.

These are the key ideas that guided those who happened to bring the Foundation into being. My personal recollections of the immediate, specific steps that gave it birth may be of some interest to you.

In 1948 it was my privilege to serve as Acting Dean of The George Washington University Law School. Conder C. Henry, former Assistant Commissioner of Patents, who was teaching Patent Office Practice at the time, came in to my office to chat. We discussed several controversial issues regarding the role of the patent system, and I ventured the thought that perhaps one way to resolve such problems might be a university-sponsored foundation.

Conscious as I was that The George Washington University's location in Washington and its traditions in providing instruction and training in patent law offered attractive prospects, I blurted out to Conder: "Why can't we start such a foundation here?"

To which he replied, in the characteristic vein of a man of action: "Let's do it."

In February 1949, Conder Henry presented to the American Patent Law Association, a resolution, subsequently approved by referendum member vote, which recognized the need for university research and education in the fields of the patent and related systems.

Thereafter, President Cloyd H. Marvin of this University appointed a University-sponsored committee to draft a declaration of trust. And in this effort, great and competent assistance was rendered by Henry R. Ashton, Conder C. Henry, Robert C. Watson, the present Commissioner of Patents, and Virgil E. Woodcock.

The Declaration of Trust was signed by the Board of Trustees of The George Washington University on August 3, 1950.

The events that transpired in the interim prior to the commencement of actual operations are described in the first issue of the Foundation's *Patent, Trade-Mark, and Copyright Journal of Research and Education.*[1] Many acknowledgments are there made of persons who assisted in this launching of the Foundation's work.

In the period in which I served it is fitting that I should make special mention of the significant assistance rendered in establishing the Foundation by Max McGraw of Chicago and Frank A. Howard, a Trustee of this University.

Now, no account of these early days would be complete without paying my tribute to the inspired leadership of Dean Oswald S. Colclough, the present Director, whose vision and competence guided the Foundation in the fund-raising stage, in planning its organizational structure, in the selection of the Advisory Council and other personnel, and in supervising all other aspects of the Foundation's activities.

It is to the Dean's credit that he perceived the sterling qualities of L. James Harris, the Executive Director, who has truly dedicated himself to the direction and coordination of the administrative, research, and publication work of the Foundation.

At this first public conference the Foundation is committing to professional scrutiny the fruits of its completed projects and those making progress. I believe the Foundation has kept faith with the concepts I have described as its original motivations. This conference will enable you to judge whether this faith is worthy of being matched by your own faith and whether it has measured up to the expectations that governed the creation of this Foundation as a university enterprise.

In exercising your function as professional judges, may we hope that you bear in mind another guidepost of the Foundation's work. In the interest of preserving the integrity of research and avoiding compromise of the highest possible standards, a

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[1]See p. vii.

substantial investment in time has been unavoidable. In fact, it has been three years —just about three years—since the Foundation first began its actual operations. This explains why some years have elapsed before this public debut was possible.

Thank you. [Applause]

MR. ASBURY: Thank you, Professor Oppenheim. I think that was a very good outline of the origins and the motivations of this Foundation.

Now we're going to call on Dean Colclough, who, as you know, is Dean of Faculties, is Acting Dean of the Law School, but he's going to speak to us here this morning, I think, as Director of the Foundation.

I might say that he's not all serious business either. He has his light moments, I understand, and he has engaged in amateur theatricals for some time. And during the war he got into quite a bind with the Navy. He's a retired admiral from the Navy. He got himself involved in a play in which he had to act as a mad Russian. [Laughter] Now, I hope there's nobody here from the McClellan Committee today; otherwise we might see him on television. [Laughter and Applause]

DIRECTOR COLCLOUGH: Chairman Asbury and Partners in This Enterprise: Somebody must have been talking last night. I was out or I'd have been there to protect myself.

I would say only a few words this morning, for we should get on to the substance of this conference. I want first to convey our feelings of gratitude—and when I say "our" I mean the staff that you find listed on the back of your program. We appreciate your being here. We appreciate what so many of you have done to make possible this milestone in the progress of the Foundation which Professor Oppenheim has just so clearly set forth.

I came along in 1949 and found Professor Oppenheim and others involved in this matter. I sort of fell heir to a partnership in it. It's been one of the most exciting enterprises in my life. This conference today has seemed to some of us a long time arriving, but we believe that, in order to do that which this Foundation was created to do, integrity should not be sacrified to time.

You have the first copy of the *Journal.*[2] We hope that you find it meritorious. We recognize that it is not—as research never is—perfection. We ask sincerely for your comments not only here at this conference, but in the future.

You see, ladies and gentlemen, the basic philosophy in which our work is cast is a basic philosophy also in our way of life. In our free society, our institutions—be they political, economic or social—will in the final analysis be—and perhaps I should say "should" in the final analysis be—that which the people of this country want them to be. In a representative democracy—or, for those who prefer it, a constitutional republic—the will of the people is supposed to be reflected in its institutions.

Now, "the will of the people" is a very fine term and we all believe in it, but how often the development or operations of our institutions seem to go by default to the few. It was really this germ of an idea—it *is,* rather—that has motivated us from

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[2]See p. vii.

the beginning. There needs to be more discussion, better understanding, more public consideration of the patent system, the trade-mark and copyright systems, and all the related systems, if they are to be that which they were intended to be when the foundation for them was laid in our Constitution.

And it is for that reason that a gathering such as this, in which all three branches of the government are represented, is so significant. Here are representatives of the Executive Department, among whom representatives of the Patent Office are particularly valuable to our discussions. We will have with us in the course of today and tomorrow members of the judiciary, many of whom have written me that they are most anxious to be here, and that when they can get away from the bench they will be here. I have had similar communications from members of Congress. And then there are those of us who represent the field of education. There are those of you who represent the professions. And there are those of you who represent business and industry. It is this sort of give-and-take discussion in the public atmosphere that I maintain augurs well for the future of the system in which we are so interested and to which we are dedicated by this discussion.

I would be remiss if I did not at this time pay respects to our research staff. I ask you to look, in due time, on the back of the program in order to realize the wide coverage, both in the disciplines and geographically, which our staff represents—not from just The George Washington University. We are the guiding light, yes. But you will find members of our staff from Washington and Lee University, the University of Pittsburgh, Simmons College, Princeton University—from many institutions. That will continue to be the pattern of our research staff.

Now, finally, may I point out that, if we are going to go forward in the future, we need your assistance. We need your interest. We need your support, financially and intellectually.

You all have received at some time during the past year a bulletin which lists our membership. It is national. It represents all interested groups. And it must continue to do that, in order that we find it possible to represent all interested groups—and, may I say, the one comprehension group, namely, the American people, for whom this system was created.

If I may use a naval expression, ladies and gentlemen, this is an "all hands" job. [Applause]

MR. ASBURY: Thank you very much, Dean Colclough.

We are next going to hear from the Executive Director of the Foundation, Professor L. James Harris, who I think, as you heard from Professor Oppenheim, has been a devoted, dedicated member of the team that is putting on the show and has done the work here today.

He was formerly Committee Counsel to the Judiciary Committee of the House of Representatives and Counsel to its Subcommittee on Patents, Trade-marks and Copyrights, and he directed and supervised the actual drafting of the bill that culminated in the Patent Act of 1952.

He's a Professorial Lecturer at The George Washington University Law School. [Applause]

EXECUTIVE-DIRECTOR HARRIS: Mr. Chairman, Members of the Conference: You have heard Dr. Marvin talk about why the University undertook the establishment of the Foundation, Professor Oppenheim on the initial conception of the Foundation, and, Dean Colclough about the reasons for the conference of the Foundation at this time. I would like to make a few remarks relating to some of the practical problems we encountered.

I'm sure that none of us here think that the bare conception of a Foundation is all that is really needed and it only remains for us to pick up and use the idea. I am also quite sure that, except for those who have actually participated in and been through the actual process of planning the over-all program of a Foundation, none are aware of the many problems, the blood, sweat and tears that go into the design of such a program, the intense study that goes into the formulation of a disciplined attack upon the many areas of ignorance that exist in the fields of the Foundation's interests.

Although previous methods of attack have not been systematic and coordinated, there have been contributions, and it was important for us to be familiar with as many of these previous efforts as possible. It was also important that we know about the people who made these contributions, and to gather information about potential contributors.

But even before the programing phase it was necessary to raise funds. It was necessary to raise funds to give some assurance that there would be sufficient finances to support at least a modest beginning, a relatively short period, but enough to prove whether we were entitled to further support.

I will not burden you with the trials and tribulations of fund-raising, especially the difficult problems of raising funds for an idea, because there really wasn't any evidence to demonstrate at that time the feasibility of the Foundation.

I remember with warmth and gratitude those hardy ones with faith who based their contributions to our work, as one put it, "on the color of our eyes." However, I also remember with some disappointment, of course, the gentlemen who told me that they would rather wait and see how we did before they came aboard, or who were satisfied with how things were and would support us if they were sure of what our findings would be.

Looking back now, some of the experiences I had in bringing the story of the Foundation to the country were amusing, if not always fruitful. To mention but one example, I telephoned the president of a leading Chicago corporation when I visited that city. I mentioned our common acquaintances and asked for an appointment. He refused. But after a short conversation he finally agreed to five minutes, informing me that he would not be interested in a membership.

I went over to see him anyway, and after waiting some 20 minutes in the anteroom I was ushered into a long, beautifully furnished office. When I reached his desk, he looked up and said: "Sit down. Remember, I'm not interested. Go ahead. Five minutes." [Laughter]

I sat down, with some misgivings, and launched into the story of the Foundation—with one eye on my watch. At exactly five minutes I broke off and rose to leave. He stopped me and asked a question.

This process went on for about half an hour—when he finally asked me for a membership application. By this time I had grown quite confident and optimistically asked him how much he intended to make the membership for. He replied, "A couple of hundred dollars."

I suggested he make it for a couple of thousand instead. Oh, he said, he'd have to take that up with his board of directors—that kind of a membership—and he couldn't tell the story as well as I. I volunteered to appear before his board of directors, and he accepted. But he never did send me that invitation.

Needless to say, I never let my optimism run away with me again. [Laughter]

One of the most important considerations that faced us in setting up the over-all program was that we were expected to produce before we began. Our support coming in large part from the business community, we were sensitive to the expectations of businessmen, many of whom considered scientific production in precisely the same manner as the production of their own particular commodities for market. Although we were keenly aware that we could not over-do the pressure on our research staff, we were also aware that we had to have relatively quick results, that we couldn't engage in long-drawn-out studies.

Accordingly, after the Foundation was placed in operation in February of 1954 and we were constructing an over-all plan of investigation, it was decided to carry out the plan by means of pilot projects, modestly conceived. By means of these pilots, facts could be collected on a limited basis to determine what information was available and to develop methods for extending the project to larger studies if that were feasible.

As we completed these pilots we planned to make available this information to the various publics whom we served.

An example of the kind of problems we encountered was the difficulty in assuring ourselves that certain assumptions that we had to make in our planning were valid. As all scientific investigation starts with assumptions, this was in the best tradition. But this making of assumptions is a question of judgment, and judgment is a very personal thing. But, of course, scientific method is self-corrective. That is, in the light of our findings, we can always change our assumptions.

For example, some people assume that the invention and the patent right are one and the same thing, that they might be compared to the car and the permit to drive the car. Accordingly, it is their contention that the value of the permit should include the value of the car. In the pre-planning that went into the project of "The Value of the Patent in the United States," we had to ask ourselves: The value of what? The invention? The patent? Both? And the value to whom?

There was only one way to be sure our assumptions were as valid as we could make them, and that was by their constant examination and reexamination as our investigations proceeded and more and more facts were marshaled.

There was always the danger here of coming up with an output consisting of the sum of an input made up of a false assumption plus the square of the investigator's personality. [Laughter]

This constant examination and reexamination of our hypotheses and our policy of limiting ourselves at first to pilot projects served another important function. It provided some assurance of relatively concrete goals, of something relatively definite and certain.

However, while remaining constantly alert to keep our formulations concrete, it was equally important for us to remain sufficiently flexible to accept and evaluate all information gathered without bias or preference.

We were also convinced of the importance of studying the patent in the environment in which it exists. Our studies on the role of patents in the creation and growth of small industrial units, which you will hear about later on in the program, is an example of how we applied this approach. We wanted to see the whole organism, so to speak. We wanted to see the patent as a complete, functioning part of the industrial and social picture.

The scientific method sometimes has a tendency to detach the specimen from society. It fixes its attention on a definite thing, finds out everything it can about the thing and neglects everything else. Although this method may be successful in developing all the available information of that particular specimen to be examined, it very definitely limits the usefulness of the results.

Thus, what we were seeking has to be achieved by actually studying the patent in context with other pertinent factors. To obtain this sort of information, there was no substitute for empirical, factual study. To appreciate the importance of the patent, a direct perception of its function as an actuality, as a concrete fact, not a theory alone, was necessary.

Of course, as one is not merely a patent lawyer—that is, he lives in other areas of society as well—and to understand his life as a whole we need to employ expertise in the other areas too, so our research could not merely employ a single discipline. This type of single-discipline observation would lack balance. Our experts trained in a certain discipline would see the problem from their own particular experience and other specialists would see it from theirs. We found that it was necessary to bring these different sets of experiences and trainings together to do a true interdisciplinary job of research.

Ultimately, projects resolve themselves into people—into people carrying them out—and these people study the effect of the patent rights on other people who perform certain functions in the economy, such as the inventor, the manufacturer, the attorney, the worker, the consumer, et cetera.

Accordingly, to ascertain the intrinsic worth of a patent in its environment, we realized that we had to consider, among other factors, how it directly or indirectly motivates people, and the lasting implications.

I should like to direct your attention to the box in the lower right side of your program. You are invited there to examine the first issue of *The Patent, Trade-Mark, and Copyright Journal of Research and Education.*[3] This is the medium for communication of the work of the Foundation.

Thank you. [Applause]

MR. ASBURY: Thank you, Professor Harris.

I think you can see he's not only a teacher of law but he's a salesman too. And there's no doubt about it that he has done a good job in that capacity.

## EFFECTS OF CERTAIN ANTITRUST DECREES INVOLVING PATENTS AS A MAJOR FACTOR

Now we're shifting over to the first project presentataion on the "Effects of Certain Antitrust Decrees Involving Patents as a Major Factor." There is no doubt about it that this is a real hot subject, and the people who put it first on the program must have foreseen actions by the Supreme Court before other lawyers did.

Now, this paper is going to be presented by the team of Professor Oppenheim and Mr. George Frost. As I understand it, Mr. Frost is going to talk first.

MR. GEORGE E. FROST: I think Professor Oppenheim has a few words first.

MR. ASBURY: You're going to let him talk first? All right. Then we're going to have three discussants participate—Mr. Doane, Mr. Kahn, and Mr. Van Cise. And we're going to ask all five of these gentlemen to be on the platform.

Now, our experience with patent lawyers is that they don't always agree. They're very outspoken in their opinions. And we're going to try to get a lot of discussion going here today after the papers have been presented and the discussants have made their remarks.

Members of the staff of the Foundation are going to be passing some cards to you on which you can write down some pertinent questions. Now, if we don't get questions, we're going to call on you, so you might just as well make up your mind that we're going to have some discussion, because, frankly, I think the boys who have worked so hard on these papers need the practical comments from patent lawyers and people in business who have the day-to-day contact with these problems that they're presenting.

So we'll ask these five gentlemen to come up here and sit on the platform during this paper, and we'll ask Professor Oppenheim, who now needs no further introduction, to start the discussion.

### RESEARCH PROJECT INTERIM REPORT

PROFESSOR OPPENHEIM: I'll deliver my prepared paper extemporaneously—if

[3]See page vii.

it doesn't get here in a moment. I feel like the students I call on who say, "Unprepared," or, "I pass." [Laughter]

My function is simply to tell you something about the planning of this project entitled "The Effects of Antitrust Decrees in Which Patents Appear to Be a Major Factor"—and that takes in both litigated and consent judgments.

In the planning stage we realized that there has been a great deal of controversy about the propriety of compulsory licensing provisions. As a matter of fact, as you will note from the *Journal*,[4] which contains a little foundation piece of the statutory and judicial aspects, compulsory licensing today at reasonable royalty rates is considered by government as standard form.

But we also realize that when you go back to the first period when these provisions were inserted in antitrust decrees, they were considered by some as a drastic departure from the normal rule that the owner of a patent may use his own discretion as to whether to license or refuse to license and as to the terms of the license.

A good many assumptions have been made about the need for these provisions in decrees. Obviously, the one that immediately comes to mind is the assumption that were injunctive relief against the prohibited patent practices found or alleged to be in violation of the antitrust laws would not suffice; that in order to remove the unreasonable restraints or the monopolization or to pry open the market to competition, as Mr. Justice Jackson once put it, there was need for compulsion to license. And then more controversy, of course, ensued when the government inserted in consent judgments royalty-free provisions and later in a few litigated judgments.

If you were to examine the *Journal's* backdrop for this, you will find that the courts and the government have not really given us a precise rationale for compulsory licensing. To be sure, either in the comments of the courts in their opinions, the Supreme Court and the Federal courts below, or in releases of the government, there has been the tendency to state certain economic considerations that made necessary compulsory licensing. Sometimes it was candidly said that this was needed to correct past abuse of patent rights, which, of course, engendered the idea that perhaps compulsion to license was a punitive element rather than a mere corrective element.

So, when we thought of this project, we thought of it in terms of asking: Is the basic assumption that compulsory licensing, royalty-free or at reasonable royalties, materially contributes to the loosening up of the market for potential or existing competition a valid one?

Let me emphasize that my function in this has simply been that of a principal consultant. The actual work and the sweat have been undertaken by Mr. George E. Frost, with whom was associated Mr. Neil Twomey. They are the ones who prepared the questionnaires, did the field interviewing, and drafted what you will hear in this final report of the Besser decree[5] case study and a preliminary look at the Vehicular

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[4]See p. vii.

[5]United States v. Besser Manufacturing Co. *et al.*, 96 F. Supp. 304 (E.D. Mich. 1951), *aff'd* 343 U.S. 444 (1952).

Parking decree[6] study. I had the privilege of sharing in the planning and in supervising the progress of the work.

Our greatest interest was in launching a modest pilot project. We selected these two decrees because, prima facie, they appeared to show differences in the industry and in the antitrust charges, and we thought this offered real prospect of valuable comparisons. Furthermore, like the cliché about one has to learn to crawl before one could walk and one has to learn to walk before one could run, we thought by taking these decrees in less complicated situations and developing a methodology, this would pave the way for studies of more complicated industry situations, and even, we hope, that similar studies will be undertaken by others outside the Foundation. The more specific case studies we have the more will the findings and conclusions be well grounded in factual information. And it's the factual information that we need.

Now let me say in brief terms what Mr. Frost was confronted with in launching this study. In the first place, one condition was that we must get the factual information. What actally happened may override any assumptions that might be made theoretically or may override any logical inferences and deductions which prove to be untrue because of the illumination that the facts gave to show that something else was the case.

Secondly, we realized that this must be done with primary emphasis on first-hand sources of information as far as possible. This meant carefully prepared questionnaires followed up by interviews in the field with the personnel of the industry, the firms that were in the industry and the firms that came in subsequent to the decree.

At all times we had to have in mind what were the conditions prior to and at the time of the entry of the decree, what has actually happened since the decree with respect to the structure, the behavior and the accomplishments of the industry or the line of commerce involved in the patented or unpatented art.

In addition to field interviews and follow-ups, there was a canvassing of all other sources of information for factual data as reliable and authoritative as it could be. This included consideration of the following: the patent history in the industry; the unpatented art; the number and relative economic strength of the competitive firms in the industry and their entries and withdrawals; the productive capacity, production, sales, the percentage market shares of these firms; the effects of such matters as investment in research and development, innovation, advertising, servicing, and the like.

There was also need to consider the impact of the personalities of industry members, which industry firm had at its helm a person of great capacity whose executive skill and management vision and efficiency might have accounted for its growth apart from other considerations.

So, from this complex of criteria and tools of measurement which were constructed as a framework for going into the field and finding out what actually happened, came this methodology of empirical and objective research governed by the primacy of over-

[6]United States v. Vehicular Parking, Ltd., 52 F. Supp. 749 (D.C. Del. 1943), 54 F. Supp. 828, (D.C. Del. 1944), 56 F. Supp. 297 (D.C. Del. 1944), 61 F. Supp. 656 (D.C. Del. 1947), 7F.R.D. 336 (D.C. Del. 1947); 74 F. Supp. 4 (D.C. Del. 1947); see also Magee-Hale Park-O-Meter Co. v. Vehicular Parking, Ltd., 180 F. (2d) 897 (3rd Cir. 1950).

riding facts, regardless what the original ideas or assumptions may have been. This methodology is the only one compatible in the generally accepted standards of research in the social sciences.

This method was followed by Mr. Frost and Mr. Twomey.[7]

So, with that, I am very happy to present to you George E. Frost, who will give you a description of this case study and will give you a look at the findings and the conclusions.

Mr. Frost is a member of the firm of Frost and Verhoeven, a law firm in Chicago. He was a member of the Attorney General's National Committee to Study the Antitrust Laws. He has been teaching patent and trade regulation law at the John Marshall Law School in Chicago and also at the University of Chicago.

I hope you will pardon my pride if I end by adding that George was a student of mine in his law school days at George Washington, and he was an outstanding student. Since then he has continued to merit equal distinction in his profession.

Mr. Frost. [Applause]

MR. FROST: Thank you, Oppie. I do appreciate those kind remarks.

On April 28, 1949, the Department of Justice filed an antitrust suit[8] in Detroit, Michigan, under Section 4 of the Sherman Act. The defendants named in that suit were Jesse H. Besser, an individual; the Besser Manufacturing Company, which was a company of which he owned essentially all of the stock; the Stearns Manufacturing Company, which was a publicly-held corporation of which Besser then owned a substantial part of the stock; Hamlin F. Andrus, who happened to be the man, the angel, whatever you want to call him, who had chipped in money to a man named Gelbman, the fifth defendant, in connection with the development of a vibrating-type concrete block-making machine. These defendants were all joined in the suit.

One of the notable omissions of the defendants in the suit was Eugene F. Olsen, who, during the time with which the complaint was concerned, was the president of the Stearns Manufacturing Company. We will have more to say about Mr. Olsen later on.

This case concerned concrete block-making machines. I think everyone here is familiar with concrete block. Obviously there has to be a way to make them. And the current-type concrete block-making machine is a large, mass-production structure. It turns these blocks out something like the Schmoos laid eggs in "Li'l Abner" —at a great rate. A very important and complicated machine.

I must say this though: A concrete block-making machine is not like a radio transmitter or a television receiver. It's not the result of endless years of theoretical research. On the contrary, it's a matter of applied engineering. Techniques can be

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[7]This was the methodology which produced the facts. Obviously judgments must then be made to give meaning to the facts from which findings and conclusions stem. In this way the compulsory licensing provisions can be evaluated in the whole context of the industry developments and then it can be determined from the plurality of the factors considered, to what extent, if any, these patent provisions have been a causative factor in prying open, or promoting competition, in the relevant market. (S. C. Oppenheim)

[8]United States v. Besser Manufacturing Co. *et al.*, 96 F. Supp. 304 (E.D. Mich. 1951).

borrowed from other manufacturing fields and have been borrowed, and the history of the industry, I think it's fair to say, is one that is primarily one of applied engineering based on borrowing.

The industry is one of substantial size. To give you an idea, last year there were made in this country somewhat in excess of two billion concrete blocks. Two billion. And while the number of establishments making blocks has decreased over the years, there are in the neighborhood of 3,000 substantial block-making enterprises.

What were the offenses charged? What did the government contend?

First, as to the Bessers. The charge there was that the Bessers had attempted to monopolize and had monopolized and were guilty of monopolization of the business of making concrete block-making machines. And in this connection the goverment pointed particularly to a series of purchases that the Besser Company and Jesse H. Besser had made over the years. Back in about 1929, for example, they had purchased the Consolidated Concrete Machinery Company, which at that time was the leading competitor of Besser, if it did not actually exceed Besser in sales volume.

The most recent purchase of importance to which the government pointed was the purchase for a figure somewhat in excess of one million dollars of a controlling stock interest in the Stearns Manufacturing Company. Now, Stearns again is another one of the defendants.

With respect to Stearns, Besser individually had purchased this controlling stock interest shortly prior to the filing of the case.

As to all of the defendants—that is, Stearns, Besser individually, Besser Manufacturing Company, Andrus and Gelbman, there were charges made with respect to a patent license agreement, and I'd like just very quickly to give you the history of that agreement.

Louis Gelbman had made some inventions in connection with applying the vibration technique to the manufacture of concrete blocks. The industry had toyed with the idea over a period of years. No one had previously really succeeded in applying the technique. Louis Gelbman did.

In connection with that, Gelbman had obtained a series of patents.

Prior to 1942—to be specific, around 1938—the Stearns Manufacturing Company had taken an exclusive license from Gelbman, and, interestingly enough, the royalty rate was in the neighborhood of 10 per cent. In any event, they worked on the development of these machines, and they did perfect the vibration technique.

By the time of the postwar period, Besser Company simply had to come out with a vibration-type machine, and they did do that. And I should add that they had started to do so considerably earlier, and in connection with that earlier start Gelbman filed patent infringement suit against a customer of the Besser Manufacturing Company. The particular patent involved was a comparatively early patent of Gelbman's.

The case was tried in New York. The court held against Gelbman, at which time —and this was back in 1942—a settlement agreement was entered into in the form of this patent license.

This was the focus—this patent license—of the government complaint insofar as patents were concerned. What did the license do? In the first place, the license settled the existing controversy. And bear in mind again that was with respect to one of the early Gelbman patents.

In the second place, Besser took a license under all of the Gelbman patents, which included first a group of patents that had subsequently issued which were, I think it's fair to say, of considerably more importance and more significance than the one that was actually involved in the suit.

Secondly, there was a rather sweeping provision with respect to future inventions of Gelbman, and, thirdly, and this again is a focal point of the case so far as the patent license was concerned, the arrangement provided that Besser and Stearns each receive a license under all these patents and that each of them had a veto power over the grant of any further license.

And, of course, it was the position of the Department of Justice that by this arrangement there was substituted the joint action of Besser and Stearns with respect to admitting others into the field for the individual action that would have existed had there been one licensee or had the patent simply been in the hands of one competitive entity.

What happened after the license? Well, for a period of time it didn't make a whole lot of difference. There was no particular production to be concerned with in this field in the war period. However, in the immediate postwar period there was a tremendous demand for these machines. I think everyone remembers the building boom of the day. Besser and Stearns were both 18 months or so behind in their deliveries of machines. They just couldn't make them fast enough.

The result was that there was a considerable number of new companies entering the field, most of them little fellows. A fellow would put a machine together here or there or had put a few together and was just starting up.

And there was definite evidence in the case of joint action between Besser Company and Stearns—and, individually speaking, it was Olsen, who was then the president of Stearns, and Besser himself, with Gelbman and Andrus—with respect to patent infringement threats and efforts made to forestall the emergence of these new concerns.

Just one incident, I think, is worthy of mention. There was one man named Darden. Darden had a rather small operation, no production facilities. Actually, he just had an office. But he did have a couple of machines that were rather effective machines apparently. And Darden resisted all threats made against him.

And in Chicago, at a meeting of the trade association, Besser and Olsen, who was then the president of Stearns, saw the Link Belt Company, which was Darden's supplier, and induced the Link Belt Company to cut off Darden's supply of these machines. Link Belt Company in its plant down South had been assembling the machines, you see. And in that way Darden finally came to a settlement with them, under which Darden was allotted a certain number of machines to make and could make no more.

And that incident was a point of focus, again, in the government complaint and in the proofs in the action.[9]

Judge Picard, after a trial, held generally for the government. He entered a judgment on April 12, 1951, which provided in substance as follows:

First, Besser individually and the Besser Company were required to divest themselves of the stock held in the Stearns Manufacturing Company.

Secondly, Judge Picard held the 1942 license agreement unlawful.

Thirdly, there is an injunctive provision in the decree against suits for prior infringement of the patents. But, interestingly enough, it included a specific saving provision permitting the defendants to proceed with the suits that had previously been filed, and there were some.

There is, in addition, a provision for compulsory licensing which ran against Gelbman, Andrus, Besser Company, and Besser personally. Stearns Manufacturing Company was not included in the compulsory licensing provision.

Finally, there was a provision of the judgment which provided in substance that with respect to machines that were then on lease the Besser Company would have to offer to the lessees the opportunity to cancel the leases, buy the machines, or continue the leases. There was no provision in the judgment with respect to the leasing of future machines.

The Bessers filed an appeal in the United States Supreme Court.[10] I don't think we need dwell on that except to this extent: One of the points that was emphasized on the appeal to the Supreme Court was that Judge Picard had erred in showing favoritism, that Judge Picard had made Besser Company, Besser, Gelbman and Andrus subject to compulsory licensing but he left Stearns Manufacturing Company out.

The government's response to that argument was: "We don't want to play favorites. We'll be right back into this District Court asking compulsory licensing be effective as to Stearns as soon as the Supreme Court enters its judgment and mandate goes down."

And that's exactly what the Department of Justice did, and in July of 1952 judgment was again entered by Judge Picard which was essentially like the earlier judgment except that it inclued Stearns Manufacturing Company under the compulsory licensing provisions as well as the other defendants. And, of course, the government did win the case in the Supreme Court.

What has happened since? What has been the effect of all this? What has happened to this industry?

Let me give you just a few quick figures, and I think it will give you a little bit of the flavor.

In 1946, Besser and Stearns were both hopelessly behind in their production. Of all the concrete block-making machines made in this country, Besser was making about 34 per cent, Stearns 16 per cent, and others about 50 per cent. Now, bear in mind that's all types of concrete block-making machines. The ratio of Stearns' pro-

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[9]*Ibid.*, at 312.

[10]United States v. Besser Manufacturing Co. 343 U.S. 444 (1952).

duction to Besser's production was about 48 per cent, which means that Stearns was almost 50 per cent of Besser's sales volume.

In 1947, Besser had gone up to 48 per cent, Stearns had increased to 19 per cent, and the others had gone down to 33 per cent. But the relationship of Stearns to Besser had decreased slightly to 40 per cent. And, interestingly enough, in that year Stearns in absolute volume did the best it had ever done and far better than it has done since, I might add.

In 1948 there was a definite reduction in the demand for the machines. Besser sold about 52 per cent of all machines. You see Besser is going up in this period. Stearns sold about 13 per cent, which was the beginning of a decline for Stearns. The others sold about 35 per cent. And the relationship of Stearns to Besser was about 25 per cent.

We don't have detailed figures beyond that point, but we do have this much: That for the 1948 to 1952 period the relationship of the Stearns sales to the Besser sales was about 36 per cent, which can only mean that Stearns had a sharp decline in the period of 1948 and shortly thereafter and then it came up to more than compensate for that declining period. And we know that to be the fact because Stearns had had a rough time. Stearns went through a period when its earnings were way down, and the worst year was 1949, which again is about the time, you see, of the antitrust action.

Now, what do we know about the industry today? The best figures we can get indicate something like this: First, Besser has withdrawn into what you might call the large-machine market. Besser Manufacturing Company is not making the smaller size of block-making machines. It regards those machines as being uneconomical. In that market, the large-machine market, the Besser Manufacturing Company is doing about 60 per cent of the volume. Stearns is doing somewhere in the neighborhood of 20 per cent.

Eugene Olsen, who left the Stearns Company at the time Besser purchased his stock interest, formed a new company called "Gocorp," which started operations in 1948. Gocorp is now doing, we think, in the neighborhood of 10 per cent of the business.

A Bergen Manufacturing Company, which I will talk more about in a minute, is doing about 10 per cent.

There is one other company making these machines which is doing a very, very small volume in relation to any of the others.

So that what we have here is a 60/20/10/10 ratio roughly of the business today. And in the market to which Besser has now confined itself I think it's fair to say that the company is in an exceedingly strong position, and its relative volume is certainly at least as large as it was at the time of the antitrust action, and there is a good deal of evidence to indicate that it's greater.

The problem, you see, is that it's very difficult to separate the market for the larger machines from the market for all machines and to take figures for 1947, let's say, where Besser was in the entire market, and take them and carry them over to the present time when it's only in a portion of the market.

There are a number of small-machine manufacturers—I mean manufacturers of small machines. And there are quite a good number of those manufacturers. There's something like half a dozen. Again, though, that is a market that the Besser Company is not in, and I don't think we need pause on it.

Let's just consider briefly the nature of the companies now in the field. As to Besser I think I have indicated enough. Gocorp was the company formed by Olsen. Now, Gocorp is a new concern in the field. It was not in the field prior to 1948. Gocorp was refused a patent license under the Gelbman patents, and in defiance of those patents Gocorp designed a new machine which operates on hydraulic principles. I think it's fair to say Gocorp has done a substantial engineering job, and it has done reasonably well, but, as I indicated, its volume we think is in the neighborhood of half that of Stearns.

The second concern in the field that bears mention is Bergen, located at Nutley, New Jersey. Now, I think this is a case where there is just no possible question but that the compulsory license provisions have made it possible for others to enter the field. Bergen is an example.

Bergen was in this business prior to the decree. Bergen had found out that it could make money by making replacement parts for the Besser machines. So it had all the tools and dies and molds and such for making the parts for the Besser machine. All that Bergen had to do was to put the parts together—no great amount of engineering design, no great effort in those directions—and that's exactly what it did.

So, today, Bergen is assembling the repair parts that previously it had only sold as repair parts and making these complete machines.

No matter how narrow or limited the patents that Besser Company might have, it would be almost inevitable that those patents would cover a machine that was made by assembling the spare parts for the Besser machine. And Bergen has relied on the availability of a compulsory license. However, the major business of Bergen is selling these spare parts. It has limited interest in making the complete machines. It's about one-fourth of its total business we are informed, and the other three-fourths is in these spare parts.

The Bergen Company has done very little, so far as we can see, other than to follow the Besser design.

And that is the situation with respect to Bergen.

The other company to which we must point as an example of a company that has gone into the field by reason of the compulsory licensing is a firm called Oswalt. Now, Oswalt is located in Chicago. Oswalt was an operator of a block plant. He discovered that he could speed up the existing Besser machines by making certain improvements, which he did, and he formed an engineering service corporation to do that.

Well, in the process, you see, he became very familiar with the Besser machines, and he is now making a machine which again is very, very much like the Besser machine. And as to Oswalt there is little in the nature of engineering design there. It's again making the machine which Besser had been making and is making.

With respect to Stearns I just want to mention one thing. Stearns, of all the companies in the field, has been emphasizing product improvement. Stearns came out with a new line of machines in 1950. The Stearns management considers that it was the state of its machines rather than anything else that accounted for its unhappy experience in 1949. In any event, Stearns did come out with new machines then. It has since come out with still another new machine. And in this new machine it has gone to a somewhat different technique by way of the cycling mechanism.

And I think it's fair to say that it's the Stearns Manufacturing Company that has done far more by way of coming out with new machines, new ways of doing things, than anyone else in this industry.

What's in the future? In the first place, Besser Company is an individual organization. Besser is now 75 years old. Certainly there is a change that's going to come along with the Besser Company when Mr. Besser retires.

Secondly, Stearns Company is quite proud of its record with respect to sales and new installations. It's quite proud of its record with respect to new machines. There's some reason to believe the Stearns people will have an increasing share of this market, although I must confess in the past few years their sales volume hasn't shown a very promising increase.

We think that there is some likelihood that a third company will emerge as a more substantial competitor in this field—probably concurrently with the change of Besser. Who the company will be is anybody's guess, of course.

Finally, we doubt that in this field there is ever going to be a situation where you have a dozen or 20 companies of approximately the same size. All history indicates to the contrary.

So much for that. Do I have just a minute?

MR. ASBURY: Yes, sir.

MR. FROST: I would like to just say very briefly something about the Vehicular case.[11] Now, in the Vehicular case we have a somewhat different situation. There the Antitrust Division based its complaint largely on a series of price-fixing license agreements and a patent-pooling arrangement. The decree was entered back in 1944 or 1945.

Since the decree, there have been two entries of substance into the business. Neither one of them is attributable to the patent decree at all. The one entry was by a subsidiary of the American LaFrance Foamite Company, and we know their work commenced well in advance of the decree. We have carefully studied their situation, and we don't think there was ever any real risk of patent infringement judgments against it.

The second one was the Magee-Hale Park-O-Meter Corporation in Oklahoma, and there too the effort had commenced long prior to the decree. A complete parking meter had been developed prior to the decree. And with respect to Magee-Hale I don't think we can fairly say that its entry into the business was due to the decree.

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[11] *Supra* note 6.

Now, aside from those two, there haven't been any substantial entries into that business.

At the time of the decree, the parking meter business was divided between about five concerns—not evenly, of course, but I think it's fair to say that they weren't too disparate in size. We know today that the Magee-Hale Company, which entered the industry subsequent to the war and had been working on its meter prior to that time, enjoyed something in the order of 70 per cent of all of the sales. Magee-Hale, of course, is not subject to the compulsory licensing decree at all.

So in the Vehicular case we have the rather interesting situation of a complete turnabout, a situation where at the time of the decree we have the five concerns which together aggregated essentially all of the production in the field, and a newcomer coming into the field who today does far more than all of the rest put together.

I'm afraid that's all I have time for. There is a lot more we could say. We spent a long time working on these cases. It's almost hard to stop talking about them. But I do want to express one further thought: That this kind of work entails time. It takes resources. There's been a lot of travel, there's been a lot of work done, and, just as a very personal thing, I'd just like to say that I personally appreciate what the Foundation has done in making it available to us, because no matter how interested a person may be in something like this there has to be some way to do the traveling and to get the work done.

Thank you. [Applause]

MR. ASBURY: Gentlemen, before we plunge into the discussion by the three discussants, I think we might take a few minutes' recess to get up, stretch, talk to your neighbors a minute. The chairs might be getting a little hard.

[Whereupon, a short recess was taken.]

MR. ASBURY: I wonder if we could get started again, gentlemen.

## DISCUSSION

Gentlemen, we'd like to get started on the formal discussion part of this section, and the first gentleman is Mr. Doane of the Washington law firm of Burns, Doane, Benedict & Irons. He's both an engineer and a lawyer. He's been in practice here in Washington for a good many years—in fact, since 1938. He's a specialist in patent and trade-mark matters, and he has participated in cases involving antitrust problems.

We'd like to ask Dr. Doane to make the first comments.

MR. V. H. DOANE: Thank you, Mr. Asbury.

I have in my practice represented one block machine manufacturer, and therefore, I have found it necessary to learn a little bit about the concrete block machine industry. I will, therefore, restrict my comments to those portions of Mr. Frost's paper[12] relating to that industry.

[12]In addition to the copies of the research project interim reports appearing in the first issue of *The Patent, Trade-Mark, and Copyright Journal of Research and Education,* material developed subsequently was furnished the discussants.

First, I would like to discuss what I think to be the practical effects of the compulsory licensing provision of the decree in the Besser case[13]—that is, the action brought by the government against Besser and others under Section 4 of the Sherman Act.

I might say at the beginning that I think the practical effect of the compulsory licensing provision of that decree is very small. One reason for that is something that might not have been foreseen. In 1952, the same year that the decree became final, the Sixth Circuit Court of Appeals held the patents to be invalid and not infringed in litigation which we refer to as the Lith-I-Bar litigation.[14] The Supreme Court denied certiorari in the patent litigation. So, after 1952, there seems to have been very little risk that the patents involved would again raise their heads in other litigation.

However, there are perhaps two minor benefits, we might say, from the compulsory license provision. There had been advertising and extensive activities by Besser and Stearns and Gelbman which had made the block producers—that is, the purchasers of block machines—very patent-conscious. Besser and Stearns had advertised extensively in the postwar years that they were licensed under what they termed the "basic" Gelbman vibration patents—designating those patents as "basic"—whereas in the Bell litigation[15] in 1942, to which Mr. Frost has referred, Judge Rifkind in the Southern District of New York made a finding of fact that there was no novelty as early as 1930 in vibration of the mold in a block-making machine. Both Besser and Stearns were involved in that litigation, so they knew of that finding of fact at the time those advertisements were inserted.

Besser and Stearns had helped defray the cost of an advertisement by Gelbman saying that Gelbman was the inventor of what was termed "vibration under pressure." That meant that the concrete mix in the mold was vibrated and at the same time a pressure head was lowered on the mix to impart pressure to the mix. Those advertisements were inserted by Gelbman in 1947, and indicated that he held patents on "vibration under pressure."

As early as 1939 Besser had filed an informal protest to the Patent Office calling attention to certain expired patents which Besser said disclosed vibration under pressure in block machines, and Besser suggested that no further patents should be issued.

It was that type of, I think, misleading advertising that had made the block producers so patent-conscious. So a competing block machine manufacturer might have desired to obtain licenses under any applicable patents, even though the patents had been held invalid in the Sixth Circuit, so that the competing manufacturer would be able to assure his customers that his machines were licensed under any applicable patents.

Perhaps the reasonable royalties which that competing manufacturer would pay for such a license would be more than offset either by his increased sales or his encounter-

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[13]Andrus *et al.* v. Whitman; Andrus et al. v. Wenzel et al.; Besser Mfg. Co. v. Whitman, 93 F. Supp. 383 (E.D. Mich. 1950), 194 F(2d) 270 (6th Cir. 1952), cert. denied 344 U.S. 817(1952).

[14]Whitman v. Andrus, 194 F (2d) 270 (cert. den. 73 S. Ct. 12).

[15]Andrus *et al.* v. H. W. Bell Co., Civil Action 7-314 (S.D.N.Y. 1942).

ing less resistance to making sales because of his being able to assure his customers that his machines were licensed.

There is also, of course, the remote possibility that a suit might have been brought on these patents in some circuit other than the Sixth, and a competing manufacturer might desire to be able to assure his customers that no suit would be brought in some other circuit.

It seems to me those are the only real, significant advantages of the compulsory licensing provision.

Now I want to pose a question based on certain facts. First, it seems to me inescapable that both Besser and Stearns became further entrenched in their positions as the giants of the industry during the period of their antitrust law violations.

Second, it seems to me that the strengthening of Besser and Stearns during the period of their violations was accomplished at least to some extent at the expense of smaller manufacturers whose activities were either curtailed or eliminated during that period.

Third, it seems to me inescapable that by the time the decree in the government action became final in 1952, Besser and Stearns had become so entrenched in their positions that it was altogether probable that they could thereafter maintain those positions even without continuing the illegal practices which the court enjoined.

Now, that raises the question in my mind as to whether Besser and Stearns have not, in the long run, benefited or profited by their antitrust law violations. I won't attempt to answer that question. I have my own ideas on it, but I don't think it's proper for me to attempt to answer it. But I think it is a legitimate question.

You will understand that the discussants here have had access to a draft of Mr. Frost's paper,[16] which, of course, is much more extensive and complete than he has been able to give you today. I have only one criticism of that paper. I think not enough consideration or significance has been given to the probable effect of Besser's control or domination of Stearns during the period from 1948 to 1952. I will give you the facts very briefly on that.

In early 1948 Olsen, who was then president of Stearns, sold a large block of Stearns stock to a then unidentified purchaser, which soon turned out to be Besser. Besser had approximately a million dollars tied up in Stearns stock. I started to say "invested," but I'm not going to use the term "invested" because I don't believe the stock was bought as an investment.

Besser originally registered that stock in the names of others, including a man named Hultmark, who had been a Besser salesman.

The block of stock which Besser purchased in the spring of 1948 enabled Besser to elect three of his men to the five-member board of directors of Stearns. One of those three men was Hultmark. The new Stearns board of directors promptly elected Hultmark as president of Stearns, a position which, incidentally, he still occupies today.

Prior to World War II, Hultmark had been in the general construction business. He worked for the War Production Board during World War II, and his duties there

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[16] *Supra* note 12.

included the allocation of scarce materials to block-making machine manufacturers. At the close of World War II, Hultmark went to work directly for the Besser Company. He was a salesman for the Besser Company for two and a half years and then became the president of Stearns.

Besser continued to own this large block of Stearns stock, with the power to vote it, until about July of 1952. Hultmark has testified that Besser exerted no influence on him. It is a little difficult to see how Mr. Besser, with a million dollars invested in Stearns stock, Stearns being his biggest competitor, with Mr. Besser having three men on the Stearns board of directors, could have resisted the temptation to exert some influence on Mr. Hultmark.

Now, as I said, Hultmark became president of Stearns in June of 1948. During the fiscal year ending in August of 1948, Stearns' net income was in excess of $200,000. During the next fiscal year, the first fiscal year in which Hultmark was president of Stearns, the net income of Stearns dropped to $17,000.

Those facts prompted Judge Lederle in other litigation to inquire of Hultmark whether he was ever interested in whether Stearns operated at a profit or a loss.

My time is about up. [Applause]

MR. ASBURY: Thank you, Mr. Doane, for those questions.

Now, we're not going to let our men answer these questions until the end. We'd like to get them all together here so we will go ahead with our next discussant, who is Dr. Alfred Kahn, professor of economics at Cornell University.

He has had quite a varied experience as an economist and helping out on various antitrust committees, and presently he's a consultant in the Council of Economic Advisers. He has published several books. And at the present time, I'm interested to note, he's working on a study on integration and competition in the petroleum industry for Yale University Press. We're quite interested in seeing that one come out.

Dr. Kahn, would you carry on? [Applause]

DR. ALFRED E. KAHN: Thank you.

I haven't actually done any direct work in the patent field for many years, and I used the occasion of this invitation to look at some of the literature in the field that has accumulated in the last 15 years since I last did any writing in it myself.

I was abashed to find that the literature, much of it, consists of the same kind of ringing, unsupported generalizations about the patent system that I was accustomed to reading about before 1940. It seemed to me—and this is not a thorough survey—many of the really substantial ideas presented you could find in Mr. Gilfillan's books in the 1930's, in Floyd Vaughan's book, the first edition of which I think was in 1926, and the Congressional investigations of pooling of patents in the 1930's. And, as I recall, when I wrote my master's thesis in the field there was a wonderful Congressional investigation around 1912. I think it was the Oldfield inquiry.

So, as I say, I was a little abashed to find the more things changed the more they remained the same.

It's for that reason, however, that I was particularly gratified to be invited for this occasion, because I think what the Foundation is doing is something new. Mr. Frost's report,[17] which I think is an admirable report, represents an attempt to do some honest work on the patent system rather than to confine ourselves to ringing generalizations to the effect, on the one hand, that the founding fathers of the Constitution in their infinite wisdom gave us a system in 1776—or, excuse me, in 1789—which is good for all times and all places and has made America the greatest country in the world, or, on the other hand, that the patent system is a mask for privilege and ought to be thrown out lock, stock and barrel.

I certainly agree with the assumptions underlying the work of the Foundation that the only way to make any intelligent observations in this field now, any new observations, is to make a series of empirical studies, of which I think this first one represents an extremely interesting and promising start.

Secondly, I would underline the warnings which these studies that I have seen already emphasize, and that is the dangers of drawing broad generalizations from particular reports based on particular industries and on particular experiences.

So I want to express some hesitations about the remaining observations that I am going to make. These hesitations are no greater than those already expressed by Mr. Frost and I think Mr. Oppenheim in one of the original papers,[18] which indicate that it's going to take a lot of these studies before you can draw any vast generalizations.

Still, I do have four observations which I think are underlined by the report in a very interesting way, and I'd like to put these before you in the few minutes I have and, of course, would be glad to discuss them at length if you wish.

First of all, the concrete block-making machinery field seems to emphasize what many of us have already recognized is a problem in the patent field, and that is the plight of the individual inventor. I gather that Louis Gelbman was not another Lee De Forest in the sense that he made dramatic, revolutionary contributions to the technology of the field. As Mr. Frost points out, his work was essentially an application, a borrowing, of known technology. But if anyone was the inventor in this field, according to the report, and I have no other sources of information, it was Louis Gelbman. And in that sense at least, in the sense of what happened to him, he seems to fit into a long list of inventors, of whom I have always regarded Lee De Forest the archetype, people who worked all their lives, invented all their lives, and died disillusioned and broke—I don't know he was broke; this may not have been entirely fair, but at least he was disillusioned—dupes of the patent hoax.

Now, of course, as long as people like that don't seem to realize the dice are loaded against them or as long as, realizing it, they still seem to be pressed to invent and to give society the benefit of their inventions, I suppose in a certain sense we should say this is a pretty good system.

[17] *Supra* note 12.
[18] *Supra* note 12.

In any case, you can say it works well from the point of view of society.

I would still argue myself, however, if we put any faith in the patent as an incentive to innovation, then high on the list of reforms of the system that we have to work on is some method of making the law more effective in singling out people like Louis Gelbman, assuming I am interpreting his role correctly, or Lee De Forest, singling them out and giving them some real protection.

Alternatively, we might consider throwing the whole thing out the window.

That's No. 1—the plight of the individual inventor.

No. 2, again an observation based upon this study: What was the role of the patent system and patent practices in augmenting and sustaining the quasi-monopoly or at least the dominant position of the Besser Company?

From the report[19] I certainly draw the general observation, with which I have no basis for quarreling, that the patents were not the prime reason for Besser's dominant position.

The report also makes perfectly clear that patents certainly helped.

But, in general, I think the report points out that Besser's position rested much more on the character of the service, the efficiency of the operation, the aggressiveness of Mr. Besser as an entrepreneur.

Here, of course, it's very dangerous to generalize from one industry to the role of patents in the economy as a whole. From my own observation I would say that American industry exhibits a very wide range in the role of patents in creating monopoly problems. On this spectrum I would put the automobile industry on one side as an industry in which I find competition unworkable, or alternatively, in which I think there is a lot of monopoly power but monopoly power that's not based significantly on patents.

I'd put oil refining on that side today as well. And I'd be glad to discuss that with anybody who wants to.

On the other side of the spectrum I would put—picked out of the air—cellophane in the past and electronics. I would put those at the other end—as areas in which patents have been extremely important in maintaining monopoly positions.

And I judge that the concrete block machine manufacturing industry belongs somewhere in between.

I think it is interesting that the general tenor of the report on this second point, the role of patents, is very similar to the tenor of Professor Joe Bain's new book *Barriers to New Competition.* Bain also points out that the role of patents as a source of monopoly in American industry seems to be overrated, looking at American industry in the broad, or at least that patents pose barriers to entry of less over-all importance, in fewer industries, than, let's say, the advantages of a head start, customer preference, advertising, product differentiation, and so on.

And this is, I think, in general what we find in the report as well.

However, one concluding observation on Point No. 2. Patents were an obstacle in

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[19]*Supra* note 12.

this industry, and it seems perfectly clear that Besser thought that they were an obstacle or he wouldn't have gone to such trouble to acquire them, to pay fancy prices for them, and to use them.

I won't say that he used them to harass competitors, to make life difficult to compete. I'll let you make the value judgments. But, anyway, it seems perfectly clear he thought patents were important, and the report certainly points out they were not a negligible factor here in economic terms.

All right. Point No. 2. The role of patents. They were important but probably not the most important source of monopoly problem. And in general I would say in American industry as a whole this probably is true as well with important exceptions.

No. 3. No. 3 is related to No. 2. How effective, then, are antitrust decrees requiring compulsory licensing under patents? Obviously, if patents are not terribly important as a source of monopoly power, then to that extent you can't expect very much from an antitrust decree which attempts to eliminate only that barrier.

Now, here's a case where I think it takes a certain amount of discretion. It may well be that patents may have been important at some time in the past to give a company a very strong and dominant position, and in that case the removal of the patent may not do much good. I think that can be clearly demonstrated to be the case of the United Shoe Machinery Company,[20] for example, and even Alcoa,[21] if you go back to the Cowles Brothers litigation,[22] when I think patents were very important, but a decree eliminating patents in 1945 or 1953 wouldn't make very much difference.

Since I have only one minute to go or less, it appears now, I will just make some generalizations on this point and let it go. You can't expect the antitrust laws to do everything. You certainly can't expect decrees which are directed solely at the patent limitation to entry to eliminate all obstacles to entry.

The purpose of the antitrust laws is to secure a fair field and no favors. One major purpose of the antitrust law is to leave entry free, not to assure business success to everybody, efficient or inefficient alike, but to see to it entry is not blocked by means that have nothing to do with efficiency in serving the public.

Here's a field in which patents were one such obstacle. Here's a field in which the elimination of that obstacle has had some effect, as I think the report makes very clear. And beyond that I think all one can say is, in facing the fact that Besser still is the dominant firm in the industry, the following things and then I'll stop.

First of all, we have to give the law time. You can't expect an industry to be transformed overnight. People don't spring into a new field overnight. In time it may be that the elimination of these patent restrictions will have greater effect than is now visible.

Secondly, are we so sure that we want the law to do any more than that? If Besser's position is now based upon efficiency, the kind of service it gives the public,

[20]United States v. United Shoe Machinery Co. 110 F. Supp. 295 (D. Mass. 1953), *aff'd* per curiam 347 U.S. 521 (1954).

[21]United States v. Aluminum Company of America, 148 F (2d) 416 (2d Cir. 1945).

[22]Pittsburgh Reduction Co. v. Cowles Electric Smelting & Aluminum Co., 55 F.301 (N.D. Ohio, 1893), 64F. 125 (N.D. Ohio, 1894) 121 F. 556 (N.D. Ohio, 1903).

is it the function of the antitrust laws to break up firms merely because they are efficient or because they give the customers what they want?

Point No. 3, and my concluding point. If entry is easier now than it was before, then is it not possible that we have a really greater limit on Besser's monopoly power, its power to exploit the public, than we had before when Besser's position was smaller? A 60 per cent position in an industry is not necessarily a source of consumer exploitation if people can fairly easily enter that industry. If from now on Besser can maintain its position only by giving the best possible product and the best possible service at the lowest possible price and the patent barrier to entry is eliminated, maybe we have workable competition in this industry today. [Applause]

MR. ASBURY: Thank you very much, Dr. Kahn, for those refreshing comments.

Our last discussant is Jerrold Van Cise, who is known to all of you I'm sure as an antitrust lawyer and by some as "the" antitrust lawyer. Some of his clients feel they can go and sit with him and get the pulse of the antitrust department from him at the moment.

He has done a tremendous amount of helpful work in the Practicing Law Institute in New York, and he has put out some helpful books on understanding the antitrust laws and how to comply with them.

Recently he acted as a highly catalytic moderator—that's a confusion of terms, but that's what he was—in a debate with Hollabaugh and Diggins on the antitrust laws.

Jerry Van Cise. [Applause]

MR. JERROLD G. VAN CISE: Mr. Chairman, Fellow Platformers, Ladies and Gentlemen: I have three somewhat controversial observations to make with respect to George's very excellent report.[23]

First, this report seems to confirm the belief held by many of the bar that the principal effect of patent antitrust decrees is to destroy the value of the patents licensed. The report states that the royalty rate fixed on the Besser patents was fixed at a nominal figure. It further states that the royalty payments collected by Besser and Stearns were insignificant. It concludes, therefore, and I quote: "Management of both companies has expressed the opinion that the effect of the compulsory licensing decree has been to make patent enforcement not worth the effort."

It is my firm conviction that the principal effect of patent antitrust decrees, whether they say "royalty-free" or not, is to substantially destroy the value of the patents involved.

First, they say that the licensor must open up his patents to anyone, which takes away, of course, most of the value of the patents. Then they usually say that the licensor must, upon request, set a value for every single patent that he has.

Third, if he gets through those hurdles and comes up with some figure not only for the package rate but for the individual rate, if there is a dispute—and if patents are valuable there always is a dispute—you know he has to go to court, and the court almost always decides against the naughty licensor and in favor of the licensee.

[23] *Supra* note 12.

And if he ever survives that with anything worthwhile, he never can bind his licensee to pay anything because after a year's time the licensee upon 30 days' notice can throw the license back.

How can you plan research on that basis?

The net result of these decrees I submit is primarily destructive of the patents involved. And the most dramatic case I know of to that effect was a famous licensor whose patent income was over $7 million before the decree and some years after the decree was under $700,000 and it still goes down.

Second, this report further confirms the belief of many that this destruction of patent values does not automatically insure competition in the market. It states that compulsory licensing is a desirable form of relief. It says further that it has encouraged some entrance into the industry. But it also points out that in "the period since the antitrust decree" there has been "seen no decline of Besser in relation to competitors and that the Besser market position is as strong, if not stronger," today.

This result is not true in all antitrust decrees, but in many it is true. In part the reason is because, candidly, additional, non-patent relief was needed to pry open the market. But more often, in my humble opinion, the reason is because the patent restraints were not as serious as charged.

Again and again our government, incensed at language used by patent lawyers—and you gentlemen certainly can use the darndest language on occasion—[laughter]—orders destruction of restraints that have not restrained. Thus, when patent agreements divide international territories which are already divided by trade barriers, the destruction of those patents will mean nothing in the form of trade and commerce.

Again, when patents give a monopoly of an industry to one company and the market, however, is so limited that only one company can survive, destroying the patents will mean nothing.

The most amusing case that I was ever in was one in which the Department was most indignant about the terms of a very restrictive patent pool and insisted that we go through the motions of a consent decree that destroyed that pool. We agreed, but we told them at the time the patent pool had never been in operation and the parties didn't even know whether there was a single patent in existence and had to make a very real, difficult search to try to find some patent that would be licensed.

Third, the Besser report[24] is consistent with but does not endorse my own personal belief that at times these decrees affirmatively discourage competition in the marketplace. As I say, the report states that there has been some encouragement of new parties into the industry, but it also points out that the "royalties paid to the defendants have been insignificant in all instances."

I respectfully suggest that, although this may not be true in the Besser case,[25] the operation of a compulsory licensing system which gives no royalty income of any substance is usually destructive of competition.

You gentlemen know very well in your corporations the terrific fight that goes on

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[24]*Supra* note 12.
[25]*Supra* note 5.

between the patent department and the sales department. The patent department wants to be self-sufficient, to do research and licensing on an industry basis in return for royalty income. You also know that your sales department wants exactly the opposite. They want to keep that research and patents for themselves. If a compulsory licensing decree should come along and decide in favor of compulsory licensing at a really reasonable royalty on reasonable terms, it has decided in favor of the patent department, and you have a force in that department which can go out to look for newcomers and try to educate them because they are going to be paid for doing so.

On the other hand, when you have a compulsory licensing system which destroys the patents and destroys the patent department, it is deciding in favor of the sales department to let that company grow bigger and stronger and without regard for the opposition and the little company, the newcomer.

In one case, under the operation of these so-called compulsory licensing, "opening up the industry" decrees, the company as soon as the judgment was entered curtailed its research. In other cases the patent attorneys at least have told me—whether it's true or not—if they can they're not going to take out patents. If they can keep an invention as a trade secret they'll do so, because why patent when they have to throw it away?

And I know of no case where, when you have a compulsory licensing system, you have anyone in those companies rushing out to grant licenses. On the contrary, I think they often drag their feet as long as they can.

In summary, Mr. Chairman and Mr. Frost, this study[26] in my opinion suggests, first, that the principal effect of patent antitrust decrees is to destroy patent values.

Second, its further effect is not always to encourage competition.

And, third, its possible further effect, rather, may be to discourage competition.

I do not wish to be misunderstood as saying I'm against compulsory licensing. I do not. If patents have been abused, they should be thrown open. But I believe they should be thrown open on terms that encourage competition. If you wish a patent department of a licensor to lay eggs and hatch out newcomers. I submit it is senseless to kill the hen by starving her. [Applause]

MR. ASBURY: Thank you very much, Jerrold Van Cise, for those inspiring comments.

Now, I think we'll give the authors of this report a minute or two to make any rebuttal or correct any points of fact that have been misinterpreted or misunderstood along the road.

Professor Oppenheim, do you want to make a comment first?

He yields to Mr. Frost.

MR. FROST: First, I'd like to express a word of appreciation to these three gentlemen for their very fine discussions. They are very helpful. I do have a few thoughts.

Mr. Doane has very properly pointed out that the major Gelbman patents were held invalid and not infringed, and it's something that I should have indicated. The

[26] *Supra* note 12.

fact of the matter is that there are other patents involved, and it's with respect to these other patents that we do have some utilization of the compulsory licensing provisions. And where you have a company which is making a so-called Chinese copy, I think you can see that no matter how narrow the other patents are they're almost bound to cover what the company is doing. That's true of Bergen and true of Oswalt.

Now, a good deal has been said about the status of Mr. Gelbman and the subject of competition here. First as to Mr. Gelbman, he died not very long ago. He was blind, sick, disillusioned, utterly at war with the way the world had treated him, and he had gone through a period where he had lost a good deal of money. And I think if there ever was a case of a disillusioned man whom everyone ought to feel sorry for, it was Mr. Gelbman.[27]

Now, with respect to competition, I wonder if we shouldn't first decide what we mean by competition. Now, there are all sorts of competition. There's competition in price. There's competition in delivery dates. That's the kind of competition that was important in 1946. There's competition in services. And there's also another kind of competition—competition in product improvement.

Now, it may be that this industry—and I think it must be said that it is—is a borrowing industry. But somebody has got to do the borrowing, and it seems to me that we have to give consideration to this suggestion of competition in product development. That's perhaps part of the sales versus the patent department argument that Mr. Van Cise referred to. But, in any event, it seems to me that a good deal can be said with respect to the status of Stearns, whatever its position in the industry is, as a medium of product development in this industry. It has consistently emphasized it over a period of years.

And in that respect, it seems to me that consideration can well be given to the effect of the decree in relation to the product competition activities of Stearns.

Thank you.

MR. ASBURY: Professor Oppenheim is going to make a few comments here too.

PROFESSOR OPPENHEIM: My comments are directed more to some of implications of the very stimulating remarks of the discussants rather than any of the factual data in the projects in which Mr. Frost has been engaged.

I think it is very important to have in mind that the Foundation, even with the background of what the courts have said and done about compulsory licensing and what the government has said and done, has not taken a position on compulsory licensing. The *Journal* backdrop piece was merely to tell about what the judicial attitudes and the governmental attitudes have been.

Fred Kahn—who by the way served on the Attorney General's Antitrust Committee and this gave me an opportunity to know his thinking much better than I could know

[27]Mr. Gelbman's disillusion was directed to the antitrust proceedings and their aftermath and the court decisions refusing to uphold his patents. He has not expressed any criticism of the way he was treated by the industry prior to 1949. (G. E. Frost)

it by just reading the cold print of his economic analysis in his writings—is right in pointing out that the greatest caveat we face is: No generalizations of breadth are justified today with respect to compulsory licensing and the effects of the compulsory licensing on the basis of the factual information we now possess. That, I think, is the most important thing to bear in mind.

Therefore, he is also quite correct in saying that those two pilot studies involve conclusions that are strictly limited to what the factual data and the value judgments applied to them mean in these two instances.

Also I think that Jerry Van Cise—whom I also had the privilege of knowing in a very close way on the Attorney General's Antitrust Committee and in other connections—might want to ask himself again whether he would be willing to make broad generalizations on the basis of what is known about the effects of compulsory licensing in decrees generally.

As he said, this doesn't mean he's precluded, nor am I precluded, from taking a personal position on what we think is essential from the standpoint of the theoretical aspects of patents and from the standpoint of the assumptions underlying the patent system. But if we are to be true to the Foundation's methodology and the Foundation's original purpose of ascertaining the facts, then we must, I think, yield to the necessity of knowing more facts generally before we can say that compulsory licensing provisions, for example, completely vitiate or dull the incentives for research and development.

Because what Fred is asking and I think what Jerry is also asking, is whether we have a workably competitive system, and if patent rights are to be considered in the context of a workable competitive system, then I think they are also asking whether we have a workable patent system.

I think Fred and Jerry would concur that they do not hope for the ideal model of perfect or pure competition, whether it be in the patent field or otherwise.

I also want to emphasize another point arising from what the discussants have indicated: that you can't talk about patent rights without some considerations of the qualitative value of patent rights. I think this specialized and informed audience knows that patent rights vary in their significance.

I see in this audience Andy Schmeltz, whom I also claim as one of my former students, and when I say that I mean, just in passing, I might have thrown out a thought that might have planted a good seed.

But he can show he surmounted all the fallacies I might have uttered too.

I remember Andy Schmeltz's testimony, as recorded in the Alcoa case,[28] in which he told the court that out of the great number of Alcoa patents—and I'm talking factually on the record of that case—that only a few—eleven—were competitively significant.

So if we're going to talk about patent rights and their effects, we have got to remember their qualitative differences.

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[28]*Supra* note 21.

As to the difficulty, as I say, of generalization, I just want to close again with this primary point: I have spoken out against compulsory licensing in written words that I don't want to recall. But I say in my Foundation function as Research Adviser I could not serve honestly nor with a clear conscience if I didn't keep in mind at all times the necessity for bowing to factual information reasonably evaluated to tell us what happened and why it happened. And it may well be that in different industries patent rights have different competitive effects.

For example, I am thinking of the recent IBM consent decree.[29] Five years from now, 10 years from now, I would like to know to what extent the opening up to compulsory licensing of the electrical tabulating machine patents and to a lesser degree the electrical data processing machine patents will result in a great number of applications to IBM for patent licenses and to what extent from that will flow competitive endeavors of other firms that could not be accounted for otherwise.

So we have to put the patents in the complex of the whole industry. They may or may not be important in a particular case. The degree of their competitive importance and effects may vary.

MR. ASBURY: Thank you.

Professor Oppenheim touched on an important consent decree, and it so happens that the first question I pick off my list here is about that decree. It says: "The IBM decree contains a provision which compels a person asking IBM for a license to grant back to IBM a license under its own patents. Does not this provision have the effect of discouraging persons from asking for an IBM license? Is this provision commonly contained in antitrust decrees?"

Who would care to answer those two points?

Jerry?

MR. VAN CISE: On the first question, I do not think it does discourage competition. It's only "turn about is fair play." If the licensor is required to license everything he has and can be put out of business by the patents that someone else has, all you're doing is creating a new restraint of trade.

As to whether it is a frequent provision in antitrust decrees, it is not frequent in consent decrees until recently.

MR. ASBURY: Mr. Frost?

MR. FROST: Dr. Kahn has comments.

MR. ASBURY: All right. Dr. Kahn?

DR. KAHN: Without trying to decide that question I think it's worth pointing out there's another side to the issue about the desirability of having grant-backs—not about the fact, which Jerry is much more competent than I to discuss. But the point has often been made, for example, with respect to electric lamps, that Westinghouse did not have a lot of incentive to engage in innovation in the electric lamp industry

[29]United States v. International Business Machines Corp., CCH Trade Case ¶ 68, 245 (S.D. N.Y. 1956).

as long as the terms of its licensing required it to license back to G.E. anything it developed.

And I think one can make a strong case that the development of competitive innovation in an industry and the restoration of competitive conditions may require that you not have this "turn about is fair play" provision. I think it would have to be admitted that it may diminish the incentives of the licensees to set up their own independent research laboratories and do their own research.

Simply the other side of that point—

MR. PHILIP YOUNG (Esso Research): Aren't you putting a penalty on the one who has done and who probably will do the greatest amount of research in the industry if you do that? You're picking out the very one who is going to contribute and who would and putting a penalty on him, leaving it open to somebody who hasn't done anything.

DR. KAHN: I think that's true, but I'm talking about decrees in antitrust suits where it's decided that there is an excessive amount of monopoly in an industry that is illegally achieved. In those circumstances, I suppose any remedial decree in a sense imposes a penalty. I think that's quite true. And you'd want to weigh those two.

MR. ASBURY: Dr. Kahn, while you're on your feet here, we have another question for you, directed to you.

"Do you think that society should undertake to prevent an inventor against improvidence or lack of business judgment?"

DR. KAHN: I take it that is to "protect" an inventor against improvidence or lack of business judgment.

That's a tough one. It's obviously loaded. [Laughter] I won't plead the Fifth Amendment, but I think I have a right to. [Laughter]

No, nobody should be protected against improvidence and bad judgment. On the other hand, I wasn't talking about improvidence and bad judgment. I was talking about a person who has made a real inventive contribution and then gets hamstrung by the gigantic boondoggle for patent lawyers which the patent system is.

Nobody knows what the validity of patents is. Anybody who wants to find out has to pay tens of thousands of dollars for highly skilled help. And that's not a situation which is conducive to getting adequate rewards for people, even people who have good business judgment and, what's more important, people who have good inventive judgment.

MR. ASBURY: Mr. Frost wants to get into this act too.

MR. FROST: I would just like to throw out this one thought. You will recall that in 1942 or just prior thereto Judge Rifkind decided this Bell suit[30] adversely to the patent and that the license agreement which was the focus of the whole antitrust action[31] resulted from that when Besser was in a position to insist on terms.

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[30] *Supra* note 15.
[31] *Supra* note 5.

Now, I raise the question: What would have happened if the patent were held valid and infringed at the time of that suit?

MR. ASBURY: There is another question for Mr. Frost. "What is Besser's present per cent of over-all industry—that is, large and small machines?"

Do you know?

MR. FROST: No, we have no way of getting that information.

MR. ASBURY: Okay. Now, we have one other question from the same gentleman. This is directed at Professor Kahn.

"If Besser paid fancy prices for patents, presumably to Gelbman, how was Gelbman the neglected inventor"—on the same theme again—"if he got paid fancy prices?"

DR. KAHN: I was summarizing a very detailed part of the report[32] which I myself have had to read very hastily. But he didn't buy from Gelbman only. There was a Scott patent I believe, for example,—

MR. FROST: That's right.

DR. KAHN: —which he bought, and several others as well. And I can't tell you, I'm sorry to say, what the respective amounts are that he paid each but will note that Mr. Frost corroborated my general impression from the report that Gelbman took a rooking in some way.

MR. ASBURY: We have got another question here. I'm going to ask Mr. Doane if he will answer it.

"Do you think that Besser's withdrawal from the small block-making machine field was caused by the compulsory licensing provisions?"

MR. DOANE: No, I do not. As a matter of fact, I believe Besser withdrew from the manufacture of small or low-production type machines several years before the antitrust decree.

MR. ASBURY: We have got a couple more questions here. This ties in to the last question Mr. Doane answered.

"Are large and small machines competitive?"

I don't know whether Mr. Frost really might be more in a position to answer that one.

MR. FROST: Well, my first reaction would be this: That of course there is a degree of competition, but they do serve markets that are rather dissimiliar and the number of instances where a man buying a machine selects one or the other is probably not great. I would distinguish the Cellophane case,[33] if that's what the questioner had in mind.

MR. ASBURY: I think we have got a minute here for a couple of questions from the

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[32]*Supra* note 12.

[33]United States v. E. I. du Pont de Nemours and Co., 351 U.S. 377 (1956).

floor. I hope some of our distinguished patent attorneys here who are slightly on the defensive will say something. Please give your name when you stand up.

MR. CHARLES W. HELZER (General Electric): I would like to direct a question to Mr. Frost, just with regard to the patents involved, the scope of them. Can you give me some information as to the scope of the patents involved on which the decree was issued? Were they the type where a person would be in danger of a charge of infringement where you couldn't possibly design anything without falling into that failing? Or were they fairly specific improvement-type patents?

MR. FROST: Insofar as the patents were broad they were held invalid. Insofar as the patents were not broad anyone who put in a modicum of original engineering design could make a machine that would not infringe, and that was done by several concerns.

MR. GORDON W. DAISLEY (Cameron, Kerkam & Sutton, Washington, D. C.): I would like to supplement the last question by asking Mr. Frost whether it wasn't true that the decree against Besser extended to all patents acquired by Besser within ten years following the decree. Was that correct?

MR. FROST: That is correct.

MR. DAISLEY: And what effect, if any, does your study show that this has had on the making and patenting of improvements by Besser?

MR. FROST: Besser's expenditures for product improvement we are told have not been influenced by the decree. Insofar as obtaining patents are concerned, I think it's fair to say Besser is very indifferent. I think there are one or two since the decree he has obtained. He has never been a large factor in connection with patent matters in any event. The way Besser has acquired patents has been by purchase.

Now, the decree does not in terms prevent Besser from taking an exclusive license from an outside inventor and going on from there without any obligation to grant compulsory licensing.

MR. ASBURY: One more question from the floor.

MR. FRANK NEUHAUSER (General Electric): On behalf of the defensive patent lawyers here who have been accused of engaging in a gigantic boondoggle, I'd like to prescribe for Professor Kahn a dose of his own medicine: Avoid over-generalization. [Laughter]

MR. ASBURY: We had one other question for Professor Oppenheim but it would take about half an hour to answer. It's in regard to the GM—Du Pont situation. We're going to hold that till we have more time.

Dean Colclough wants to make an announcement.

DIRECTOR COLCLOUGH: I purposely waited until this time to mention another feature of the Foundation about which I think you are aware, but to which allusion has not been made. It is the organization that you find listed on the back of your program known as the Advisory Council. The Advisory Council is composed of men who from the beginning of this Foundation have given of their time, effort, and wisdom. It is with them that we discuss our program for policy and technical guidance.

It so happens at the moment there are in the room at least three of four and perhaps more members of the Advisory Council whom I should like to mention. Your Moderator, of course, Mr. Asbury, is a member. Mr. Cyrus Ching is sitting in the room. The Commissioner of Patents, Mr. Watson, is an ex officio member of the Advisory Council. Mr. Woodson of Chicago. I believe Mr. Gary is here, or, if not, he is expected. We have hoped that Mr. McGraw might find it possible to join us.

So I take this opportunity to pay our respects and our appreciation to them. [Applause]

MR. ASBURY: We are going to break up for lunch now. As I understand, the lunch is in the Blue Room.

[Whereupon, at 12:07 P.M., the conference was recessed, to be reconvened at 1:30 P.M., this date.]

## Thursday Afternoon Session

## June 13, 1957

1:30 P.M.

MR. ASBURY: Gentlemen, I wonder if you'd mind taking your seats now. We'd like to start the afternoon session.

Gentlemen, the first project to be presented relates to "Patent and Other Factors in the Future Organization of the Steel Industry."

The gentlemen presenting this study[1] are Dr. Irving H. Siegel and Dr. Robert M. Weidenhammer. Dr. Siegel is the director of research of the American Technology Study for the Twentieth Century Fund, and a member of the staff of the President's Council of Economic Advisers. He is also an author and a lecturer on economic and technological subjects. In addition to many papers, he has written books on concepts and measurement of production and productivity and on production, employment and productivity in 59 American manufacturing industries.

The other co-presenter is Dr. Weidenhammer. He has taught at the University of Minnesota. He was an investment analyst at Dillon, Read, specializing in the steel field. He was chief of the Metals and Minerals Division of the Department of Commerce. Since 1953, he has been professor of economics and finance at the University of Pittsburgh.

Dr. Siegel will now open this presentation.

### PATENT AND OTHER FACTORS IN THE FUTURE ORGANIZATION OF THE STEEL INDUSTRY

RESEARCH PROJECT INTERIM REPORT

DR. IRVING H. SIEGEL: In starting, I should like to tell you a little about my role in this particular study.

When the Foundation asked me to participate in its work, I found myself already over-committed to other responsibilities. I agreed, however, to help organize certain case studies which might provide a basis for formulating and testing hypotheses on the role of the patent and other factors in industrial organization, especially the creation and growth, or frustration and demise, of small firms.

I suggested a trilogy of studies. The one on the steel industry, concerning which Professor Weidenhammer will report to you, is among these three. His report deals with the future organization of the steel industry. The two companion studies deal with the custom heat-treating industry, about which you will hear later this afternoon, and with the electronics industry springing up in the Boston area.

The aim of the three studies is to cast light on the role of the patent in a wide variety of circumstances and in significantly dissimilar industries.

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[1]The presentation of Dr. Siegel and Dr. Weidenhammer is based on a research project interim report published in the first issue of *The Patent, Trade-Mark, and Copyright Journal of Research and Education* and material developed subsequently.

Thus, the steel industry is generally considered as mature and monopolistic. In this case we are interested in the possibility that the new technology looming on the horizon may eventually lead to significant changes in the size, structure and geographic location of the industry's firms and plants.

The electronics industry, on the other hand, is considered to be part of the technological frontier. In this active many-branched industry, intellectual capital—the ability of engineers and scientists—is an important asset, as our study of the experience of the Boston area particularly shows.

The third study, on custom heat-treating, concerns a service industry which has risen up between the fabricator of metals and the user of metals.

Professor Weidenhammer was asked to address himself to the meaning of the new steel-making technology for the future organization of the steel industry. He was asked, for example, whether the many innovations provide a realistic basis for expecting financial and geographical decentralization. Do they mean that small integrated facilities will be able to operate profitably in the neighborhood of limited ore deposits and near secondary population centers? Will the future geographic and size distributions of firms be significantly affected by the ownership and accessibility of patents on the new technology?

Professor Weidenhammer did the research work on this study, while my role has been that of consultant. I now yield the floor to him so that he may report his findings to you.

Thank you.

DR. ROBERT M. WEIDENHAMMER: Mr. Chairman, Discussants, Ladies and Gentlemen: The steel industry is, as you know, a very important one. It accounts for about 95 per cent of all the metals produced and for about 85 per cent of all the processed materials used by mankind. Especially in this country, the industry provides detailed information on productive capacity, on raw materials consumed, and on products delivered.

From the time of the T.N.E.C. hearings until a few years ago, the industry has been a favorite whipping boy. Critics have pointed to its excessive capacity, as in the T.N.E.C. era; or to its insufficient capacity, as in early years of World War II and in the aftermath. The industry is typically blamed whenever it raises prices, whatever the circumstances and without regard to the behavior of other industries.

This background explains why the industry is a bit apprehensive of any kind of "investigation" of what it is doing, including our own study. The sensitivity of the industry has doubtless limited access to information, but another handicap is that our study must rely, in its very nature, not on hard data and hard facts, but on opinions of what is going to happen, opinions as to the feasibility and profitability of future technological projects. Although the engineer may be fascinated by the feasibility of a new technology, the operating man who has to account for profits may be skeptical—so it makes a difference whom one interviews. I must accordingly emphasize that, in spite of my checking and rechecking of opinions, the conclusions drawn in this study are tentative at best.

I wish here to express my sincere thanks to the many people in the steel industry and in the steel equipment industries who have given of their time to educate me in the new technological processes and to provide me their best opinions of what these processes will mean.

Now to the study itself. I believe that we are becoming more and more convinced that the "dismal thirties" were but an interlude between a century of rapid capital formation and rapid capital expansion all over the world and a new surge of capital expansion. The problem today in our own country is how to attract savings to finance the many projects which seem so urgently needed because world population is growing rapidly, certain raw materials are becoming scarce, and higher wages press constantly on unit production costs. Since higher productivity is essential in these circumstances, new technologies command attention.

Patents also have an important place in the new move of expansion. If new techniques of a necessarily uncertain profitability have to be financed by the steel industry (the cost of a piece of equipment may run into millions of dollars), those people who decide on such investments have to feel sure of a certain protection. They must feel that they have the same sort of opportunity to reap the fruits of investment as is provided by the Atomic Energy Commission in this country and the Eldorado Mining Corporation in Canada in fixed-price purchase contracts with uranium miners running to, say, 1962. Such price contracts encourage expansion of the uranium industry. The steel industry finds a similar shelter in the patent. This form of protection encourages expenditure on research, pilot plants, and new full-scale production plants.

The dismal thirties, to go back to them for a moment, created adverse attitudes regarding profits and savings. These attitudes are reflected in our tax laws against undistributed corporate profits and perhaps also in the judicial treatment of patents.

In my study I have sought to summarize briefly the history of the steel industry with reference to the patent as well as other factors. It was in 1857 that Sir Henry Bessemer introduced the Bessemer process in this country. He collected about $10 million on his patents. Mr. William Kelly, an American who apparently discovered the process earlier but had not developed it commercially to the same extent, collected about $450,000 in royalties during his lifetime.

I need not recount to you the great number of other important technological developments and patents which are part of the record of the steel industry in the last hundred years. I shall mention only the by-product coke oven, which is linked to the name of Koppers; and the continuous rolling mill, which was invented by Tytus, who assigned his patents to American Rolling Mill Company.

Nevertheless, the steel industry has in the past shown a general hostility to the patent system. Operating men have evidently hated to pay tribute to competitors for their inventions. Royalties collected since Sir Henry Bessemer's time on patents for the continuous rolling mill, continuous galvanizing and electrotinning, and other processes have really been insignificant in comparison with the cost savings or products improvements achieved. Instead, patent holders have induced the manufacturer of equipment to add, say, $100,000 or $150,000 to the price of a rolling mill, which is "chickenfeed" compared to the total price of the mill, rather than impose a charge per ton of steel rolled.

Today a change in attitude appears to be in the making. The steel industry has in the last five years greatly increased its interest in research. Figures indicate that the money now spent in the steel industry is several times what it was a decade or so ago. It stands to reason that, with such an increased stake in the development of new processes, the industry will have a new mentality, and show less hostility toward patents than it has, generally speaking, shown during its earlier history.

What are the most important technical developments underway in the steel industry? The basic process of making steel today is the same as it was a hundred years ago, despite innumerable refinements and the increasing reliance on mechanical and automatic methods. But three new processes suggest a technical breakthrough.

One new method that may prove economic is the direct reduction of iron ore. This process could eliminate, or at least reduce, the need for by-product coke ovens and blast furnaces. It would simply use a gas, probably natural gas, as a source of hydrogen for the removal of oxygen, the main impurity in the iron ore, and thereby yield an iron that might be called a synthetic scrap.

About five varieties of this process are being tried out in pilot plants.[2] If it takes hold, as seems likely, it could set a new pattern for the future location of steel plants.

Historically, the steel industry in this country was built up around Pittsburgh, near the best coking coal in the world and accessible to the rich iron ore of the Mesabi. The direct reduction process would suggest location closer to natural gas fields. New locations would include, in addition to Texas, Venezuela, which has plentiful high-grade iron ore and natural gas; India also has abundant supplies of good iron ore, and natural gas could perhaps be pumped through pipelines from the Near East.

I should like to go on record as saying, however, that in the next 30 or even 50 years there will be no important change in the American steel industry's locational pattern. In the first place, of the three factors which determine the location of a steel plant (two used to be coke and iron ore—now, maybe natural gas and iron ore—and the third is the market) the market is the most important one.

Take, for instance, Duluth. The steel plant in Duluth is right next to the iron ore. You might say you could economically bring the iron ore down and take the coking coal up in the same boats. Yet that plant has never become very important, while a location like Chicago, a large market, has steadily grown.

In other words, the American steel industry's locational pattern is determined by its markets, and the markets in this country are not going to change in the next 50 years in my opinion sufficiently to make much change in the locational pattern of the steel industry.

I have mentioned so far only one new technique—direct reduction of iron ore. The second is the steel-making in an oxygen converter instead of, say, in open hearth

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[2] *Fortune*, July 1957, p. 156, reports that National Lead Company has spent less than $2 million on its share of the R-N (Republic Steel-National Lead) direct reduction process, but eventually expects royalties from steel companies of $40-50 million a year.

furnace. The converter, which requires oxygen in large quantities, is economical of capital. It can melt a batch of steel every 45 minutes instead of about 10 hours, as in the most modern open hearth furnace.

The third new technique is continuous casting, which also has important implications for labor-saving and capital-saving. This method avoids the casting of ingots and their subsequent reheating for the rolling of billets. Employed in conjunction with direct iron reduction and the oxygen converter, it would streamline iron and steel making.

If all three new processes should become commercially feasible, they promise a reduction in investment of approximately 50 per cent. In addition, they might expect a reduction in operating costs of about 5 per cent. From these figures, one might jump to the conclusion that the steel companies will fall over each other in starting to build these new steel plants. But the existing traditional plants are still technically adequate and still commercially profitable. Furthermore, although the new-style steel plants could be built today at only half the cost of new traditional plants, they would still cost twice as much as the existing plants did when they were actually built! Having modest book value, existing plants are not easy pushovers. Current technology can only slowly be displaced.

Permit me to elaborate. Let us assume that a new plant using traditional processes would cost $300 per ingot ton of annual capacity if built today. Let us further assume that the new processes would reduce this to $150 per ton. Yet, most of the capacity in being today, which performs satisfactorily, costs only $75 per ton. Accordingly, if the American steel industry should add, in the indefinite future, something like three or four million tons of capacity a year, and if one-half of the increment should represent the new processes, you can see that it would take about 70 years for the present capacity to be replaced completely by the new processes. (The increment devoted to new technology would be 2 million tons, while total ingot capacity at the end of 1957 will be about 140 million tons.) In other words, while we have before us the opportunity for a potential technological revolution, economic facts indicate a moderate note of adoption of the new processes.

Another point that ought to be brought out is this: The three new processes all have to do with stages prior to the rolling mill. While they seem to make it possible to start a relatively small local operation either in an outlying part of this country, let's say, Texas—[laughter]—or in a South American country, (where coke is simply not available), profitability or commercial success would require one or more large rolling mills to provide customers with a complete line of products.

And it is just inconceivable to start a small steel-producing plant and then not have the finishing facilities which today have to be of a minimum size in order to be competitive and to give the customer a full range of products.

Therefore, I have also come to the conclusion that the present trend toward larger plants and further integration, both vertical and horizontal, will continue unless and until the Department of Justice says, "No!"

Further integration also seems inevitable in the light of experience in Europe, where desperate attempts are being made to regain a competitive position in the world market, and even in Russia, where the profit motive and monopoly power are not supposed to be important for a particular steel plant. Foreign steel plants are becoming larger and more integrated—from the raw materials down to the finished product. Only through size and integration can diversified customer need for high-quality products at reasonable cost be satisfied.

In conclusion, it appears that policies with respect to patent licensing and to the sale or rental of equipment will become more and more important factors in the reshaping of steel technology. Although the new technology does not offer new hope for small business in steel-making proper, it does promise opportunities for small business in the field of special equipment and instruments makers.

Thank you. [Applause]

MR. ASBURY: Thank you, Dr. Weidenhammer.

Now, we have several prepared discussions on this paper.[3] But before we start, I'd like to say that cards will be passed out to you, and we hope that you will write down any questions that you might have. We'd appreciate your writing your name if you care to on there. It would help us. If you don't, that's all right. And then we're going to have some open discussion after that if we have time.

Now, the first one of our prepared discussants is Mr. Horace B. McCoy, who is now the Administrator of Business and Defense Services Administration of the Department of Commerce. He's a graduate of The George Washington University, and he has a long record of dedicated service in government and particularly in the Department of Commerce.

He has received a number of awards for his outstanding contributions during these 37 years of service, and he has held a great number of positions in the government.

We'll ask Mr. Horace B. McCoy to open the discussion.

## DISCUSSION

MR. HORACE B. MCCOY: Mr. Chairman and Panel Members and Members of the Conference: I'm not an expert in this field, make no pretense of being so. I don't know what my qualifications are to be here as a discussant. I have had a lot of relationships with the steel industry over the years, particularly in their expansion programs and particularly in meeting the requirements for war, for mobilization build-up, and regarding future mobilization base.

In the 10 minutes that the chairman allows me here I am pretty sure I can dispose of everything that I know about or might contribute to the subject.

I take it that our function here as discussants is not to review the report[4] but merely to discuss some aspects of it, contributing to the general subject which you have before you, which is patents and what part they may play in the future developments of this industry.

As Dr. Weidenhammer's report indicates and as he has explained and as I under-

[3]*Supra* note 1.
[4]*Supra* note 1.

stand the context of his report, certainly patents have not had a dominant part in the development of the industry in its structure, or its location. There was a cluster of patents around the original processes of the converters, the Bessemer and the Thomas, the open hearths, and later on in machinery, and equipment to handle and process steel. Certainly the process of making steel hasn't changed very much—basic steel, that is. The developments that have come along have been more in the process of developing greater efficiency in the making of steel, in the processing or rolling of steel, and in turning out new kinds and forms and shapes. The main influence in the structure of the industry to date has been economics and not patents so much.

Now, that is my view, both on the history written here—which, incidentally, is a very good one—and on the basis of my limited experience and knowledge in this field.

We have found in our governmental work that economics in this industry is the all-important factor. I don't know of any case where we ever found that any problem in the expansion of the steel industry was complicated in any way by a proprietary ownership of patents or processes. It's always been the matter of economics, of raw materials, of location of the plant, and, of course, most important, of money.

The steel industry, of course, as you all know, is both an integrated and a non-integrated industry. It seems to me to have pretty generally reached a position of maturity at least in organization form, although proposals have been made recently, and perhaps there may be others, to further combine existing production facilities. But what the outcome of that will be, I do not know and would hesitate to make any prediction.

Economics has been one of the important factors, if not the dominant factor, in the organization of the industry as it is presently constituted.

I would not venture any judgment on whether or not the industry has been a laggard in research and development. That's a matter of judgment. I have heard it often said that less money has been spent in this industry than in industries of comparable size.

If that has happened, there might be an extenuating circumstance. There has never been any competing material breathing down the neck of this industry. It is still the major metallic in the world and so far doesn't seem to have any really serious competition from the standpoint of mass production and mass use. I don't believe the steel industry ever even noticed the fact somebody had developed a plastic that was going to make automobile bodies, boats or most anything you can name. I don't believe the industry lost one night of sleep over that competitive development.

It is said that when you're not pushed, when competition is not enough to worry you, that research goes by the board. I don't think that's true here. I do think, however, from what I know about it, that research in this industry has been stepped up recently. We see it in our work particularly with reference to new alloys.

If you accept the conclusion which I think the report makes, patents have not had a very important role or a dominant role such as might be said of some other industries. Take electronics for example. A very large number of patents have been issued in the electronics field and this doesn't exist in the steel industry.

But if the suggested frontiers do develop along the lines indicated—that is, the direct reduction of iron ore; the greater use of the oxygen process in the metallurgical phase; and the direct casting or continuous casting process were adopted—they would seem to bring about a change greater than any during the last 75 or 100 years, and more significant than any other one development or series of developments in the steel industry.

Will these advances in steelmaking be developed through research? Yes, I believe so.

Will patents play an important part in the development and, say, the structure of the industry? It's probable. I really don't know. I couldn't offer an opinion on that. I do know, that in the weapons field, with which we are most concerned in my agency, in the development of mobilization resources for the future, that new metals, new materials are all extremely important.

We, as you know, since World War II and particularly since the coming of the atomic age, must find materials which will do the kind of things required with the heats that will be generated and the corrosive qualities that will exist.

So that the development of alloys is certainly a frontier where we're probably only at the beginning.

One observation I would like to make was not treated in the report. What might be the influence in the next 10, 25, 50 years in the control and utilization of nuclear heat?

It might well be imagined that these very high heats, which presumably go far beyond anything we now know of, might bring a whole new field of metallurgical developments, and it might even be possible, of course, to make new metals out of steel. We might not recognize the materials that could be developed in combination with other metals with the application of these degrees of heat.

So it seems to me that Dr. Weidenhammer might want to devote some attention to that. I realize it's a new subject. I don't know how much research has been done in this field at all or whether even research is beginning.

As you know, in the food field, the government will soon build an atomic reactor and an accelerator to explore widely into the use of atomic energy for food processing and preservation.

Some of these developments are revolutionary. Is the same thing being done with respect to steel? If it is, it would seem that these frontiers spoken of in the report,[5] the "breakthroughs" perhaps, may have real meaning and that the industry may change —change fundamentally—in the way of making steel, in the processing of it.

But as to the structure, whether this will influence the structure of the industry, I agree with Dr. Weidenhammer. I think the steel industry is still a big-league industry, big aggregations of capital and know-how, and that the smaller institutions, whether they have patents or not, do not seem to me to offer much prospect for expansion of the small firm in this field. It will still have to be the tried and tested concern, the great aggregations of capital, the integrated type of production, because the only way, apparently, we can make steel—is to make it in a very big way.

[5] *Supra* note 1.

Thank you. [Applause]

MR. ASBURY: Thank you, Mr. McCoy.

Our next discussant was to be Mr. Pool, president of Air Products, Inc., but he wasn't able to make it today, but he sent two men instead. He made a wise choice, however, since he picked out a man by the name of Mr. Arthur E. Steele. He is a chemical engineer from Carnegie Tech. He has had four years with the Corps of Engineers where he helped in operating and supervising oxygen-generating equipment.

Since 1946 to the present time he has been with Air Products in engineering design, plant erection, and he was sales manager of the steel mill sales division. He is now assistant to the vice president.

In case he has any trouble, he's got a man right behind him by the name of Dr. Clyde McKinley, who is director of research at Air Products, in case he needs any further help.

We will ask Mr. Steele to give us the lowdown on steel.

MR. ARTHUR E. STEELE: Thank you, Mr. Asbury. Fellow Speakers or Discussants, and Fellow Listeners: Mr. Pool sends his regrets. He wanted to be here because Air Products is very interested in patents and the steel industry, and we hold both of them in high value in our company.

Dr. McKinley and I and others in our company have had the privilege of studying Dr. Weidenhammer's paper[6] in detail, and I assure you that each of the 50 typewritten legal-size pages is worth reading. I understand that his paper is to be published, and I hope each of you will have the opportunity to read and analyze it.

We want to congratulate Dr. Weidenhammer on his fine work and the research he has done. It has given us a vivid picture of the steel industry from its very inception to the present time, and it has also given us a good look into the future of the industry. I know we're going to reread it many times for the facts and information that he has presented.

He has also discussed the role of small business and the opportunity small business has in serving the steel industry. Air Products is in this role. He made a statement which well sums up this position when he stated:

"Through hundreds or even thousands of other developments affecting the blast furnaces and steel furnaces, such as better refractories, new charging equipment, the use of forced air or oxygen and of control instruments, many of these improvements were patented and so provided openings for small businesses to serve the steel industry as makers of equipment or instruments."

More specifically, another comment that Dr. Weidenhammer made in his paper fits us directly, and it's this:

"Gases, especially oxygen and to a lesser extent hydrogen and argon, are finding important uses in the newer ferrous metallurgy. Thus, the prospect of new small firms arising around the steel industry should not be neglected."

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[6] *Supra* note 1.

Air Products for several years has engaged in a supporting role in the steel industry, and if I could tell you a few cases of how we have engaged in this supporting role I think we will have a picture of how small businesses like ours have been serving the steel industry.

Air Products was incorporated and designed its first oxygen generator in 1940 in Detroit, where we began to serve the steel industry. During World War II the armed forces required practically all of our production capacity so it was not until 1946 that we really began serving the steel industry to a significant degree.

I'd like to tell you first why we served the steel industry so you can see the role of a very critical and important patent in the first years of our company's history.

Air Products first major oxygen generator installation in the steel industry began operation on Janaury 2, 1956, at the Weirton Steel Company in Weirton, West Virginia. Up to this time oxygen had been supplied to the steel industry from oxygen-producing plants located about a hundred miles or more from the point where oxygen was used. The lowest-cost oxygen at that time was 29 cents per 100 cubic feet, or $70 per ton.

One reason for the high cost was that oxygen was produced at a few locations across the country and transported in expensive equipment to the point at which it was to be used. Air Products saw an opportunity to provide substantial savings to the steel industry by supplying equipment which would permit them to use their own free air to produce oxygen. Today the same user who paid 29¢/100 CF for oxygen in 1946 is getting oxygen from Air Products equipment for 8¢/100 CF. The Air Products 525 ton per day plant at Weirton, West Virginia, is producing oxygen at 2¢/100 CF, total cost including capital charges.

In addition to savings that we were able to offer the steel industry, we were making another important contribution that we weren't aware of at first. By making low-cost oxygen available for the first time in the history of the American steel industry, oxygen began to be used for metallurgical purposes. Some of these uses were entirely new. Others were known uses but were impractical because oxygen was high priced. We discussed with Armco Steel Corporation, for example, the use of oxygen for the "new" open hearth roof-lance, where oxygen is blown onto the surface of molten iron for rapid refinement. And as we were discussing this subject and referred to the "new development," Armco reminded us that they had experimented with roof-lances in 1923 but the program had to wait for the time when low-cost oxygen would be available.

Air Products has had an important role in the development of the new metallurgical uses of oxygen that Dr. Weidenhammer has referred to.

The question you may ask then is, how did Air Products, a newcomer in 1946 come to its position of serving the steel industry in this capacity.

Air Products saw the opportunity to serve the steel industry by reducing oxygen costs, but this meant an oxygen generator had to be produced and put on location where oxygen was being consumed. But there was a formidable obstacle to face. The steel industry needed oxygen under pressure, and they required high demand rates, which means that we had to store large volumes of oxygen under pressure.

How can oxygen be produced under pressure? It's not easy to compress oxygen because compressors have to be lubricated, and oxygen compressors cannot be lubricated with oil. The best lubricant available at the time was water, and water is a notoriously poor lubricant.

Air Products tackled this problem and developed a liquid oxygen pump which pumps the oxygen while it's in the liquid state at about 300 degrees below zero, and while it's boiling. A boiling liquid is inherently difficult to pump because of vapor-locking.

This problem seemed impossible because on the intake stroke of the pump the liquid oxygen could be expected to vaporize and fill the cylinder of the pump with oxygen gas.

We developed the idea of sub-cooling the liquid oxygen below its boiling point so that the cylinder would be filled with liquid and hence were able to make this pump work. We patented this feature together with some other patentable features of the pump.

We guarded and valued this patent particularly because we were now able to build a plant that could be put into the steel industry which was inexpensive, simple, and easy to operate and maintain.

Heretofore oxygen had to be compressed by water-lubricated compressors, which were basically hazardous, difficult to maintain, and unpredictable. The oxygen had to be dried after compression which was also a hazardous and an expensive operation.

So we were on our way then with this small, compact, simple oxygen generator, with our whole company more or less supported by this one development, the liquid oxygen pump, which we had patented and guarded well.

In our sales presentations in the early days we, of course, featured our patented position as we would open up an oxygen plant flow diagram before our customers. This had real value to us saleswise.

As our company has grown larger, however, and as was expressed by one of the discussants this morning, we value our service to the steel industry even greater now than our patented liquid oxygen pump. In fact, we are even licensing our pumps now to a competitor.

I would like to mention just one or two reasons why we have grown in the steel industry, since these apply to companies similar to our own in the steel industry.

When Air Products contracted with its first steel customer in 1946, the nation's steel production was 91.9 million tons per year, but during the last 11 years the producing capacity has increased about 45 per cent to the present 133.5 million tons. So we just couldn't help ourselves. We were destined to grow along with the steel industry. But there has been another significant factor that has influenced our growth, and this has influenced the growth of others as well to some degree. The oxygen consumption per ton of steel has steadily increased and will continue to increase for some years to come.

The oxygen consumption per ton of steel was 30 cubic feet in 1930. In 1940 it was 50 cubic feet per ton. In 1946 it was 100 cubic feet per ton. Today it's about 250 cubic feet per ton. Some of the new uses that Dr. Weidenhammer mentioned require much greater quantities of oxygen: the oxygen roof-lance for the open hearth uses about 500 cubic feet per ton, the oxygen converter uses 2,000 cubic feet per ton, the blast furnace uses about 2,200 cubic feet per ton. Oxygen which is used in the production of hydrogen by partial oxidation of hydrocarbons for the direct reduction of iron ore, will take about 8,000 cubic feet of oxygen per ton of iron produced.

Air Products is vitally interested in this whole subject of research and development in the steel industry. We invest heavily in money and time in research and development to improve our generating equipment, and also to find new and better ways to use our equipment and its products in the steel industry. We are, therefore, intensely interested in the program and objectives of The Patent, Trade-Mark, and Copyright Foundation and we value the whole subject of patents dearly. [Applause]

MR. ASBURY: Thank you, Mr. Steele.

Our next discussant is Dr. Howard Turner. He's had experience as a research chemist at Du Pont. He was the director of research and development at the Pittsburgh Consolidation Coal Company. And now he's the vice president of research and development at Jones & Laughlin Steel Corporation. And it's very appropriate that he's here in this capacity to carry on this discussion with us.

DR. HOWARD TURNER:[7] Mr. Chairman and Members of the Conference. The paper[8] prepared by Professor Weidenhammer will be read with a great deal of interest throughout the steel industry. The substantial research that has been done in its preparation is obvious in the tremendous amount of pertinent detail on which the paper is based. My comments on the paper bear particularly on the relationship of certain currently apparent technical trends and their effect on the further organization of the industry and the part patents may play. In the process area, I will confine my comments to direct reduction, the basic oxygen furnace process, and continuous casting.

*Direct Reduction*

This area of process development has a broader significance than might at first be assumed from Professor Weidenhammer's paper. For example, the current development of a fluidized bed process that treats -20 mesh ore, departs from most other conventional processing concepts of the steel industry in its requirement that the feed material be of fine size, and that the reductant be based on natural gas or petroleum. This stands in contrast to the traditional demand for a coarse ore for reduction in a blast furnace, and dependence on high quality coke as the reductant. This new development, with its special material requirements, points particularly to Venezuela. Here the bulk of the ore occurs naturally in a fine size and as such must be sintered for most effective use in conventional bast furnaces. The new process prefers fine ore. Furthermore, Venezuela probably offers the cheapest natural gas in the Western Hemisphere. This suggests interest in converting ore to iron and shipping the iron rather than ore, and it also suggests the possibility of investments in Venezuela by industrial components outside of the steel industry to do this job.

Several laboratories, including a Bethlehem-Hydocarbon Research combination and U. S. Steel, are studying the fluidized solids method of iron ore reduction. However,

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[7]This is the prepared paper from which Dr. Turner spoke.
[8]*Supra* note 1.

there is another important process being carried forward by use of a kiln. This work is being conducted by National Lead in conjunction with Republic Steel Corporation. Taken together with the fluidized solids studies, these developments are substantially further along the path toward a complete process design and engineering analysis, compared to long-standing investigations of Madaras, than the author's paper suggests.

For reasons that are brought out subsequently in discussing the methodology of process development in the steel industry, it is my feeling that patents in the direct reduction area will definitely become more important. The quality of the work being conducted is high, and a greatly improved understanding of the process considerations is the result.

*Basic Oxygen Furnace Process*

In the basic oxygen furnace process we feel that an important new door has been opened to the industry that will provide means of producing steels of quality equal or superior to the best open hearth grades, while at the same time offering inducements in reduced investment. Professor Weidenhammer suggests that the process generally contemplated by the basic oxygen furnace process has become commercially feasible because of the reduction in the price of tonnage oxygen. His explanation might be clarified by rephrasing, but his point is well made and important. In giving credits for the availability of tonnage oxygen in the United States to Air Products, I feel sure the author would wish to draw our attention to the early pioneering toward this same objective led by Linde Frankl in Europe.

If one wishes to undertake heated discussion about oxygen employed in steel-making, he need only concern himself with the words for process identification. I think it would clarify the paper were it pointed out that the designation L-D or oxygen converter is now considered to be just one type of the basic oxygen furnace process. Others being employed in Europe include the Kal-Do and the Oberhausen rotary processes. Just what L-D stands for is a question certain to further the argument; at least four explanations are extant:

| *Suggested meaning of L-D* | | *Explanation* |
|---|---|---|
| Linzer Düsenverfahren | — | blowing process from Linz |
| Linz-Donawitz | — | plant locations in Austria |
| Linz-Donan | — | Linz on the Danube |
| Linz-Durrer | — | after Prof. Durrer, an early proponent of the method |

On the licensing side, I think the record should show that the European patents for this top blown oxygen converter are now held by VOEST (Vereinigte Osterreichishe Eisen-und Stahlwerke A.G.). Brassert Oxygen Technik (BOT) of Zurich, Switzerland, are represented by a member of the Board of VOEST, but they do not have a controlling interest. Kaiser Engineers are the licensing agent for VOEST in the U.S.A.

Since Jones & Laughlin Steel Corporation has executed a license arrangement with Kaiser Engineers, it would indeed be foolhardy on my part to make any comments about the significance of patents in this field. It seems unlikely, however, at this date that any new broad coverage would come about.

*Continuous Casting*

Many in the steel industry are watching the development of continuous casting with great interest. There can be no doubt that with achievement of the substantially higher rates of production that are required, this process will go far toward making some conventional rolling equipment obsolete. However, developments carried forward on super-pilot plant equipment are not likely to spawn a large number of very strong patents since flexibility in the experimental facilities is necessarily limited, and only a narrow range of conditions can be explored. This is not to express any views on the validity or strength of existing patents, but merely to emphasize the difficulty of obtaining any new, broad, and dominating position as a consequence of investigations conducted at this stage.

*New Steelmaking Flowsheets*

The author suggests that a future flowsheet would involve direct reduction, an oxygen-blown converter, and continuous casting. Current practice in the use of oxygen in the converter production of steel is to charge with about 75 per cent of hot metal and 25 per cent scrap, (based on McLouth and Dofasco practices and raw materials). Hence, some means of providing either hot metal or at least a substantial per cent of the charge as molten metal would be required in the flowsheet envisioned by the author.

*Instrumentation and Control*

The significance to the steel industry of instrumentation and automatic control can hardly be overestimated. Several steel companies appraise favorable results so high from programs aimed toward developing and using such equipment that separate organizations have been established in their technical departments to concentrate on these programs. Very substantial cost savings and improvements in quality control are being obtained.

One such development is the X-ray gauge developed and patented by Jones & Laughlin for continuous thickness measurement of the tin layer on tin plate. Manufacture of this instrument has been licensed to North American Philips. Many other examples of instruments could be cited that illustrate similar developments. Considerable effort is going forward on the application of computers of different types for process study, measurement, and control. Automation in rolling facilities and in other steel handling steps is moving ahead.

Patent possibilities in this area seem to me to be quite real and provide means for giving instrument manufacturers and steel companies a good chance to capitalize on such developments beyond their own applications.

*Mergers*

I have already made some comments under the subject of direct reduction that bear on further vertical integration in the industry. The factors that have led to mergers of the vertical variety in the past certainly need reconsideration in projecting any forecast. Some of those in the past may not have been either prudent or profitable.

For example, there is real question whether, in the past decade, steel companies have achieved good enough returns from their coal mining investments to warrant tieing up capital in these operations. During the same period the more immediate competitive pressures drove the non-captive or commercial coal producers to levels of mechanization and resistance to costly labor practices, that placed the best of them far ahead of the captive producers. Hence one might argue that a shrewd coal buyer in a steel company could have done more for his employer during the period than could the head of coal production who was at the same time requiring capital from the corporation treasury.

Today the captive producers are constantly moving ahead in productivity, but whether the future will reverse the picture and confirm the virtues of vertical integration here, is problematical.

There can be no doubt that vertical integration into ore has been a profitable policy for steel companies. And if present pricing policies are preserved, further integration may be fostered by increasing demand for beneficiated ore.

These traditional pricing practices place no higher value on a unit of iron when it is present at 65 per cent concentration in the ore than they do at 52 per cent. Yet to raise the concentration requires capital for beneficiation facilities, operating cost, and very importantly, results in a yield loss of iron. In an integrated corporate structure the incentives for this upgrading are recognized in the lower gangue load placed on the blast furnace. But needless to say, the blast furnace operator does not take the initiative in passing along these credits to the independent ore producer.

Competition forces the independent ore producer to higher levels of iron content in his product, to hold his customer, but he actually loses ground financially. As the operator demands higher and higher levels of iron in the ore for the blast furnace, the incentives for further vertical integration are apparent, further supported by the generally profitable nature of iron ore production.

*Research*

Professor Weidenhammer has said, "The steel industry has often been accused of technological sluggishness. . . ." In connection with blast furnace developments, he says further: ". . . the size and cost of the installations . . . do not lend themselves easily to use in unpredictable experiments . . . there remains the hard fact that in good times a furnace cannot be spared for 'laboratory tests' because customers are waiting in line. In times of recession, when a furnace may well be idle, management may have neither the will nor the wherewithal to gamble."[9]

This has been a matter of concern to management and students of the industry, but they as well as many technical people themselves seem not to have addressed themselves to the core of the problem. Yet it appears to stand out when reference is made to the technical and economic problems of conducting costly "laboratory tests" on large scale production equipment.

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[9]*Supra* note 1.

The key lies in the science of "scale-up." This is the term used by the process engineer to describe the path he follows in employing the results of laboratory or pilot plant trials in the design of large scale equipment. Obviously when this can be done, and the performance of the large scale unit can be predicted with confidence, the scientist-engineer has a powerful tool at his command. There is no tie-up of costly production equipment, no hand-wringing for the inevitable failures of exploratory work done at the expense of production, and most of all, better plants are designed and conditions for best operation are more fully understood.

The foundation on which the procedure rests consists of an understanding of the components of the process that is independent of the specific equipment in which these data are collected. This concept and its application are the great contributions of chemical engineers that opened the way to the rapid process developments of the chemical and petroleum industries.

With its full understanding of process variables, developed in small scale equipment, the petroleum industry had a tool of tremendous value in its ability to study unfamiliar crudes on a small scale, in relatively cheap equipment, and not under the "operational gun." The resulting data provided the basis to determine whether full scale units could be built and operated with acceptable risks, and with predictable results.

By contrast, we in the steel industry have not developed pilot units for our major process components that can be relied on for this job. And until we do, process developments and improvements will come very slowly and expensively.

For example, our knowledge of the blast furnace in any engineering sense is a knowledge that is tied quantitatively to a particular furnace, or at least does not extend to a sufficient number of furnaces of significantly different design or mode of operation to provide us with the basis of "scale-up." Hence all proposals for design changes can only be evaluated on full scale furnaces, which means few such ideas are ever tried. And when new furnaces are built, there is little quantitative basis for making significant design changes to meet the needs of our modernized burdens.

This problem is not solved by construction of a small scale blast furnace. Actually we need many different kinds of devices to study the blast furnace process, and very likely none would bear a physical resemblance to the full scale unit. Yet one can visualize a long range program using such devices that would lead to the answers desired, at considerably less cost, and with far more useful results than are gained in the typical blast furnace trial.

However, much more than specialized equipment is required; rather the specialized methods of the process engineer need recognition as the proven path along which the steel industry must move as this "scale-up" problem is recognized to be at the core of the industry's reputation for sluggishness in the process area.

Most pertinent to the concern of this audience, it is well known that small scale process work, with intrinsically more flexible facilities, is much more conducive to production of broad and numerous patents than is work on a full scale facility, so limited in range and costly to modify.

*Higher Research Expenses*

Two opposing factors are mentioned by Professor Weidenhammer[10] that influence research outlays. One is the slow obsolescence, the large existing investment, and the high replacement cost even of intrinsically cheaper new processes. These tend to snub effort to develop new processes. On the other hand, the generally more favorable attitude toward innovation, and a different view on expansion, tend to favor research.

A second factor favoring research should be mentioned, i.e., serving as a basis of cost reduction. Great strides have been made in decreasing man-hours per ton of finished steel, but much more needs to be done in increasing capacity of existing equipment, and in getting more out of existing investment. Many cost and competitive factors are driving in this direction, but organized research having these objectives, as against plant scale investigations, represents a new concept and progress is not yet under a full head of steam.

*Inventor-Entrepreneur*

The author mentions "The driving adventure spirit of the inventor-entrepreneur." The original creative thinker will always be required, but I suggest that you take a look at the major process developments of the past 30 years in the chemical and petroleum industries and you will not hear much about "inventor-entrepreneurs." Instead, you will find well-led teams of men, thoroughly grounded in the physical sciences, who have evolved some rather sound, efficient, and therefore low-cost ways of coming up with new processes. My experience with inventor-entrepreneurs has not been very rewarding. Their zeal to see their invention used obscures the importance of objective analysis, economics, and sound process engineering. We end up with either a resounding and costly flop, or a success held to narrow application because the time has not been taken to understand the elements of the process.

*Conclusion*

Despite a general awareness of technical matters and currently receptive attitude toward technical developments, the steel industry remains handicapped in its forward movement in the process area by restriction of process studies to the use of full scale equipment. The methodologies evolved by the chemical and petroleum industries that expedite process development via bench and pilot scale work, and the techniques of the chemical engineer, encounter special problems in the steel industry. Some of these problems are compounded by the need to handle solids, and by high temperature operations. But the key to basic progress lies in a clearer recognition and use of the principle of "scale-up."

As time goes on, and these problems are overcome, process developments will move ahead more rapidly. The result will parallel the chemical and petroleum industries in that patents will assume a larger role. Patents are likely, as a result, to have more technical significance. Greater technical activity will breed a higher regard for patents and their utility will be more widely recognized, as devices for drawing together information peculiarly required for each company's special problem and use. It is unlikely that

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[10] *Supra* note 1.

industry dominating positions will be acquired and this will favor the value of individual patents for trading purposes.

I agree that the chemical and physical changes with which we are concerned in the steel industry are unlikely to permit process changes so radical as to decimate minimum economic unit investments. Therefore the opportunity for newcomers into the industry is unlikely to be altered even by the certain technical developments that lie ahead. It is possible, however, that developments which encourage reduction of iron ore with natural gas rather than coal, and the special situation in Venezuela or along the Gulf Coast, could lead a large natural gas producer to undertake reduction of iron ore. This "disintegration" of the traditionally close tie between ore and steel is opposed in other areas by factors involving the cost and pricing of beneficiated ore which tend toward further integration.

The field of instrumentation and automatic control represents an enormously important one for the picture of the steel industry. Furthermore, while the steel laboratories are actively developing this equipment, they apparently expect to depend on instrument manufacturers for its production. Hence this important trend in the steel industry will foster growth of these supplying concerns.

Thank you. [Applause]

MR. ASBURY: Thank you, Dr. Turner.

We'd like to collect any questions we have. Will you turn them in? And I wonder if while we're doing that the authors of the paper have any quick comment they want to make of corrective type?

DR. SIEGEL: No.

MR. ASBURY: Professor Weidenhammer, do you have anything you want to say?

DR. WEIDENHAMMER: No.

MR. ASBURY: I think one thing we ought to try to discuss while the discussion period is on—and I hope it will be a lively one—is the point that was raised that it it might be 50 years before the steel industry really takes over some of these new developments. Now, that seems like an awfully long time. I realize that for any complete displacement of existing equipment it could be 50 years, but I would think that you could see some impact in the way of new units on these new developments within a much shorter time.

We'll start on our questions that have come in here. The first one is by Mr. Gilfillan, and this is addressed to Professor Weidenhammer.

"Since oxygen cannot well be stored nor shipped very far and involves nitrogen and argon production too, do we need wider integration to use the main air products—that is, wholesale in one locality, perhaps piping them about as we do gas and water? In other words, a sort of utility?"

DR. WEIDENHAMMER: This question probably should be answered by Dr. McKinley. All that I would say is that the contribution of Air Products in the field has been to create a piece of machinery, which provides oxygen by simple extraction from the air and installing it at the plant of the customer.

MR. ASBURY: We have the next question here directed at Mr. Steele. It's along this line:

"Would your present commercial situation have been different if you did not have your liquid oxygen pump patent?"

MR. STEELE: Well, I don't think there is any question that it would have been different. We have to thank the military requirement for, say, catapulting our company into a healthy position. The government needed a packaged oxygen generator, all on a trailer, which was simple, easy to maintain, easy to operate, and easy to train others to operate. And the liquid oxygen pump did this. And I would say that we probably would have found a way around the liquid oxygen pump by maybe a better compressor. We'd have spent some money, as much as we could have. But I think that the liquid oxygen pump was basically responsible for our company's growth and healthy position. Without it I don't think we'd have made it.

MR. ASBURY: Including the patent? I think that was part of the question.

MR. STEELE: Well, there is no question about it, because at the time our company started in 1946 we had two other competitors whose sales today are about what they were in 1946.

MR. ASBURY: We have another question here for Dr. Turner from Mr. C. F. Carlson.

"In view of the lag in adoption of new steelmaking and testing processes, is there much likelihood of commercial use within the life of a patent? If not, what inducement is there to inventors or small companies in research?"

DR. TURNER: I think you can get misled when you talk about the length of time that it has taken certain developments to be adopted by the steel industry. We tend to look at major items. For example, how long has it taken perhaps to pick up oxygen-blown steel. The limitation here was cheap oxygen. But there are innumerable improvements—and I gave the example of instrumentation—where these facilities are placed in use well within the period of the 17 years.

Research, generally, is going to go ahead anyway for cost reduction purposes. Where patents can be obtained they will certainly be sought. In other words, the inducement to carry out research is to make money, not primarily to secure patents, although where protection is possible, we will certainly seek patents.

MR. ASBURY: The next question we have is directed at Professor Weidenhammer.

"The Steckel four-high rolling mill patent earned about $40 million. Has any other patent ever made its owners more money?"

DR. WEIDENHAMMER: Once in a while one has to go to the end of the road in order to find an answer. For two years I have tried to find out exactly how much the Steckel patents earned and have never been able to get a concrete figure.

The Steckel patents were in the courts for about 20 years, and this figure is probably what the businessmen would call a gross figure, after deduction of what the attorneys collected to get the judgment.

MR. ASBURY: Any other comments from the floor? We'd like to have people who ask questions try to get over to this microphone if you can. It would help in getting the question across.

Any other questions from the floor?

[No response.]

Do the authors of the paper have any other comments?

DR. SIEGEL: I should like to make one comment.

MR. ASBURY: Dr. Siegel.

DR. SIEGEL: Notice that if you think of the steel industry as conventionally defined, you are confronted with process patents that may take a very long time to exert their fullest influence on the future structure of the industry, the geographic location, and so on. But, to see the whole picture, you must expand the scope of observation to include suppliers normally classified in other industries—say, firms like Air Products. A mature industry that is well established, that has its future life character already largely delineated by its past investment history, evidently cannot undergo extensive change in the near future. Nevertheless, in the interstices or on the fringes of such an industry you will find new firms arising, new ones that may owe much of their vitality at first to the development of many new items of equipment—instruments, gases, and other supplies—and to the existence of the patent system.

Mr. Turner mentioned the X-ray gauge as an example of instrumentation. We do not yet have any idea as to what the use of atomic radiation may mean for the future of the whole field of instrumentation. There are any number of gauges already in use which differ from X-ray equipment and make use instead of fission products that still have some radioactive life in them. I am sure that the use of radioisotopes for gauges and instruments will find their way into the steel industry as well as many others.

I simply want to underscore the idea that confinement of attention to a mature industry proper may lead to a dim view as to the variety of changes taking place and their rate of adoption. It is important, instead, to look at the whole complex—not only at large industries dominated by established large firms, but also at auxiliary and ancillary industries and firms. Only by this enlargement may we hope to find out what is really going on in technology and to find out the full role of the patent.

Thank you.

MR. ASBURY: I wonder if Dr. Hopkins of United States Steel would care to make any comment before we close here?

DR. HOPKINS (United States Steel): Mr. Chairman, I have already commented privately. I believe that any more general comments would not come well from me under the present circumstances. So I will have to ask to be excused.

MR. ASBURY: Well, I think, to summarize what Dr. Hopkins says, he has already made quite a few contributions to this study, and he just doesn't feel he has anything more to add right today. Is that right?

DR. HOPKINS: Correct.

MR. ASBURY: Any other questions?

This gentleman here.

MR. GILFILLAN (Chicago): If the steel industry has not produced the expected amount of advance, is there not a case perhaps for some different organization as a trade association sponsorship for invention or perhaps government inventing or interposition?

MR. ASBURY: Mr. Gilfillan asks whether, if the steel industry can't move these things along faster, it might not be in order for some trade association or some governmental department to try to expedite the use of inventions.

Who wants to answer that?

DR. TURNER: "When did you stop beating your wife" I guess. [Laughter] I don't think, to start off with, that I would agree that in looking around the industry today there is room for a great deal of criticism at the speed with which it's going ahead technologically. I might say the biggest problem the industry has today is competing with all these other good fellows like those on the platform with me, for the scientists and engineers necessary to move technical programs ahead.

The American Iron and Steel Institute, as an industry body, sponsors research at universities through its General Research Committee. This, however, just like the American Petroleum Institute, confines itself to fundamental and basic research, mostly at universities. From my own experience, I don't feel that industry groups are nearly as effective in carrying forward research programs as individual companies. They simply don't have the competitive drive.

In England, as you know, the British Iron and Steel Research Association is a sort of quasi-governmental body that is supported by both industry and the government. They do some very, very fine research. They happen to be doing a good bit on continuous casting. But this is a pattern of organization which is foreign to us in this country.

My guess is that the technology of the steel industry is really moving a lot faster than the public realizes at the present time.

MR. ASBURY: Did you want to add a comment, Mr. McCoy?

MR. MCCOY: Well, on this general subject, you know a few years ago the six countries of Europe went together in the Coal and Steel Community with the support of the United States Government. Now, I was over there recently. It seems to me that while some may call that a combine in our terms, nevertheless, they're doing a great deal of work which seems to enhance the general productivity of the industry.

They do common buying on some raw materials. They exchange raw material resources. They even exchange hot metal or supply each other. And not too long ago you know several went together to build a new mill.

Apparently the research is taking somewhat the same turn over there—perhaps a common pool for improving the product of the European steel industry. It may well be that they should catch up perhaps with some of the things going on here. But certainly one of the ambitions of the European steel industry is to sell steel to the world. They have not been able to sell too much here except limited quantities, because the quality and the specifications have not always been up to American standards. But they intend at least to improve that.

So my observation for the American steel industry is that the combine in Europe is moving and moving fairly fast, and research may be one of the more important endeavors and one of the more important results of that organization.

MR. ASBURY: I don't know anything about the steel industry, but I do feel that we need competition in research just as we need competition in business, and I hope that regardless of what may happen in Europe we see our individual companies pushing research as individuals here.

Now, I think this is about all the time we have for this section, and I want to thank everybody who participated and the discussants and the two gentlemen who presented the report. [Applause]

I think we will take a few minutes' recess here.

## PATENT UTILIZATION

MR. ASBURY: Please be seated, gentlemen. We are just about to get started on the next subject, which is "Patent Utilization." This paper[11] is to be presented by two gentlemen, Dr. Rossman and Dr. Sanders.

Dr. Rossman is quite well known to you. He's the patent counsel of the Marathon Corporation of Wisconsin. He was the editor of the *Journal of the Patent Office Society* from 1931 to 1935, and he is the author of a number of papers, including a book on the *Psychology of the Inventor,* one on the *Law of Patents for Chemists,* one on *Protection of Patents on Scientific Discoveries,* and numerous other articles. He is very active in the NAM Patent Committee, where he has carried a big load for a number of years. He will be followed immediately by Dr. Sanders, who is research consultant of the Program Development Branch of the Division of General Health Services in the United States Public Health Service. He is a lecturer in statistics and economics at Johns Hopkins and Catholic University.

In 1947 he was adviser to General MacArthur on social insurance. He has published a number of articles, papers, and pamphlets on various subjects.

We will start with Dr. Rossman.

[11]The presentation of Dr. Rossman and Dr. Sanders is based on a research project interim report published in the first issue of *The Patent, Trade-Mark, and Copyright Journal of Research and Education* and material developed subsequently.

RESEARCH PROJECT INTERIM REPORT

DR. JOSEPH ROSSMAN: Mr. Chairman, Panel Members, Ladies and Gentlemen: You will note in the list of staff members on our program that patent attorneys are not in the majority. Perhaps the reason is that in our profession we ask too many questions. I don't know. [Laughter]

But, seriously, I do want to allude to the idea that Mr. Harris touched on earlier today—the idea behind the Patent Foundation, which is to focus on the patent system the analytical tools of other disciplines, such as that of economics, statistics, sociology, psychology, and so on, with the expectation of discovering new insights and facts which may be useful to all those concerned with the patent system.

I must tell you a little secret about Mr. Harris concerning the early talks I had with him regarding the subject of utilization of patents prior to initiating this project. I found him to be quite a psychoanalyst in his way. He goes to great pains to make sure that each staff member has an open mind and no complexes which might warp his specific assignment.

Well, in my case I assured him that without evidence I couldn't ever report that the American patent system is the best in the world as the National Patent Planning Commission reported some years ago.

As many of you here know, many guesses and rough estimates have been made as to the extent of utilization of issued patents—anywhere from one per cent to 20 per cent. But they have been all pure guesses. We know, of course, that there are roughly about 600,000 United States patents in force today, but no study has ever been made which sought to determine or even approximate in some fairly reliable basis the extent that patents are actually used; and by use of a patent I refer to the commercial working of the invention covered by the patent.

And, of course, as you know, such information would be very valuable, because it would help us to evaluate how well our patent system is working and to what extent industry is relying on patents and actually putting them to use.

The study might possibly answer many collateral questions: Is the patent system worth the expense and the cost which it involves today including the operations of the Patent Office, the work of patent attorneys, the cost of licensing and litigation, and so on?

We don't have statistically valid information today. We have, of course, the gross number of patents that are issued. We hear stories. You have heard some first-hand evidence earlier today of patents which are utilized in the steel industry. We have much discreet data and scattered data, but no statistical study of a cross-section of all patents.

Now, this study we have undertaken is an attempt to take a typical cross-section of issued, unexpired patents, study them intensively and in detail, and find out how many are or were utilized commercially, to what extent, and possibly the reasons for non-use and many other related factors.

Now, the problem, of course, is: How do we go about this kind of a study? Well, I suggested to Mr. Harris that the only way it could be done was by having a competent statistician, a man who has a rich background and the statistical techniques and approach to study a properly-selected sample of patents. It seemed to me that Dr. Sanders was highly qualified for this study. So we had a few sessions with Dr. Sanders. We "brain-washed" him thoroughly and felt he was completely well qualified to go ahead. He has absolutely no prejudices one way or the other as far as the patent system goes.

We told Dr. Sanders that we had very limited funds. We didn't have any Univacs, and we didn't have a large staff. The study would have to be done on a pilot basis as a start.

Dr. Sanders has worked out a very interesting methodology. I hope our discussants here will give us some criticism on this methodology after Dr. Sanders presents his paper[12] today, so that we may have a little more guidance. Personally, I feel, although I have personally a meager statistical background, that Dr. Sanders is on sound ground, and that his preliminary results which he will now present to you are remarkable, surprising and most unexpected—that's the parlance we use in the Patent Office, you know, for getting patents allowed. [Laughter] Dr. Sanders will now present some of the details of his work.

DR. BARKEV S. SANDERS: Thank you, Dr. Rossman, for your kind words.

Mr. Chairman and Panel Members: I don't know which one to accept—whether I'm the blank-minded person or just what. [Laughter]

But, anyway, when I was called to undertake this job, as Mr. Harris indicated this morning, there were several conditions put. One, that this thing had to be done quickly, and, of course, for research that is a rather unheard-of thing. The other was it had to have limited objectives that are attainable in a short time, and therefore, I'm just as conscious as probably many of you that this is not a perfect answer. This is merely a very limited attempt to see whether this type of approach might prove productive in this area of patent utilization.

As Dr. Rossman has indicated, somehow everybody has taken a fancy, or at least a large number of people have, for guestimating what proportion of patents are utilized. Just to give you an idea that this is not a very limited concept, in its latest Senate Report No. 72, the O'Mahoney Subcommittee on Patents, Trade-Marks and Copyrights starts on page 10, Section C, with this heading:

"The effect upon the patent system and the economy of the issuance of vast numbers of unused patents."

Then it proceeds:

> "The accumulation of vast numbers of unused patents by some companies and the effects of such accumulation (1) as a deterrent to newcomers attempting to enter these industries and (2) on the conduct of research by others is a matter of real concern. Related to this problem is the number of patents issued to corporations as against those issued to independent inventors. Indeed, the fate of the independent inventor, heretofore a prolific source of new inventions, is a cause for alarm."[13]

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[12]*Supra* note 11.

[13]Report of the Subcommittee on Patents, Trademarks, and Copyrights of the Committee on the Judiciary, U. S. Senate, 85th Congress, 1st session, Pursuant to S. Res. 167, Study No. 72.

I'm not reading this excerpt with any intent to pass any judgment on it, but merely to indicate that there has been considerable interest and a great deal of speculation as to just what proportion of patents are used. And I therefore think the Foundation apparently had a great deal of vision in selecting patent utilization as one of its basic and initial studies.

Now, as it has been indicated, there are some 600,000 patents in force. It would have been impractical to attempt to ascertain the utilization of every one of these patents. Therefore, the approach was a sample selected from these patents, a sample which a statistician calls a probability sample, randomly selected.

Experience in other fields has indicated that with such a sample we can determine or predetermine our margin of error; and to the extent that our resources permit or to the extent that it seems desirable, we can get as precise an answer to our question as the nature of the question permits.

In fact the true limiting factor in our study is the sharpness with which we are able to define "use" and not the sample size which can be extended commensurate with our resources and our need for precision. In other words, our main concern may not be whether the sample is 60 per cent or 30 per cent of the universe, but rather what we mean by "use." Is this operational definition the most suitable definition that we should apply? In such matters, of course, a statistician will depend on Dr. Rossman and others who are in the subject matter field.

Now, for our immediate purpose we wanted a quite limited concept of use, not that we were satisfied that it is the best, but it seemed to us an operationally workable definition. We defined the "use" of a patent as the making or selling of the patented invention or using the patented invention in the production of goods and services. This use was to have occurred within the period that the patent was in force.

We could not say this use is synonymous with usefulness of the patent. A patent may have usefulness which by our definition may not be regarded as use. We were after some specific, narrow definition that we could follow effectively.

If the study proves of value, if we want to sharpen or extend the definition, it's up to us and up to those who have supported the Foundation if they feel this is a productive field to go further and sharpen our concepts.

Now, of course, at least from the statistician's point of view, it would have been highly desirable to have selected a sample from every year in which the patent is in force and more ideally still to pick a cohort of patents and follow them through the 17 years to see what happens to those patents with respect to utilization. But the conditions of a quick return and concrete answers made this impractical. Therefore, as a substitute, what was done was to select three years and take a 2 per cent sample from each of those three years. Those years were 1938, 1948, and 1952.

The reason the years were so selected was to have years that would reflect the life of the patent—one at the one extreme, one at the other extreme, and one somewhere in the middle. We thought that in this way we would have some inkling of what happens over the life course of the patent, and I think our study throws some light on the changes in use of the patent in the 17-year period.

Now, the information that we have sought with respect to utilization has been from the inventor and from the assignee in the case of an assigned patent.

Those of you who have copies of the *Journal*[14] might turn to page 79 to see the size of our sample—that is, what the 2 per cent sample yielded. It yielded about 2,114 patents in the sample. The table gives you the distribution of these patents according to the assignment status and according to whether the patentee was a resident of the United States.

In our study, because of convenience and need for quick answers, we eliminated the 12 or 13 per cent non-residents. In other words, "The Utilization Study" was limited to inventors who were residents of the United States.

Also you will see, we have divided the assigned patents into two groups, those where the patent was assigned at the time it was granted and patents which were assigned subsequent to issuance. As most of you know, the name of such an initial assignee is actually on the printed patent letter. The proportion of patents assigned subsequently in this study is 6 per cent. Six per cent of the patents issued in 1938 were assigned subsequent to the granting. That is, 16 per cent of the patents that were not assigned at the time of granting became assigned in the course of the 17 years.

If 1938 is typical, it means that some 6 per cent of all the patents or 16 per cent of the initially unassigned patents become assigned in the 17 years. Some 60 or 62 per cent of the patents are assigned at the time the patent is granted. Therefore, something like 66 to 68 per cent of all the patents are assigned at the time of expiration.

Fortunately, Mr. Federico who sits here has helped us very much. His publication for the Senate Subcommittee shows the percentage of patents that have been assigned initially in the last 20 years has been roughly about the same. There was some increase during the war, but other than that, the percentage has not been much above 62 and it reached 65 during the war. For the period 1935 to 1956 there is no indication that there has been any upward trend of the proportion of patents that are assigned initially.

There are two other aspects that I might touch upon at this point. One of these is with respect to multiple inventors. There is an indication that among the assigned patents the proportion of patents that are issued to two or more inventors is increasing. And there is also some slight indication, though it's more a hunch at this point, that these multiple inventors' patents are more likely to be used. Their utilization ratio seems to be somewhat higher than for patents with only one inventor. Now, whether that is a confirmation of the popular saying that two heads are better than one, I leave that to you at this stage. But there is some such suggestion in our data.

The other characteristic is that these 1,200 or so assigned patents—1,218 to be exact—are held by some 500 assignees. The bulk of these assignees have only one patent—in our sample—but some of them have as many as 49 patents. In fact, at one stage, I wagered with Mr. Federico that I could approximate his list of companies

[14]See p. vii.

with specified numbers of patents from my small sample. Of course, since my sample was limited to only three years, I could not get the number of patents held, but I could approximate the ranking of leading companies according to the number of patents that they held. In fact for the largest companies one can approximate the number by blowing up our sample.

If you want to blow up our sample to get the actual number of patents for each of the three years sampled or for the three years combined, you multiply the numbers in the sample by 50. This same process can be applied to any sub-sample, subject always to the sampling error.

Before getting into testing the sample, perhaps a few words should be said about the size of our sample. We were so cautious of not wasting the Foundation's funds that even a 2 per cent sample, it was thought, might be too big. Therefore, we started with a so-called pre-pilot sample. For this, we took 10 per cent of our 2 per cent sample and tested the various methods of reaching inventors and assignees of these patents. I believe the Foundation's approach is in line with modern technology, starting first with a pre-pilot plant, followed by a pilot plant, and finally getting into production on a larger scale.

In the pre-pilot sample we started with the 10 per cent of the 2 per cent sample and tested the various approaches before we ventured upon our pilot project. Our work with the pre-pilot sub-sample has given us a good deal of insight. It also permitted us to develop our study in stages so that we could compare the consistency of our findings in the different segments that constitute these stages. And that consistency gives me one reason, among others, for my confidence that our preliminary results will not change materially if it were possible for us to get a 100 per cent return of our questionnaires.

What I am going to say now about the sample is with respect to the 100 per cent sample.

One is, for instance, estimating from our sample the total number of patents in force by multiplying the samples by 50. Those of you who have the *Journal,* if you will refer to page 81, you will find there estimates of the number of patents from our sample. These estimates may be compared with the total number compiled by Mr. Federico in his publication for the Senate Subcommittee. In 1938, instead of the 38,100 as we estimate, the true count is 38,060. In 1948, instead of our estimate of 23,950, the true count is 23,963. In 1952, instead of 43,650 as we estimate, the true count is 43,616.

I would like to say that there's no magic in this. Any statistician, as my colleagues could tell you, could have prognosticated this close parallelism. I had no special hat from which to pull out any rabbits, no tricks, whatsoever.

Now, turning to page 82, you find there some other comparisons between this sample and some other samples that the Patent Office has obtained for its use.

For instance, the first table there compares the percentage of initially-assigned patents. If you will look at the figure for the combined three-year sample you will find that our estimate is 61.9 per cent. The Patent Office estimate is 62.5 per cent. The difference is six-tenths of one per cent.

With respect to foreign patents for the three years our estimate is 12.5 per cent. The Patent Office estimate is 12.7 per cent. Two-tenths of one per cent difference.

With respect to average length of time that the patent remains in the Patent Office, the lapse of time between application and granting of the patent, our estimate is 38 months for the three years. The Patent Office estimate is 37.81 months. That is less than two-tenths of a month difference.

We have since added to the draft manuscript of which the discussants have copies, the number of claims per patent. The Patent Office had a sample in 1953 that they counted, and we had, of course, these other three years. Again, the comparison, in spite of the fact that it was for different years, is phenomenally close. That is, I'm sure if Mr. Federico had our figures substituted at night for his own figures he would not have known the difference.

So much for the comparisons of our estimates with those of the Patent Office.

We started this survey with interviews. That would have been the most ideal approach—interviewing every inventor in our sample. We found that at least from our initial experience no inventor turned us down for an interview. Unfortunately, the cost of interviewing every inventor in the sample would have been prohibitive. Therefore, we used the initial interviews merely in planning our questionnaire and in getting a feel of the field.

You see, this was what might be dubbed the pre-pre-pilot stage. We interviewed about 50 inventors around Baltimore, Philadelphia, and Wilmington. Then we used that insight in perfecting our questionnaires.

One questionnaire was developed for the inventor and a different one for the assignee. Therefore, for the assigned patents we had these two views—the inventor view about the patent and the assignee view—which has helped us a great deal in giving a third dimension which is self-correcting.

I think, one of the most pregnant remarks, from my standpoint, made this morning by Mr. Harris, was that scientific method has this virtue, that it's self-correcting. And as long as we can remain reasonably open-minded, this self-correcting aspect of science will be our saving. That is, we can try, try again, and adjust and readjust our findings with reality. There is this backfeed process of self-correction as we go ahead. And that's essentially, even in this preliminary stage, what we have done.

Coming to some of the results, I think probably I can move faster in reviewing these if we turn to the tables[15] that were distributed to you.

The first table, Table A, gives our preliminary findings with respect to use. Let me emphasize that this is preliminary, and let me add further that our investigation is not limited to just this one definition of use. We have tried to probe around what we mean by use by asking a number of other questions, such as: How extensively was it used? How long was it used? From what date to what date was it used? How did

[15]See Appendix I, p. 150.

it affect your sales ? How did it affect your production costs? We even have asked the difficult question, and some, fortunately, have answered: What was the net yield from this patent? That is, what were the costs and what have been the profits to date? So don't feel that we have tied everything to this one definition of "use." We have not.

Because we're waiting until we can maximize our returns, in order to save the Foundation's money, we have not as yet put this information on punched cards, so that we could rapidly correlate the information. Ultimately we intend to bring all this information to focus on the problem of use from these various angles.

One other thing that I want to say is that it is within our plan, after we have done all we could to get returns from the mailings of our questionnaires, to interview a subsample of the non-respondents. Those who received our questionnaire, but failed to complete and return it, will be interviewed to see to what extent this group that did not respond is different from the group that did respond. The weakest part of our present study is the possibility that the self selection of respondents may introduce a bias in our returns.

Much of the draft manuscript that was sent to the discussants is addressed to this problem. Do we have here in our present returns what we can regard as a representative sample? I have no final answer to this. But, the indications are, or at least my present hunch is, that the final result will not be a great deal different from what we have in these tentative findings. I might be mistaken but I doubt it.

I shall take a few minutes to indicate to you what I base my confidence on. Now, if you look at Table A and look at the last columns, 18, 19, 20, and 21, that tells you as of now what our inventors have indicated. The inventor reply indicates that some 58 per cent said that their patent either was being used or had been used in the past. And an additional one or 2 per cent indicated that the patent was expected to be used in the near future.

In this case this was for assigned inventors. For this group of patents we had another point of view to look at: How did these replies from inventors compare with the replies of the assignees? Fortunately, we had some 200 patents to which both the assignee and the inventor had replied with respect to the same patent, and we analyzed these. We found that there was a tendency on the part of inventors to report patents that had been used in the past as being in current use, and patents that were going to be used in the future also as being in current use. In other words, it was inaccurate information on the part of the inventor as to whether the patent was used or not. It wasn't so much falsification, puffing up, but rather inadequate or inaccurate knowledge.

And we found, if you turn to Table B, that according to the assignee replies, about 50 per cent of the patents are used. We're inclined to believe that this is the more reliable criterion of the patents that are being used or have been used.

According to the assignee replies the patents are divided in this way: About 50 per cent have been used or are being used. About 30 to 33 per cent—that is, close to one-third—are reported in current use. About 20 per cent have been used in the past, and are not in use now. And something like 8 per cent will be used in the near future.

As of now, these percentages are our best approximation of patent utilization based on assignee replies to our questionnaires.

Now, what confidence have we that this will not change, since, for assigned patents, we have received to date returns with respect to about 60 per cent of the patents in our sample? If the other 40 per cent turns out to be patents that were not used, and that is the reason why the assignees did not answer, our results will be decidedly different. If we took that possibility into consideration, it would cut our utilization ratio from 50 to about 30 per cent. Even with that possibility in mind, at least it gives us a zone, let us say 25 per cent to 60 per cent, of use. I'm inclined to believe that the true percentage is nearer to the 60 per cent mark, and I give you three considerations that lead me to this belief.

First, as I told you, we started with personal interviews. For this we had a small and geographically concentrated sample of 50 cases. Then we undertook the 10 per cent pre-pilot sub-sample. Next we mailed out a larger group of questionnaires and, finally, still another group of questionnaires. We have compared the patents that have come in after we have repeatedly requested people to respond with those for which there were no repeated requests. These different segments are quite homogeneous with respect to use. You see some of these comparisons and their consistency in the columns, Tables A and B, as well as Tables D, E, and F.

You will find the percentages are quite consistent. In fact, a statistician would say tests of significance indicate that these are relatively homogeneous sub-samples from a common population.

This is no proof that the non-respondents are like the respondents. It merely says that the hard-to-get respondent is no different from the easy-to-get respondent, if I may use that phraseology. And that gives us some hunch that maybe the non-respondent may not be too different.

But we have another approach. As I have told you, we have response for assigned patents both from inventors and from assignees. Now, when we compare the returns where only the inventor replied with those where the inventor and assignee replied with respect to the inventor's statement as to whether the patent was used or not, we find the two groups are no different. In other words, the patents of non-responding assignees (patents of assignees from whom we have gotten no information) are no differerent with respect to use, according to the statement of the inventors, from those patents for which we have assignee questionnaires.

Then, in Table B, we take the other view. Here we compare the questionnaires to which the assignee only responded as to use, with questionnaires to which both the assignee and the inventor responded. Are the questionnaires in which only the assignee responded and where the inventor was a non-respondent different from those in which both responded? We find the utilization rate in these two groups identical. Tables A and B give us the strongest evidence that the proportion of unused patents is no greater for patents for which we have received no information from either the inventor or the assignee as compared with patents where both have responded.

We have tested a third consideration in this respect. As I told you at the beginning, there is a certain proportion of patents that have two or more inventors. We asked ourselves this question with respect to patents with multiple inventors: Is the probability greater that more of the multiple inventors where the patent is not used have not answered than those where the patent has been used? We found no difference—again suggesting strongly that there is no indication that the patents of the non-responding inventors are different from those patents for which we have a response from the inventor, the assignee, or both.

And when we analyze patents for which we have completed questionnaires, we find that the reason for non-response is that many, at least as far as inventors are concerned, are older inventors who have died, who are incapacitated, or who cannot be found. For the older inventors the Patent Office address is more likely to be out of date. Therefore, these are the reasons for non-response rather than any attitude of the inventor being sour with respect to patents and not responding to our questionnaire. I'm inclined to believe therefore that the present findings are reasonably indicative of what the picture is with respect to the proportion of patents that are used. You may accept this view or you may not. But in any event, on the basis of this study, one can say that at least 30 per cent of patents are used, if you accept our definition of use.

Now, I want to call your attention to the four other tables very quickly. In Table C we have analyzed the replies of the inventors and assignees with respect to the reason for current non-use of the patent. You find that both the inventor and the assignee of the assigned patents have similar replies. The first one is "lack of market demand." Both give that as the most frequent single reason for current non-use of their patent.

The second reason is "development of the art has taken a different course." This occurs in the inventor reply. In the assignee questionnaire we did not include this specific item. But we find that they have listed this item in the category of "other." Therefore, the replies are consistent.

The third reason which again coincides is "patent competitively at a disadvantage."

And, finally, "rapid obsolescence" is the last reason.

Again the ranking is the same for inventors and assignees.

Now, you find the individual inventor of unassigned patents has a somewhat different pattern of reply, as one would expect. The first reason for non-use given by inventors of unassigned patents is "shortage or lack of venture capital."

The last three tables refer to some of the characteristics of the inventors as to their age, as of the beginning of 1957, their age at the time that they received their first United States patent, and their education. You find that in all of these there is marked contrast between the inventors of assigned patents and inventors of non-assigned patents. The inventor of assigned patents is a somewhat younger man—that is, in comparison to the inventor of unassigned patents. The inventor of an assigned patent was a younger man when he got his first patent as compared to the inventor of an unassigned patent when the latter got his first United States patent. And the inventor of assigned patents has about four years' advantage in education. That is, on the average he is a college graduate, while the average level for inventors of unassigned patents is high school graduation.

So you find this sharp demarcation between these two groups of inventors.

Now, I know I have overlooked telling you about the unassigned patents. In the unassigned patents the use is somewhat lower but not a great deal. And perhaps that lower level is significant. The difference in use is about 5 to 7 per cent lower for unassigned patents as compared with assigned patents.

I'm sorry that the time does not permit—and maybe your patience does not permit either for me to say much more about our preliminary findings. There is considerable detail given in our *Journal*. And we hope to give more details in a subsequent report where some of this analysis will be presented as to why we feel that, incomplete though our study is, its indications are likely to persist as times goes on.

Thank you very much. [Applause]

Mr. Asbury: Thank you, Dr. Sanders.

Now, we have three prepared comments on these papers. I point out again that we will pass some cards around, and if you have questions you would like to ask, please write them down on the cards and we will collect them later.

Now, our first discussant is well known to you. He's a very modest fellow. He asked me not to give a long introduction, so of course I have got to throw away all this paper I worked up on him. But Pat Federico is well known to you, to all of you. He's been a tower of strength in the Patent Office since 1923. And you might say that administrations come and go and Presidents come and go but Federico is here with us. [Applause]

## DISCUSSION

Mr. P. J. Federico: I want to take exception to the remark about "prepared comments." There are just some pencil notes on a piece of paper, and they were prepared this noon with my colleagues here, who did the same thing.

Dr. Sanders' work has been extremely interesting to me because I've been a dabbler in trying to get patent statistics from time to time in a small way, and I've been very fortunate in having followed as an observer the work he's been doing from the very inception of the idea of having such a study.

Several things have impressed me with Dr. Sanders' work. One has been the careful way in which he has planned every detail of what he's been doing, and the other is his extreme conscientiousness in carrying out the work without skimping or taking any shortcuts.

Some of the ideas obtained from watching him work have been used elsewhere, as I will mention after the other speakers if there is some time.

I'd like to dwell on what has been done before in this same field so as to indicate the value of the work that's now going on. If you ask what's been done before, you can reasonably answer: "Practically nothing." Several years ago I had occasion to investigate what existed in the field on this subject, and I'll give you a brief survey of what there is.

I might go as far back as about 1935. There was a Committee of Congress that conducted hearings that were known as the Pooling of Patent Hearings.[16] They worked out a questionnaire designed to collect data on the utilization of patents and sent it to a large number of companies. I never did find out how many companies they sent it to. Nothing was ever worked out except that there were four volumes of hearings and exhibits printed, containing a miscellaneous, undigested mass of papers that were assembled. Buried in that mass of material are the replies received from the questionnaires, 14 in number which probably explains why nothing was ever done to continue the study.

I might mention that there was another attempt about 1939 to make a study of the utilization of patents by questionnaires to companies, but nothing was finished or published.

That's about all of direct studies. About 20 years ago there was an attempt to get an indication from the taxation of patents in foreign countries. You know that in most countries an annual tax must be paid, and if it's not paid the patent lapses. There might possibly be some correlation between the patents for which the taxes are paid and the patents that are being utilized at that time. Some statistics were gathered with that in view,[17] but, of course, while there's a connection, it doesn't give anything satisfactory.

Now, in addition to the company questionnaires in the Pooling of Patent Hearings, there is data relating to a small number of companies lying around in court records in antitrust suits where the companies were asked for reports concerning the utilization of each of their patents. That data is presumably available for study.

Now, we have the various guesses that have been made, both respectable and otherwise. These have been made by all kinds of people in different circumstances, ranging from the Commissioners of Patents down to people who hardly know what a patent is.

One of the former Commissioners of Patents is accused of having stated that not more than 15 per cent of issued patents are utilized. I have seen the statement in print charging him with the statement, but I have never seen the original statement. This is a prior Commissioner, by the way, not the present Commissioner.

People have guessed from one or 2 per cent on up to 50 per cent. Five per cent is a common figure. Ten per cent is a common figure. Some say 20 per cent. Some try to work out a reason for their guess, to make it look like more than a guess, and some don't. But the results aren't any more reliable in one case than in the other.

Just as a sample of the type of statement that's made, I will read a remark from a speech that Dr. Rossman happens to have in his briefcase, given on an unknown occasion by an unknown patent attorney; he doesn't know where he got it, so we're not blaming anybody for making this statement. [Laughter]

He talks about the number of patents that were issued last year and then, after stating that there are over two and a half million issued, remarks, "It's quite safe

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[16]Pooling of Patents, Hearings before the Committee on Patents, House of Representatives 74th Congress, on H.R. 4523, 1935. 4 parts, 3887 pp.

[17]P. J. Federico, "Taxation and Survival of Patents," *Journal of the Patent Office Society*, XIX (September, 1937), pp. 671-691.

to estimate that far less than 10 per cent of the patents issued are worthwhile or ever will go into production or be utilized in any way."

That's typical of the type of statement often made.

I have to plead guilty to making one of the guesses myself, but I was in a situation where I had to do it. A number of years ago I was at an Appropriation Committee hearing with the Commissioner's staff—half a dozen of us. After the discussion of finances was over, the Chairman started asking a few general questions including some relating to the utilization of patents.

I had to answer and did make some sort of a statement but plainly indicated that it was a guess.

This present study is an attempt to get an answer to this question in a scientific manner, in a manner to yield results, in which there could be some degree of confidence for use in the future for various purposes.

Thank you. [Applause]

MR. ASBURY: Thank you very much.

Our next discussant is Dr. W. Duane Evans, Assistant Commissioner of the Bureau of Labor Statistics, United States Department of Labor. He has worked in the government for many years, starting in 1930. And in addition he has published a number of papers in the field of statistics, economics, productivity, and technological development.

He's a Fellow of the American Statistical Association and the American Association for the Advancement of Science. He has received a number of awards, including the Rockefeller Public Service Award in 1953. And he's ably fitted to comment on this paper.

DR. W. DUANE EVANS: Thank you, Mr. Chairman.

Ladies and Gentlemen: I have some acquaintance with statistical methodology but virtually none with patents. I'm thus in the happy position of being able to assert that I know very little about the ingredients of this study,[18] but it's good. I'm going to confine my remarks principally to some very general comments on the statistical methodology.

Actually, there's really very little to say about the survey from this point of view, except to comment on the obvious care with which it has been planned and carried out, and to give a little general background for what I assume is a lay audience.

The non-statistician, when he is confronted with a sample survey, is usually primarily concerned about the possibility of sampling error—that is, the possibility that the results obtained may fail to be representative of the group which is under study—because the inquiry has been directed only to a part of the group rather than to the whole group.

He is likely to be reassured on this point only if somebody informs him that the sample actually includes a very large proportion of the total population or group under

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[18]*Supra* note 11.

study. If somebody says, "Well, after all, the sample was 60 per cent of the group," he is inclined to assume that the results must be good.

As any statistician will tell you, some of the poorest surveys that have ever been made have covered 60, 65, and 70 per cent of the group.

Now, to a person with this kind of feeling, a 2 per cent sample may seem quite small. I'm told by statisticians who have had experience in testifying in courts that 10 per cent is the magic number as far as sample size is concerned. A court or a group in a court will accept a 10 per cent sample as being very good. If you took a 13 per cent sample or a 17 per cent sample, this would raise questions and you'd probably get your testimony thrown out. [Laughter]

One of the most significant and fundamental facts about sampling is that when you're dealing with large groups, large populations, it is not the percentage of the total number found in the sample which matters. It is the absolute size of the sample.

For example, a properly chosen one per cent sample of a group numbering one million will yield more information with less risk of error than a 10 per cent sample of a group which numbers 50,000, simply because it's a bigger sample. Percentage terms don't count. To be more precise, the one per cent sample of the million group will yield 40 per cent more information than the 10 per cent sample of the group of 50,000.

Now, by all reasonable standards that a professional statistician would observe, the sample used in this particular survey is one of a very respectable size even though it is initially 2 per cent.

In very sharp contrast with the layman, the professional statistician in considering a sample survey will, except in a few marginal instances, probably be much less concerned with sampling error as such, precisely because he has an acquaintance with and a feeling for the power of sampling methods.

Almost any professional statistician, if you tell him, "Well, the sample size is above 2,000," will stop worrying about sampling error and will start worrying about some other problems. He will in particular be much concerned about problems of response and the possibilities of bias from non-response. And he will know that these problems arise equally in connection with sample studies and in connection with complete enumerations.

An attempt to run a complete census still runs into people who cannot be located. It was indicated earlier that some of them were hard to locate because they had died and left no forwarding address. And this will happen when you're running a census as well as when you run a sample survey.

The statistician will know that in a samply survey of reasonable dimensions he will be able to incorporate in the explicit sample design and carry through a variety of cross-checks, follow-ups and intensive efforts to reduce uncertainties that would be unthinkably expensive and, in fact, impossible in connection with a complete enumeration.

In such circumstances your statistician will tell you that a well-designed sample survey may be not just less expensive but it may, in fact, yield results of higher precision than some more ambitious efforts at a complete enumeration.

You will find in the paper which we are discussing a good deal of comment on the problems of non-response. The difficulties are real. And even with all the attention and effort that these problems can be given, there will undoubtedly remain in the final results when they are achieved some necessary qualifications because of them.

I don't want to seem to be playing down the problems of response at all. They are very important problems. I want you to appreciate, however, how much attention and care has been given to the problem of dealing with them. I think I should remind you that these problems are inherent in the subject matter under study. They don't arise from the methodology. And the method chosen to deal with them is probably as good as and perhaps the best of any that could have been selected.

I'll make one minor additional point. A number of the questions on this survey to which replies are wanted don't really have precise quantitative answers.

For example, there are questions here about whether the use of a patent is extensive, moderate, or limited, or whether an invention has increased sales markedly, moderately, or slightly. Now, these are essentially judgment questions. There is an inherent uncertainty about responses to questions of this kind. It's a waste of money to attempt a refinement of statistical precision which goes beyond the essential uncertainty level of such questions. A sample of more modest dimensions than the one we are discussing here might well meet this precision requirement.

In summary, I just want to say that it's a pleasure and not a very common pleasure to examine a study plan in which such careful thought to the problems of design and execution has been so obviously given.

Thank you. [Applause]

MR. ASBURY: Thank you, Dr. Evans.

Our last formal discussant is Dr. Jacob Perlman. Presently he is Acting Head of the Office of Special Studies of the National Science Foundation. During the past five years he's been associated with the United Nations, working as an expert in statistics and economics. Prior to that time he was Assistant Director of the Bureau of Old Age and Survivors' Insurance, in charge of the statistical and research activities of the program administered by that Bureau.

Dr. Perlman.

DR. JACOB PERLMAN: Mr. Chairman, Members of the Panel, Ladies and Gentlemen: There's a definite advantage in being the last speaker on a program. Most of the points that you'd like to raise have already been raised by other people, and so you can be very brief, although sometimes you're forced to repeat what has been said before.

I'm very much interested in this survey[19] for the reason that being connected with National Science Foundation we're very much concerned with the general aspect of research and development. As you know, the National Science Foundation has as its function the promoting of basic research in this country, but basic research has a definite relation to other types of research, applied research and developmental

[19] *Supra* note 11.

research. So we are interested in all the aspects of research, certainly from the statistical standpoint and from the research and analytical standpoint.

After listening to some of the speakers at the previous sessions, I'm pretty well convinced that all of us realize that we are now at the threshold of a great and new industrial revolution. Some of us may have a tendency to lose sight of the importance of what is now going on in the industrial system. But others are quite aware of the fact, and we are beginning to refer to this era as the age of automation or the atomic age or the nuclear age. And in view of that, we have great expectations of results that will emanate from this industrial revolution. We certainly hope that it will take care of the rapidly expanding population, and that it will help to expand our standard of living. And I think also we lay great hopes that this industrial revolution which is resulting in the invention of many new things will contribute greatly toward stabilizing the economy.

Well, at any rate, I think it's important from the standpoint of those who are interested in what is going on to be able to measure the effects of these events, statistically as well as qualitatively. As a result, we are in the process of developing all kinds of new statistics along this line.

In the National Science Foundation, for example, for the past four or five years, we have undertaken a series of surveys to measure the extent of research and development in terms of expenditures, as well as in terms of people engaged in the actual research work. And you heard one of the speakers at the previous session refer to a survey that was done jointly by the National Science Foundation and the Bureau of Labor Statistics covering the year 1953-54, and he quoted some figures as to the extent of research in the steel industry.

It might be interesting for me to give you the figure covering the total research and development in this country. In the year 1953-54 it amounted to 5.4 billions of dollars. And that covered all sectors of the economy. It covered private industry. It covered the Federal government. It covered universities and colleges and so on.

We haven't any data for the last few years, but all kinds of estimates have been made, and I wouldn't be surprised if when we do get the figures for those years the amount will probably exceed seven or eight billions of dollars, which is a sizable figure.

Summary figures, of course, are very interesting, and they give us an idea of the general trend of the situation, but they have certain limitations, and those limitations are inherent in the fact that they do not help us to study the impact of this tremendous activity upon the economy, and I think it's extremely important to study this impact.

The only way to study this impact is to undertake a series of special studies, and I think one of the studies which is along that line is the study of Dr. Sanders which has to do with patent utilization, because a good deal of the research activity which is going on in this country results in inventions which are patented, and so the number of patents has a definite bearing on the impact of research upon the economy.

I'm very much impressed with Dr. Sanders' study. I think the results are extremely interesting. And, like Dr. Evans and Mr. Federico, I agree that the methodology is satisfactory and that the results would not change very materially if the whole universe had been covered.

I only hope that this type of survey will be continued. Certainly I hope that Dr. Sanders will finish up the survey by getting additional information. And I also hope that this type of study will be modified to throw additional light on the problem of the impact of research upon the economy.

And here I'd like to repeat what Dr. Evans said a few minutes ago. He seemed to imply that not all patents have the same impact on the technology. Some are more important than others. And so I think we ought to develop some sort of a technique which will be able to give the different patents the proper weight insofar as the influence on the future of industry and technology and the total economy.

I think Dr. Sanders indicated that one type of study that might be undertaken as a follow-up to this survey is what might be referred to as the continuous survey type, which involves selecting a cohort of patents given out at any one particular time and then tracing the influence of those patents during the entire 17-year period.

That is not a very easy type of survey to undertake, but it would be extremely useful, and it would really help to put the various patents into proper perspective.

For example, you could follow up each patent and see how much money was involved in developing the patent and trying to transform it into production, and, on the other hand, you could also see how much money has come in as a result of the application of that patent.

At any rate, what I would like to point out is that this study is a step in the right direction, and I hope that your Foundation will continue the initiative and the pioneer work along this line, so we may really get a better picture of the total impact of research and development upon our economy. [Applause]

MR. ASBURY: Thank you.

We have had quite a few questions turned in here, and we will try to get them through. If we don't, we will ask you to try to get your answers directly from the speakers later.

The first question is for Dr. Rossman from Mr. Gale: "What objective basis caused you to say that the United States patent system is not the best in the world? Where and what is the best system and why?"

DR. ROSSMAN: Mr. Gale, I'm glad you asked the question. I'm afraid I didn't make myself clear. What I intended to say was this: That any conclusions that we may finally draw from this study, I promised to Mr. Harris and the Foundation, would be based on factual evidence.

Now, the National Patent Planning Commission that I referred to was a magnificent report, and, in the opinion of many other people, it was too good a report in the sense it was so laudatory, but there was no published data behind it.

Personally, I think we have a magnificent patent system, even if we can show that only 10 per cent of our patents are utilized. I think our patent system has accomplished more than was originally hoped for, but we want to prove this by factual data.

We want to bring the facts to Congress so that it will understand and appreciate that our patent system is a wonderful social invention for stimulating technological progress.

As a matter of fact, our preliminary figures are most encouraging and I do hope they will stand up on further pursuance of this project. As our experts here indicated, our sample seems to be very dependable, and I'm highly pleased to hear their comments today for the first time.

Thank you. [Applause]

MR. ASBURY: We have a number of rather detailed questions for Dr. Sanders, and he's going to try to answer a few of them here directly.

DR. SANDERS: One of these is: "After the unanswered questionnaires have been followed through, do you feel the sampling has been adequate for the purpose intended?"

Well, adequate within the limits that have already been indicated—that some of our answers are quite general. To the extent that is good enough, I would say reasonably yes. Subject also to the fact that even when we have interviewed a cross section of the non-respondents there are a certain number, as already indicated, of inventors who have died, others who cannot be found—these limitations are inherent in this type of approach. Within these limitations, which will affect 10 or 12 per cent of the sample, I would say yes.

The other question is: "At what age after issue is a patent most likely to be used?"

We have not analyzed this phase adequately as of now, but my hunch is that the pattern of use is quite different for the assigned and unassigned patents. It appears that something like one-third of the assigned patents are either used or about to be used by the time the patent is granted, and some have been used and are no longer in use. On the other hand, with respect to unassigned patents, the use usually starts with the granting of the patent, and there is a shorter time period within which the use or non-use of the patent is determined. In other words, it seems there is a very high probability of use shortly after the granting of the patent. This probability declines sharply for both groups of patents as time goes on. But, as I said, this is just a general impression, and I'd rather not stick my neck out too far.

The third question is: "In the use survey, was any determination made that the subject matter of each patent in question was used in fact as distinguished from opinion?"

I think this is a very valid question, but I'm sorry to say at this level no. We simply asked the opinion of the inventor and the opinion of the assignee, "Was this patent used?"—defining for them what we meant by "use."

Now, I think one of the first things for the Foundation to do would be to actually interview a sub-sample of the respondents to see what they really meant by "use" so they we could get a sharper focus of the understanding of the term "use."

That is certainly in my judgment one phase of our work which needs a sharper focus. There are many others. Therefore, my present answer is no. That is what we have is the opinion of the assignee or the inventor as to whether the patent was used or not as we had defined this term.

DIRECTOR COLCLOUGH: At the present time?

DR. SANDERS: I mean at the present time. And as I have indicated we hope to go further in clarifying the general understanding of the respondents with respect to the term "use."

MR. ASBURY: We have another question that Mr. Federico is going to answer—along with some of his other comments he's been itching to get back in. [Laughter]

MR. FEDERICO: I was hoping I'd be saved by the bell. But one question was thrown at me. It states: "Might not the low guesses formerly as to percentage of patents utilized be due to patents being of lower grade formerly?" It goes on: "My studies indicate a great fall in the percentage of inventions patented, so one would expect a higher grade of patent today than formerly."

Well, that question is practically unanswerable as far as anything I know, because we haven't yet measured the value of the patents and compared different periods to find out if the patents in one period are more valuable than those issued in another. But I doubt very much whether there would be enough variation like that to be significant here.

What is being measured at this first stage is really the threshold of utilization. A difference in over-all value of patents issued in one year over the patents issued in former years would not account for statements ranging one per cent to 50 per cent. There might be some difference in the utilization but not of that magnitude.

I believe that the widely differing estimates of utilized patents are due partially to different understandings of the word "utilization" by the person making the estimates and sometimes to personal bias and many other factors. Of course, they are made in good faith by the people that make them as expressing their belief at the time from their impressions. But most of them are purely impressions.

I reserved a remark earlier that I will take the opportunity to make now, and that is my own experience on sampling. After watching Dr. Sanders work on samples like this, I tried a few myself in the Patent Office in connection with some data we were compiling relating to length of pendency and other aspects of patent prosecution by taking a probability sample over a period, and then using various checks with known factors for the whole period. The checks were remarkably close, in connection with the length of pendency, a small sample of only a hundred was compared with the whole population which had been counted in another way, and the difference between the two was only a fraction of a month. [Applause]

MR. ASBURY: Gentlemen, I think this ends our session on this subject. We're going to take up our final paper in about two minutes, after we have a brief recess.

I want to thank everyone who sent in questions and who acted as discussants and who presented papers.

[Whereupon, a short recess was taken.]

## PATENT AND OTHER FACTORS IN THE DEVELOPMENT OF FIRMS IN THE CUSTOM HEAT-TREATING INDUSTRY

MR. ASBURY: Gentlemen, will you please be seated?

The last subject today is "Patent and Other Factors in the Development of Firms in the Custom Heat-Treating Industry." The work for this paper[20] was done by Dr. Irving Siegel and Dr. Nathan Belfer. Unfortunately, Dr. Belfer was unable to be with us, and Dr. Siegel is going to present the entire paper for himself and Dr. Belfer.

I don't need to introduce Dr. Siegel. He presented a paper this afternoon on the steel industry.

We'll ask him to take over now.

### RESEARCH PROJECT REPORT

DR. SIEGEL: In my earlier appearance on the platform I explained that I helped design a trilogy of studies.[21] The first that we spoke about was the steel industry. Now we come to the second, an inquiry into the role of patents and other pertinent factors in the development and operations of the custom heat-treating industry.

Since the study is confined to independent firms, the findings will not necessarily apply to the captive heat-treating shops which also engage in similar activities. Many of the metal fabricating firms, such as agricultural-implement and automobile makers, also conduct heat-treating operations.

Heat treatment involves the heating and cooling of a metal or alloy in the solid state for the purpose of obtaining certain desirable metallurgical properties. It changes the internal structure of metals, in contrast with such other methods as plating and anodizing, which change the external appearance and surface properties of metals.

The independent heat-treating industry is a relatively small and young one in our country. Its existence is not acknowledged in the familiar government statistics, but it is represented by a vigorous new trade association, the Metal Treating Institute, a representative of which is here today.

The specialized service of custom heat treating constitutes a link in modern industry between the producer of basic steel and the producer of finished goods. The heat treater does not deal with the ultimate consumer but typically serves as an intermediary in the manufacturing process.

Heat treating has a long history. The blacksmith of Henry Wadsworth Longfellow's poem, for example, is one of the most famous heat treaters of all time. Nowadays, heat treating is much more of a science—you might even say a scientific art—

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[20]The presentation of Dr. Siegel is based on a research project report published in the first issue of *The Patent, Trade-Mark, and Copyright Journal of Research and Education.* A copy of the published report was furnished the discussants.

[21]Three case studies for Project 3a, "Effect of Patents on the Creation and Growth of Small Industrial Units."

than it used to be. As we shall see soon, techniques which depend largely on skill and experience are still rather important.

Independent heat treaters tend to locate wherever there are users of steel and nonferrous metals. They are consequently found in virtually all centers of manufacturing activity.

Now, another important fact is that the custom heat-treating industry is essentially one of small firms. The Metal Treating Institute estimates that only five of its members at the time of the study—there were 81 in all and the present number is presumably greater—

MR. HERINGTON: No.

DR. SIEGEL: No? Good. Then we are still up to date.

We were told that only five of the members of the Institute had a hundred or more employees. As you may already know, the definitions of a small business commonly set an upper limit of 500 employees. Since the firms in the industry are rather small, they are of particular interest in connection with the patent role.

The competition among companies in the heat-treating industry is normally confined to the geographic areas in which the firms are located. Although independent metal treaters get most of their work from manufacturers who do not have heat-treating facilities, they may also obtain some of their business from manufacturers who have captive plants of insufficient capacity. Generally, the captive plants do only their own work, but they may on occasion engage in competition with independent heat treaters.

As you noticed in the discussion of the steel industry earlier today, one of the side implications of a new technology arising in a particular industry is that there are ancillary developments elsewhere in the economy. In the steel case the rise of suppliers of oxygen illustrates the generation of effects in other industries.

In fact, if you just examine this "mature" steel industry, you may be overlooking one of the distinctive features of our economy, namely, the continual introduction of small businesses, whether they survive or not and regardless of their subsequent history.

Similarly, in connection with the custom heat-treating industry, we should note the development of markets for heat-treating furnaces, salts, temperature controls and instruments, quenching oils, refractories, agitators—not Communist agitators—[laughter]—heat-treating fixtures, cleaning equipment, heating elements, industrial gases, gas generators, and so on.

Dr. Belfer was asked to make a field inquiry, to go directly to heat treaters and furnace makers and find out about their views and their operations. Two of the gentlemen who are on the platform today were very instrumental in paving the way for Dr. Belfer.

With the help of Mr. Herington of the Metal Treating Institute, Dr. Belfer worked up a little mail questionnaire intended to ascertain the role of the patent in the custom heat-treating industry. Dr. Belfer did not adopt a formal sampling approach of the sort that Dr. Sanders employed. He undertook instead what amounts to a diagnostic case study. In addition to sending his questionnaire, Dr. Belfer wrote to or visited other firms in quest of first-hand information. Of the 81 firms solicited by questionnaire, 21 responded. The degree of non-response is high and suggests that interpretation of the responses as typical of all 81 or of the whole industry would be dangerous. But the study provided what was sought—information as to modes of behavior and the varieties of experience and opinion rather than the relative significance of each in the whole.

Dr. Belfer found that four of the 21 responding companies had developed and patented processes. Eleven of the 21 used processes patented by others. Ten of the 21 developed processes which had not been patented. Thirteen of the 21 tend to alter equipment after purchasing it. And 19 of the 21 relied on what is called "know-how" in their operations.

Thus, in some instances firms feel they owe their life to a patent; and in a number of others, where a patent may even have expired (as in the case of industrial furnace-makers), companies often feel that the head start they gained by virtue of a patent now expired has enabled them to remain in a dominant position in the marketplace.

It is interesting to observe that so many of the companies set great store by this know-how—in fact, often thinking of know-how as being in contrast with a patent. Much information which has not been patented, may even be unpatentable, and is not disclosed is nevertheless deemed significant for a firm's operations.

Now, I should like to amplify some of the findings a little further. These findings refer to all firms providing information, not only those responding to the questionnaire. Six of the surveyed firms indicated that patents developed through their own research had played a significant role in their rise and operations. In one case, although the patent had expired, this fact did not hamper the firm's activities. Dr. Belfer also found that 12 of the reporting firms use one or more patented processes developed by other firms. Normally, a royalty or licensing fee is paid for the use of these patents. The firms considered such licensed patents important in their developments and operations.

Almost all the companies assigned a great role to know-how in their operations. We employed as a definition of know-how—the one provided in the Mycalex Corporation v. Pemco decision of 1946.[22] Know-how was there defined as "factual knowledge not capable of precise, separate descriptions but which, when used in an accumulated form, after being acquired as the result of trial and error, gives to the one acquiring it an ability to produce something which he otherwise would not have known how to produce with the same accuracy or precision found necessary for commercial success."

You see how important it is to be a lawyer. [Laughter] I don't know how much of this definition penetrated.

A number of the firms felt very keenly their dependence on know-how—on un-

[22]64 F. Supp. 425 (1946) D.C. Maryland.

patented or unpatentable information which involves skill and experience in application. One company, for example, reported: "Know-how is one of the principal assets in our business, from the head of the firm, his principal assistants, down to the operating heat treater. It takes at least two years to develop a good all-around heat treater, including an apprenticeship course with night school classes."

Another firm reported: "Use of ingenuity enters into our work daily for best possible metallurgical results and in physical handling of the work best to preserve its shape."

Another company said: "Our operations are determined almost entirely by our experience."

And so on. This testimony again highlights something mentioned earlier by Mr. Steele, that his company was ready to license its techniques, even its all-important oxygen pump, to other firms, depending for future viability and success in effect on the technical services that it can perform. Notice that even apart from the patent the know-how with which a patented process or device might be used could be an extremely vital factor for a firm. The patent hardly ever represents the total of relevant technical knowledge.

I wish to add here that Dr. Belfer ascertained in his inquiry that a considerable amount of research on basic metallurgical problems and on heat-treating techniques is done by the major steel companies; and that these companies generally make the results freely available to independent heat treaters. Notice here another source of information that is not patented, is generally available, and adds to the variety and sum of volume of knowledge available to people in this particular industry. The steel companies issue various technical publications on heat-treating techniques. Similar bulletins are issued by some of the companies that manufacture furnaces, refractories, quenching oils, chemicals and salts used by the heat treater.

I hope that Mr. Ipsen, who is on the platform, will tell you a little about the role of industrial heating equipment.

Dr. Belfer ascertained, on the basis of his interviews with Mr. Ipsen and others, that no firm now seems to have a dominant patent position in the equipment industry. But this does not necessarily mean that the patent did not play an important role at the time the companies did obtain the patents. Indeed, some firms have been able to maintain preeminent positions, as I said before, after expiration of their patents; and these firms reported that they obtained a position of priority by virtue of these patents.

Another thing that Dr. Belfer found may be of interest to this group—the importance of trade-marks, a topic not really covered yet at this Conference. Supplier industries in particular are concerned with trade-mark protection as well as patent protection. Dr. Belfer cites a number of instances in this *Journal*[23] report.

In summary, I should like to repeat six points. First, patents owned by independent heat-treating firms have in some instances played a vital role in commercial development and success of the firms owning them.

[23]See p. vii.

Second, some firms use one or more patented processes developed by other firms, usually paying a license fee.

Third, great significance is ascribed to know-how and to unpatented but allegedly patentable inventions.

Fourth, independent heat-treating firms receive technical assistance from equipment makers and suppliers of materials, and the trade literature also provides much valuable technical data.

Fifth, patents owned by producers of furnaces and other equipment, both current and expired, seem to have been a major factor in the financial success of the particular firms involved. Again, even after the expiration of patents, some of the firms have been able to maintain leading positions in the manufacture of specific types of equipment.

Sixth, firms supplying heat treaters with materials have a lively interest in both patents and trade-marks.

Thank you very much. [Applause]

MR. ASBURY: Now, the first member of our battery of discussants on this paper is Mr. Carl Ipsen, who is now the executive vice president of the Industrial Heating Equipment Association here in Washington. He brings to this subject an engineering and industrial background that is very helpful.

He is an electrical engineer by profession, and he had many years of experience in industry with the General Electric Company and got to the position of general manager of the Industrial Heating Department.

He served in the United States Navy, and he has also served with the Department of Commerce.

Mr. Ipsen.

## DISCUSSION

MR. CARL L. IPSEN: Mr. Chairman, Ladies and Gentlemen: I'm going to ask the privilege of reading my paper. When I start to talk extemporaneously I ramble too much, so I hope you will bear with me while I read it.

Dr. Siegel and Dr. Belfer, in their instructive and interesting paper[24] on "Patents and Other Factors in the Development of Firms in the Custom Heat-Treating Industry," made brief reference to the role of patents among producers who supply equipment to the custom heating industry.

My remarks will be limited to a discussion of that portion of their paper with particular reference to the impact of patents on the formation and growth of manufacturers in the industrial heating equipment industry.

I might better say that my remarks are reminiscences, for I'm relying solely on my own recollections of events during the past 40 years that I have served the industrial heating industry.

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[24] *Supra* note 20.

And 40 years ago is a significant date, for it was then, during World War I, that the industry started to emerge from its swaddling clothes to develop and build the equipment required to heat treat the unprecedented quantity of material required for waging a war. The necessity to wage successfully that war led to many discoveries of patentable significance.

Prominent among these were patents covering the Collins direct heat electric furnace, the Northrup induction furnace, the Hayes "Certain Curtain" furnace, the Harsh "Hump" furnace, and the Bailey carbon trough furnace. And I want to say here that I'm taking a much smaller sample than our speaker did in the previous presentation. I suspect my sample is a fraction of one per cent rather than the 2 per cent he used, because there have been literally thousands of patents issued in this field in the past 40 years.

I have done that to save time, of course. I couldn't cover them all. I have also tried to pick some that have had some significance from the standpoint of their impact on company formation and growth.

Collins of General Electric Company produced the first production type of metallic resistor electric heat-treating furnace by his invention of the direct heat principle. He suspended from the walls of the furnace sinuous loops of heavy heat-resisting alloy strip heating units that radiated their heat directly to the charge. Several improvement patents involving years of interferences and litigation—I assure you there was a lot of it—followed the Collins invention.

What finally emerged was a body of patents with liberal licensing policies that permitted an industrywide adoption of this design. With few modifications it is still, 40 years later, the most widely used construction.

Of significance here is that this invention influenced the formation and greatly aided in the growth of the General Electric Company's Industrial Heating Department.

The high frequency induction furnace, inventions of Dr. Northrup, a physics professor at Princeton, attracted the attention of Mr. Clamer, the president of the Ajax Metal Company, and led to the formation of the Ajax Electrothermic Corporation. Dr. Northrup's basic patents enabled Ajax to maintain the field of induction heating exclusively to itself for many years. Later it granted licenses to others in the field of heating solids. One such license was obtained by The Ohio Crankshaft Company, of which I shall have more to say later.

The basic Northrup patents have long since expired, but the Ajax Electrothermic Corporation continues to maintain a very prominent place in the industry.

Hayes was a pioneer in the protective atmosphere field. He invented and patented the "Certain Curtain" furnace, which provided a means of supplying a protective atmosphere to the furnace chamber and, preventing the air filtration through the open door of the furnace, greatly accelerated the growth of his company, C. I. Hayes, Inc. And that growth has been maintained up to the present time.

Harsh of Leeds and Northrup patented the "Hump" type furnace. It was a vertical cylindrical furnace with a means of placing the sensing element of a pyrometer in contact with the material being heated. When carbon steel passes through the critical or Curie point there is a change in its heat-absorbing rate that causes a "hump" in the temperature curve. This is a warning to the operator that the material is ready to be quenched.

It was an outstanding invention of its day and led to the sale of a great number of furnaces.

Following the invention of the "Hump" furnace, Leeds and Northrup patented the forced convection air draw furnace and the gas carburizing furnace. These patented designs formed the basis for a large and thriving furnace department at Leeds and Northrup.

The Bailey carbon trough furnace—and I'm talking now about patents that were taken out about 40 years ago merely for the purpose of showing that they created and perpetuated several important companies in the field or departments of companies—the Bailey carbon trough furnace inventions were the basis for the organization of the Bailey Furnace Company. Its name was later changed to the Electric Furnace Company. Subsequent inventions of cast grid resistors and control devices and entry by the company into the fuel-fired furnace field have sustained the growth and profitability of that company through the years. In fact, it's today one of our largest companies—all based on the early inventions of Thaddeus Bailey.

The 1920's and 1930's were years of many new developments in the furnace field. Included among many others are Machlett's inventions of the rotary type of gas carburizing, the shaker hearth, and the carbo-nitriding furnaces. These aided materially in the growth of his company, The American Gas Furnace Company.

While no dominant patents were secured in the protective atmosphere field and such detail patents as were secured were generally made available through licensing to others in the industry, the developments in this field had the most far-reaching effect on the growth of our industry of any that had preceded it. Protective atmospheres made possible the heat treatment of metals without scale or discoloration and with accurately-controlled surface carbon.

The introduction of protective atmospheres which could be introduced directly in an electric furnace placed the fuel-fired furnace at a great disadvantage. To protect the material being heated in fuel-fired furnaces from the products of combustion it was necessary to place them in massive retorts or muffles. Lee Wilson came up with the answer in the mid-1930's with his patented radiant tube. In his design he confined the burning gases that provide the heat in small-diameter tubes placed along the walls and in the roof and hearth of the furnace. These tubes became the approximate equivalent of the heating units used in an electric furnace and made possible the introduction of protective atmospheres.

The Lee Wilson Engineering Company was formed to market furnaces using this new design, and it is today one of the leading manufacturers in the industry. Radiant tubes have been adopted by practically all other manufacturers in the field and comprise the heating means of most fuel-fired furnaces sold during the past decade.

I previously mentioned the license granted the Ohio Crankshaft Company by Ajax.

This license was secured to develop induction heating equipment for hardening crankshaft bearings produced by the Ohio Company. The great success of this venture and the many patents resulting from the development of the crankshaft hardening equipment led to the creation of the Tocco Division of the Ohio Crankshaft Company to manufacture induction heating equipment for sale. Tocco today occupies a dominant position in that field.

In the brief time available, I have been able to skim only the surface of the role that patents have played in the development and growth of this important industry. I may not even have selected the most prominent ones but, rather, those with which I am personally familiar. I hope, however, that enough has been said to demonstrate the high value of patents in fostering the formation and growth of the many small companies that comprise today's industrial heating equipment industry. [Applause]

MR. ASBURY: Thank you, Mr. Ipsen.

Our next speaker is Mr. Herington, who is substituting for Mr. Horace Knerr, who just couldn't make it here today.

He's Assistant Executive Secretary of the Metal Treating Institute, which is a national trade association of commercial or custom heat treaters. As you will recall, this Metal Treating Institute was very helpful in obtaining information for Dr. Belfer's use.

I understand also Mr. Herington is the Business Manager of a magazine *Metal Treating*.

MR. H. R. HERINGTON: Mr. Chairman and Members of the Audience: You have had some very, I think, capable substitutes earlier today, but I'm in a rather unique position. I'm the substitute of a substitute.

First, I do want to extend the sincere apologies of Mr. Horace Knerr, president of Metlab Company, who is unable to be here because of illness. But in fairness to the report and to the Metal Treating Institute I think also I should explain exactly how and why I got here.

My appearance was precipitated by a 'phone call by Mr. Knerr explaining his doctor would not let him come. He was very sorry, but would I please go and give a report?

I said, "A report on what?"

And he explained that Mr. Harris had asked him to appear as a member company of the Metal Treating Institute.

Well, that brought back memories. And I think too, for the sake of the clarity of this report, that I should tell you the particular relationship of the Metal Treating Institute to this report.

Dr. Belfer came and visited with us about two years ago, I believe, when they began working on it, and asked us as the national trade association of commercial—this report calls them "custom"; it's the same thing—heat treaters if we could help get some information.

We sent out the questions framed with Dr. Belfer using our own letterhead. If any of you are members of trade associations, you know that one of the headaches of executive secretaries or their assistants is always the matter of responses. Members are busy working, and the responses are usually slow and few in number.

Unfortunately, I have not been in communication with Dr. Belfer since we turned over the replies of the heat-treating firms, and I have had to appear here on short notice with little opportunity to read the version of the report printed in the *Journal.*

And on that basis I do want to make a few remarks. I haven't the slightest idea what Mr. Knerr[25] would have said, but this is what I would like to say.

Some of you may have your copies of the *Journal* with you, and if you do, the report begins on page 57. Now, of course, Dr. Siegel just went over most of it. I would like to point out a few things because it might clarify some of the relationship of the Metal Treating Institute to this report. And frankly, our survey was very largely the basis of this report.

On the very first page, on page 57, it does say that the Metal Treating Institute is a new trade association. Well, that's relative. Next year we're celebrating our 25th anniversary. The MTI was founded in 1933.

Then the report goes on and mentions a fact that I would like to explain. And perhaps there is someone here, as a matter of fact, who might help us. It mentions that even though our Metal Treating Institute had only 81 members then, we estimate that there were three to four hundred independent heat treaters in the United States in 1955. Frankly, we don't know. That is a guestimate on the basis of the circulation mailing list of the national trade journal for the heat treating industry, *Metal Treating,* which is published by this Institute. And from our mailing list we know that we go to 300 commercial heat treating plants, but there may be 600, because 300 may be unfortunate enough not to be getting our magazine. But we don't know.

Last month we spent three solid days in the Department of Commerce and the Census Bureau trying to find out if they had any kind of statistics, and they do not.

It's regarded as a service business because they don't manufacture anything. They heat treat other people's products. So they are classified in the same classification as far as the Government is concerned as IBM. It's a service organization. But the Government has no statistics. They haven't the slightest idea how many there are in the country.

I would say that probably there are around 400, because I'm assuming that most of the industry is aware and is getting *Metal Treating.*

But in addition to that we do know this as far as the size of the industry is concerned, and I think this is important. Of the members of the Institute, of which there are these 81, over 60 of them voluntarily contribute to a confidential sales

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[25]A copy of the report on this project appearing in the first issue of *The Patent, Trade-Mark, and Copyright Journal of Research and Education* was furnished Mr. Knerr.

statistical organization their monthly sales statistics, and they are published, so there is nothing secret about them. They want to know their own relative positions in their areas and so forth.

Well, these 66 companies during 1956 had $36 million worth of sales. That's only 66 companies. Now, you multiply $36 million by something around 300 and then add to that the 6,000 captive heat treating plants that are in the country, and I would say the heat treating industry is one of the most rapidly growing industries in all of the metal-working industries.

But, there again, when it comes to captive plants, the heat treating department of United States Steel and of many other manufacturers, aircraft industries particularly, we have again no figures on how many there actually are except, again, the circulation lists of *Metal Treating*.

So perhaps the figure is around 6,000 heat treating departments. But this survey was made only to the members of the Institute. They are strictly commercial heat treaters.

Another thing I should like to stress is that this material on page 65 of the report[26] on the role of unpatented inventions and know-how—well, there are three or four pages devoted to it—is that, to most of our members, and from visiting many of the members' plants I know they regard know-how as one of the nice things about their business. And, incidentally, most of the heat treating businesses are passed down from father to son, and, like the old blacksmiths, they tell them their metallurgical secrets. There's no question about it.

They also have very marvelous equipment. And with the new metals now, it's getting very scientific. And recently they have to have vacuum equipment to heat treat titanium and so on.

But they do stress this fact of know-how and that it's passed on down. And one of the best ways of disseminating that information is through the technical articles of the magazine *Metal Treating* where they do write about new processes and new developments, show charts, and show people how to do it. And, of course, it actually takes experience to really know how to heat treat.

And I think the only other comments I do have to make are on the basis of the Appendix I[27] which Dr. Siegel didn't mention. It isn't that important. But the Appendix is an explanation in the report of the actual process of heat treatment of metals.

Of course, Mr. Knerr, who should have been here, is a metallurgist as well as an "old timer" commercial heat treater with his own company in Philadelphia and a very large one, the Metlab Company. And he did send to me, and I picked it up here at the desk upon my arrival in town at 12 o'clock, 10 typewritten pages[28] of revision to Appendix I. Shall I give it to you, sir?

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[26]*Supra* note 22.
[27]*The Patent, Trade-Mark, and Copyright Journal of Research and Education*, p. 71.
[28]Published as Appendix II to the Conference proceedings on p. 156.

DR. SIEGEL: Yes, thank you.

MR. HERINGTON: As I say, I don't know what Mr. Knerr would have said about this report, but thanks for listening to a substitute's substitute. [Applause]

MR. ASBURY: Thank you.

Now, our last discussant on the panel this afternoon, fittingly enough, is a lawyer. He's Mr. W. Brown Morton, Jr., of a very well-known firm—Pennie, Edmonds, Morton, Barrows & Taylor, of New York and Washington. He's a member of a number of bar associations, American Patent Law Association, Association of the Bar of the City of New York. He's on the Board of Governors of the New York Patent Law Association. And he's a member of the Board of Managers of the American Patent Law Association.

Now, those of you who are getting a little dehydrated by this heat-treating study will be consoled to know he's also a member of many bars. [Laughter]

He was admitted to the Virginia Bar in 1938, the New York Bar, and, most important of all, the District of Columbia Bar in 1951.

Mr. Morton.

MR. W. BROWN MORTON, JR.: I am, as our chairman stated, a lawyer and, therefore, apparently not highly regarded by the scientists who have been speaking here most of the day. But I find one of the things I learned when I was handed this task —which was, I might add, a delegated task from Mr. Edmonds, my senior, who likes to delegate—was a little bit about vocabulary.

First off, I never heard of a "discussant" before—and now I am one. [Laughter] And I still am not quite sure what that role is.

I also found out about "disciplines." Apparently we're subjecting each other to a variety of disciplines. That doesn't mean what I learned in the army. That means what trade you belong to. But it's a nice word. It's better than "profession" perhaps, because it's more esoteric.

My discipline is that of a litigating lawyer. And so the first question I asked myself about this paper[29] was: Does the approach really get at the effect of patents in this industry?

We heard a little about the use of patents. And, again, from the point of view of a litigating lawyer, I'm not sure that I understand that you use a patent when you use the invention which is disclosed therein.

So I looked at this questionnaire which appears in our *Journal*[30] here on page 73. It asks questions in five categories:

"Have you developed and patented any process in recent years? If so, what?

"Do you use any patented process? Pay any royalty? If so, what?

"Have you developed any process or technique that you have not patented? If so, what?

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[29]*Supra* note 20.
[30]See p. vii.

"How much do you alter equipment—a furnace, for example—after purchasing it?

"To what extent do you use 'know-how' in your operations?"

Now, the answers to those questions are all interesting, but they don't answer to me the title question of this paper.

It may be because of what I am saying I'll be a "cussed" discussant, but I find that I am not informed as to what effect patents have had on the custom heat-treating industry by the answers to those questions.

I cooked up four others—well, two other questions each with two subordinate parts —which seemed to me to be more relevant:

"How many times has your firm been sued for patent infringement? Threatened with suit for patent infringement? Taken a license under a patent?

"How many times has your firm brought a suit for patent infringement? Threatened to bring a suit for patent infringement? Granted a license?"

Because to me you use a patent only if you use the power to exclude which is granted by it and not when you use the subject matter it discloses.

It's quite obvious that in using the purely disclosure aspect of a patent function you might just as well have used something written up in Mr. Herington's journal and then you'd have: "How many times do you use Mr. Herington's journal?" So using a patent disclosure merely wouldn't have anything to do with the essential nature of a patent, as I see it.

And then I branched out in a discipline where I have no business—amateur statistics. And I looked up in the indices available in a law library certain things to see if I could get an answer myself. And I found by looking in the annual indexes—and I availed myself of the right to delegate that to my secretary—in that case, you see, it goes Edmonds to Morton to Smith—[laughter]—there was the following information:

Looking up only the last six years, and using only the names which appear in Dr. Belfer's paper as firms who are not members of the Metal Treating Institute, who are not custom treaters, but they are firms he mentioned—Leeds and Northrup, for example, and others—they have 302 patents in the last six years appearing in the index of patentees, and obviously, they may have bought many others that would not appear there. But the members of the trade association had only six.

I looked in the table of cases index of the USPQ[31] from 1942 to the end of 1956, and I found that no members of the custom heat-treating institute had ever been in any litigation at all. I found one suit in that period involving the equipment industry and one additional reported case in which the applicant had to go to appellate procedure to get his patent and so he got reported in the "PQ." But that's really not the sort of litigation that I had in mind.

Now, what I had said is really that I don't think that the paper is correct in its conclusion that patents have had a great deal of effect on the custom heat-treating

[31]*United States Patent Quarterly.*

industry as such, rather than on the equipment industry supplying it, which is quite a different story.[32]

I'm told, for example, that the metal heat-treating institute doesn't have a committee on research and patents at all, which is indicative. And I would like to suggest this: That it is possible that the nature of the sort of inventions that could be and would likely be made in that field are largely ones which would present difficulties of enforcement if patented.

For example, I rather guess that many of the inventions that would be made would be in the field of use patents, which are notoriously hard to enforce anyhow. And, in addition, if the obvious course of enforcement were taken— that is to say, they found a new mixture of salts to put in the salt bath we heard about—they wouldn't make the salt. They'd go around and license—who? A chemical supplier who would do what? He would in all likelihood either sell his own salt or, if he were also furnishing salt-bath furnaces, he would be under the gun of Professor Oppenheim's favorite quandary: the antitrust law versus the patent law. Like the Morton Salt Company. If you're primarily interested in selling salt, you probably are better off not to have any use patents, especially if you are also selling machinery, for you're going to get into many restrictive licensing problems and that kind of thing.

I don't think, therefore, that the conclusion reached in this paper is accurate, in that I think that many of the firms, if cross-examined a little, would really agree that it was the subject matter of their innovations that have brought them along, that they use, and not patents per se. [Applause]

MR. ASBURY: Thank you, Mr. Morton, for your very penetrating questions. I think it's up to Dr. Siegel to try to answer some of them first.

DR. SIEGEL: The major difference between us involves manner of speaking rather than matters of content. I suppose that we could have adopted a definition saying that litigation is the significant feature of the patent; and that, if you want to find out the relevance of the patent, you should dwell on its exclusionary features, on the problems of infringement rather than the practice of disclosure in exchange for a right. Now, when Dr. Belfer reports that representatives of a number of firms believe that the patent right is significant to the establishment or growth of their particular firms, and so on, he does not necessarily deny the possibility that other factors are important too. He has dwelt, for example, on know-how. Nor is his report on cases inconsistent with Mr. Morton's suggestion that the largely unenforceable use patent might be the most significant one for this industry, that much of the information basic to the industry is not patentable. In short, I am saying that I see more difference in our manners of speaking than in the matters of substance, except, of course, that Dr. Belfer and I did not emphasize in the inquiry the specific problem of litigation. Now, it may be desirable for others to undertake studies that go beyond the one

[32]Dr. Belfer did not intend to draw any conclusions on the role of patents in the custom heat-treating industry as a whole but rather on the importance of patents to firms owning or using them. Indeed, the small response to Dr. Belfer's questionnaire might suggest that patents are not matters of conscious interest to most of the contacted firms. (I. H. Siegel)

we made, that go on to consider litigation as a fundamental attribute of the patent system. But we were interested in getting a picture of the role of patented and other knowledge in the custom heat-treating industry, and I think that no very remarkable claims are made here for the exclusive significance of the patent. In fact, I thought we came out with conclusions to the effect that much of the information significant here is either not patented or not patentable.

Thank you.

DR. ROSSMAN: May I make a comment?

MR. ASBURY: Yes. I'd like you to come to the microphone, Dr. Rossman.

DR. ROSSMAN: I think Mr. Morton's comments are very important and vital, and I'd like to make one comment because it bears on our study also—the utilization of patents. In other words, the question is: Here's a patent, and you use the patent. Now, what are you talking about?

Well, I think in the last paper as well as in our utilization questionnaire when we asked the "questionnairee"—that's a new word also—we were referring essentially to the novel subject matter disclosed in the patent. Now, as many of you here know, when you file an application in the Patent Office there's usually a core of novel subject matter, and if there's a lot of extraneous subject matter which is not claimed, before that patent issues, as a long-standing practice in the Patent Office, the examiner is required to prune down unnecessary disclosure which is not claimed. And that's done every day in the Patent Office, because they don't want to print irrelevant material and unnecessary drawings.

In the utilization questionnaire, we didn't ask separately, "Have you used Claim 1 and not Claim 2, or Claim 4," and so forth. That would make a very complex, very difficult questionnaire, and I don't know whether we would ever be able to tabulate and analyze such data with a hundred Univacs. But I may say we're planning to interview a select number of our patentees who already have answered and run down that very point. We're going to analyze to what extent the answers we got might not conform to the claims or do conform to claims of the patents involved to see how the answers might be affected.

Thank you.

MR. ASBURY: Are there any other questions from the floor that you'd like to ask the discussants or Dr. Siegel?

[No response.]

Mr. Morton, did you have any rebuttal that you wanted to throw in?

MR. MORTON: No, I think not.

MR. ASBURY: Do you gentlemen have anything?

MR. IPSEN: No.

DR. SIEGEL: I want to make one additional comment. Mr. Herington turned over to me a manuscript by Mr. Knerr. Having skimmed through it, I find it to be a new statement on technical aspects of the heat treating of metals, one which, coming from the hand of someone so well qualified, is doubtless worth reading, and we shall certainly profit from doing so.[33]

One remark that Mr. Knerr makes at the end would seem especially significant from the standpoint of this group. He states that while the heat treatment of metals is older than recorded history—he says at least 10,000 years (you see, the art even antedates the village blacksmith)—"more has been learned during the last 25 years than in all of the preceding time as to the nature of the hardening phenomena and the control thereof. Much remains to be learned."

I am pleased to note that the last 25 years referred to here turns out to be almost exactly the lifetime of the Metal Treating Institute.

Thank you.

MR. ASBURY: Thank you.

I just wanted to make an announcement before we break up that the reception and dinner tonight are to be held in the West Ballroom.

Are there any other announcements?

DEAN COLCLOUGH: No.

MR. ASBURY: I want to thank everybody who participated in this session this afternoon, the people who asked questions and those that were discussants as well as the authors of the papers.

Thank you.

[Whereupon, at 5:38 P.M., the conference was adjourned, to be reconvened at 9:30 A.M., Friday, June 14, 1957.]

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[33] *Supra* note 28.

# The Patent-Antitrust Question From the Standpoint of an Industrial Executive

FRANK A. HOWARD

THIS ADDRESS was given at The First Public Conference by Mr. Frank A. Howard, President of Sloan-Kettering Institute for Cancer Research and member of the Board of Trustees of The George Washington University, at the dinner Thursday evening, June 13, 1957, honoring the Advisory Council of The Patent, Trade-Mark, and Copyright Foundation.

IT IS CERTAINLY a pleasure for me to be with you this evening. This Foundation has had a slow development, but I think a sound one, and the present sessions seem to represent the last major step in getting it underway. I hope this gathering will be the first of an indefinitely continuing series. It may be that the meetings sponsored by the Foundation will help us crystallize fluid opinions into solid convictions, and prove to be as useful as the fact-finding researches which are carried on.

The field of these researches and of our common interest can perhaps best be identified as that of intellectual property rights, primarily inventions, designs and writings and, by extension for practical reasons, also trade-marks. This is much too wide an area for your speaker who is first of all an engineer-inventor who also became, by the necessity of making a living that way, a bit of a patent lawyer and industrialist. So I shall not try to cover the whole field of our common interest but rather I shall impose upon your patience to concentrate on a small part of it in which I have had a great deal of experience, not always happy. What I want to talk about is the patent-antitrust question, not from a legalistic angle at all but from the standpoint of an industrial executive who tried for a generation to clear roads through this legal jungle, so that industrial operations could keep up with industrial technology in the oil industry. To most Americans the oil industry simply means gasoline, and it is advances in the technology of gasoline which have given us our motor fuel supply and which have been the special concern of our antitrust friends.

There have been four major stages in the advance of this gasoline technology. Each stage has been marked by an antitrust conflict. The conflicts have grown worse and worse.

The first stage was the pyrolytic cracking development. Until the First World War the only important source of gasoline was the fractionation process. Crude oil, a complex mixture of hydrocarbons, was fractionated to separate those portions which were volatile enough to make a good fuel for automobiles—roughly 25 per cent of an average American crude oil. As early as 1911 the demand for gasoline was beginning to outrun the supply and oil refiners were throwing into the gasoline fraction some of the lighter ends of the next fraction, kerosene. The automobile engines did not start as easily, nor run quite as well, but there was no other practical way to meet the gasoline demand. Standard Oil Company of Indiana conducted a series of laboratory tests which showed that gasoline of good quality could be made from heavy distillates; that is the fractions above kerosene, by very slow distillation under 5 to

7 atmospheres pressure and with heavy refluxing. Under these conditions pyrolytic decomposition, or cracking, of the heavier hydocarbons into hydrocarbons of the gasoline range occurred at a rate of about 2 per cent per hour, and as much as 40 per cent of the heavier distillates could be converted to gasoline before the accumulation of coke in the bottoms of the pressure stills became serious enough to end the run. Judged by modern chemical engineering standards this process was a primitive one, since it was a batch operation at low conversion rates, and with low yields, but it was practical and profitable and was quickly adopted by a large percentage of the oil industry, operating under licenses from Standard Oil of Indiana.

Many rival inventors had been working along the same lines at about the same time, and alternatives as well as improvements on the original process quickly appeared. There was a wide range in the detailed technology, but all of these processes were built on the same foundation of pyrolysis of heavy distillates at moderate temperatures and under pressure. It soon appeared that some of the other inventors had filed patent applications covering some of the essentials of this pyrolytic operation earlier than the commercial pioneer, Standard Oil Company of Indiana.

The lines of development of several processes were inextricably tangled at many points, and there were questions of interpretation and scope of claims, questions of priority, and even questions of title.

To solve these problems, the oil industry, more or less by common consent, adopted a policy of live-and-let-live. In a complex series of agreements the four major contributors to the new art defined four major lines of development, each being the road which had been followed by one of them. Each major contributor obtained from the others the right to use and license processes following his own main line of development, regardless of conflict with the patents of the others. Royalties for licensing were not directly fixed in most cases but were fixed to some degree by the payments the licensing companies had to make to one another for the right to pass on the necessary immunities. Examining this complex fabric of agreements which covered a large percentage of the American oil industry by the middle 20's, we can see some principal effects as follows. First, there was the economic effect. The output of cracked gasoline could be raised to about the same level as the output of natural gasoline. So we had doubled the potential gasoline production for each barrel of crude oil produced. While crude oil production itself had also increased greatly, the product balance could be controlled to meet the gasoline demand without producing an unsaleable amount of other oil products. As a result, prices remained quite stable not only for gasoline but in the main for all oil products.

Instead of continuing the downhill slide of quality which gasoline had entered during the First World War, quality improved. On the twin foundations of good-quality fuel at low and stable prices, and mass-produced tin-lizzies to burn it, the American automobile industry had outstripped the older auto industry of Europe, and the United States as a whole had become a motorized nation. It has never lost that lead over Europe.

What had happened to our patent system under the vast tent of licensing and cross-licensing agreements which had been necessary to permit this economic development?

No pioneer inventor had gotten the simple and absolute monopoly of the new art envisaged by the original philosophy of our patent laws, but each of a score or more inventors who had made useful contributions had received recognition and some share in the reward. There had been very little litigation to delay progress and eat up the profits. Technical competition for continued improvement had not ceased but was still continuing aggressively under the double incentive of better operating results and the hope of more royalty collections. To summarize, the oil industry of the mid-twenties thought it had successfully adapted the basic principles of the patent system to the realities of a modern industrial development. We were all quite proud of this patent contract structure, perhaps the most complex which had ever been erected up to that time, and perhaps also the most successful in its economic consequences.

But the Department of Justice Antitrust Division had other views. Their position was that instead of a live-and-let-live philosophy, our antitrust laws were based upon a kill-or-be-killed philosophy. They believed, and certainly they were right to some extent, that many invalid patents were included in the great list of those licensed, and if the parties had been compelled to fight each one out in court, instead of compromising their differences, many patents would have been held invalid. To avoid this result by making broad licensing agreements under which everyone emerged with something left was deemed to be a conspiracy in restraint of trade in gasoline.

This basic position of our antitrust friends was embellished with many trimmings. Suit was brought in a three-judge Federal Court in Chicago and tried by a master who found for the defendants on the principal issues. The trial Court reversed the master, but on appeal to the Supreme Court a unanimous decision written by the liberal leader, Judge Brandeis, held for the defendants on the principal issues.[1]

Thus terminated the first of the gasoline cases. Without further comment at this moment, I should like to turn at once to the second case which we may call the "Ethyl Gasoline Case."

During the First World War our friend, Charles F. Kettering, whom we are happy to have as one of the pillars of this Foundation, became convinced that it should be possible to add something to gasoline which would permit it to operate at higher working pressures in auto engines without knocking. He pursued this rainbow for a long time before the brilliant young engineer-chemist, Midgeley, who directed the laboratory work, found that a rare gasoline-soluble compound of lead, called tetraethyllead, in minute proportions, was effective for this purpose. Thus Ethyl gasoline was born in 1921. In 1923, Standard Oil Company (N. J.) found a cheap way to make unlimited quantities of tetraethyllead, and the two companies joined forces to form a new company, Ethyl Corporation, which undertook to sell the world on the advantages of lead-treated gasoline as a superior fuel for existing engines and a means of permitting future engines to be designed for much higher working pressures.

The only known method of distributing and selling a new product in the world of commerce is to assure the distributor and the buyer a profit or advantage. The lead-treated gasoline was, therefore, introduced as a premium product and sold at a price

[1]Standard Oil Co. (Indiana) *et al.* v. U.S., 283 U.S. 163 (1931).

advance of 3 cents per gallon, which covered the cost of the lead and a small profit for all of the interests concerned in its production and distribution. The motorist liked the new product. Ethyl gasoline sold well and when it was on general distribution throughout the country the motor manufacturers began to build engines of higher compression ratio which gave both more power and more miles per gallon. Competition for sales led the oil companies to assert that their regular price gasoline would operate satisfactorily on these new engines, and so it would if the engine condition was perfect, but engines do not remain perfect, and as soon as an engine started to knock, the customer bought the Ethyl gasoline to eliminate the knock. This caused the oil refiner to make his regular gasoline of a little better quality as soon as possible. But as soon as he did so the engine manufacturer took advantage of it by supplying an even better engine. Thus by a continuous leapfrog process, made possible by the ready availability of lead to raise the gasoline quality without waiting for new refining equipment, the oil refiner and the automobile engine manufacturer, always in response to public demand for better and better performance from their automobiles, raised this performance level by the cyclic process which I have described. As a result, the working pressures in automobile engines have more than doubled and the engines are so much more efficient, as well as so much more powerful, that two gallons of gasoline does the work which formerly required three gallons.

This spectacle of orderly improvement of motor transportation evolving and developing under a commercial system based on the availability of a patented premium gasoline throughout the country, came to the attention of our antitrust friends in the thirties and seemed to them to require immediate action. A Federal grand jury in Madison, Wisconsin, which was just then reviewing many oil industry commercial practices from the antitrust standpoint, was invited to examine this Ethyl gasoline phenomena. They examined it at some length but failed to find any reason to indict anyone.

A civil suit was filed, however, seeking to outlaw the licensing and sales agreements of the Ethyl Corporation. This case also went to the Supreme Court where the Government secured a substantial victory in 1940.[2] The provisions of the Ethyl license and sales agreements, which set the premium price of 3 cents per gallon, that is 3 cents higher than the regular quality gasoline sold by the same customer, were held invalid.

By this time, however, the premium gasoline market was so firmly established throughout the nation that there was no economic effect from the antitrust decree in the civil suit. Thus terminated the second gasoline case.

Comparing the first and second cases, the first had involved most of the leading companies in the oil industry. There had been, however, no effort at criminal prosecution, and the civil relief sought was limited to the invalidation of the contracts. The relief actually granted by the Supreme Court was of no importance. In the second case, the problem had been much simpler, but the effort had been made to accompany the civil suit with a criminal action. The grand jury did not indict. But in the civil case the Government had obtained a substantial victory outlawing those licensing contract provisions which had created a premium gasoline market throughout the United

[2]Ethyl Gasoline Corporation *et al.* v. U.S., 309 U.S. 436 (1940).

States. This was the essential economic foundation for the cycle of continuously increasing engine compression ratios and continuously increasing standards of gasoline quality. Happily the premium market was so well established that this belated removal of the props under which it had grown up had no practical effect.

The third in the series of gasoline cases was the hydrogenation or hydroforming gasoline case. A German chemist, Bergius, had discovered about 1914 that heavy bituminous materials, even coal itself, could be partially converted to good quality gasoline by heating under a high partial pressure of hydrogen. This discovery had formed the base for an intensive postwar industrial research program in the German chemical industry. By 1926, when I visited the laboratory of the Badische Company, they were far advanced on new processes using catalysts as well as high hydrogen pressure to make gasoline from coal and heavy oils. This new art of combining high temperature, catalytic action, and high hydrogen pressure, to bring about molecular re-arrangements of bituminous materials was obviously of great potential interest to the oil industry. In a series of agreements beginning in 1927, Standard Oil Company (N. J.) and the leading German chemical company, I. G. Farbenindustrie, undertook to explore and exploit this new technology together. Standard made a large payment and took the dominant position in the use of the new processes in the oil industry. Simultaneously the parties agreed to work together to develop new processes for producing chemical products from oil and natural gas, the originating party to control any process developed by him. As you all know, this production of chemical products from oil and natural gas is now called the petrochemical industry and is fast becoming the dominant branch of mass-production chemical industry.

As a safeguard for the I.G. under these agreements, which necessarily involved disclosure to Standard of some of the most advanced chemical thinking of the Germans, Standard agreed to give I.G. the first refusal on any new chemical developments unrelated to the oil industry which might be developed by Standard during the term of the cooperation of the parties. I might note in passing that Standard never before or afterwards developed new chemical processes unrelated to the oil business. They appeared to have a settled policy of minding their own business. The agreements were made in 1929 and under them there was a tremendous technical advance in the new technology of hydroforming during the ensuing 10 years. The principal foreign oil companies and most of the American oil industry acquired licenses for the new technology and did some pioneer work in this new art of combining high temperature, catalysts, and high hydrogen pressures, to convert lower grade hydrocarbons into more valuable ones. When the war broke out in Europe in 1939, Standard Oil Company (N. J.) already had two large plants for use of the new hydroforming technique, and many other oil companies in the United States had laboratory or development experience. In the petrochemical field the most important new developments were the German synthetic rubber called "Buna Rubber" which had originated with the I.G., and a second synthetic rubber called "Butyl Rubber" which had been developed by Standard on a foundation supplied in part by I.G.

Both the gasoline hydroforming processes and the petrochemical processes covered by these German-American patent agreements, became important features of the American preparedness program which got into high gear as soon as the war broke out in Europe. The hydroforming process was useful not only to make components of aviation gasoline but supplied the missing link for the large-scale production of toluol from petroleum. The quantities of toluol needed for the production of TNT were so great that the former source of supply, coal tar, was wholly inadequate. Crude oil alone was able to meet the need and hydroforming was one method by which selected light naphtha from crude oil could be converted to toluol. In July of 1940 the first tank car lots of toluol were produced from petroleum by Humble Oil of Texas, an affiliate of Standard Oil (N. J.), and from that time it was only a question of building the new plant capacity to meet the unprecedented demand for TNT.

Simultaneously with this application of the German gasoline hydroforming operation to meet our need for TNT raw material, there was set up a national synthetic rubber program. The main basis of this program was the German Buna S-type rubber, a copolymer of butadiene and styrene. Everything known about this German Buna S Rubber development had come to this country through Standard's agreements with the German chemical company, and this knowledge was sufficient to found the American industry. Under the leadership of the Government's Rubber Reserve Corporation, a patent pooling agreement[3] was quickly worked out between Standard and the four largest American rubber companies. With the help of the two war agencies, Rubber Reserve and the Office of the Petroleum Coordinator, this agreement and a large number of supplementary patent pooling agreements covering the production of raw materials for synthetic rubber were worked out and cleared with the antitrust officers of the Department of Justice.

One might reasonably have thought that the enormous value to the national economy and to the national defense of these new technologies arising out of the Standard Oil-I.G. patent agreements would have led our antitrust friends to look favorably upon them, but a combination of other factors combined to bring exactly the opposite result. In March of 1942 Standard Oil (N. J.) was faced with the choice of accepting a consent decree outlawing all of the I.G. patent contracts, and granting extensive free licenses under Jersey's own patents, as well as I.G. patents which had been involved therein, or facing immediate civil[4] and criminal antitrust actions[5] which would be most actively prosecuted and publicized in an atmosphere of national hatred for the German enemy and all of his works. The only practical course seemed to be to accept the consent decree and plead *nolo contendere* to the criminal charges.[6] Thus ended the third gasoline case.

Looking backward the enormous growth of the legal jungle in patent-antitrust law could now be seen with a good perspective. In the first case the Justice Department had sought to break down a wide licensing and cross-licensing system which covered most of the American oil industry and collected very large royalties which necessarily became a part of the cost of the gasoline, these royalties being divided by agreement

[3]See *Report on the Rubber Program 1940-1945* by Rubber Reserve Company (Feb. 24, 1945) pp. 30-33, 70, 71-72, 76, 77-78, 79, 80-81.

[4]United States v. Standard Oil Co. (N.J.), (D.C.N.J.) Civil 2091.

[5]United States v. Standard Oil Co. (N.J.), (D.C.N.J.) Cr. 682.

[6]"The Federal Antitrust Laws," Commerce Clearing House, Inc., 1947, Cases 695, 696.

among a large group of patent owners. The Government had not sought any criminal action, nor had it asked for any punitive action by way of a requirement of free licensing of the patents. The Government's basic case had been thrown out by unanimous decision of the United States Supreme Court.

In the second gasoline case which had dealt with a much more restricted situation, both economically and from the standpoint of the number of parties and agreements concerned, the Antitrust Division had succeeded in breaking down the contractual license requirement for selling the leaded gasoline only at a premium price, but they had not asked for or obtained any other substantial relief. While they had apparently contemplated criminal action they were unable to get the grand jury to act.

When the third gasoline case arose, it involved only the question of a patent agreement between one American and one foreign company, not directly competitive and neither controlling more than a fraction of the world's business in its respective industry. Nevertheless the Antitrust Division had been confident that it could get both civil and criminal judgments including the punitive measure of free compulsory licensing. While war psychology was involved, there was no doubt the antitrust-patent jungle now covered this area.

This was the background against which the fourth gasoline case had to be viewed. We may call this fourth case the "Catalytic Gasoline Case." It roots were quite old, but it was late in the thirties before the first commercial catalytic cracking plant operated successfully. The process and equipment was the result of long years of development work, first by the French pioneer Houdry, then by Socony Mobiloil Company, and finally by Sun Oil Company. The general economics of the perfected process owned by these three parties were very good for many refiners and there was one outstanding advantage—the superior antiknock quality of the gasoline produced. The three owner groups of the Houdry catalytic cracking process, as it was called, were quite willing to license it, but their terms of licensing when applied to the scale of operations of the larger oil companies of the world, gave enormous royalty figures, and it was also apparent that the process had some inherent weaknesses. Quite independently several of these larger companies, therefore, undertook to develop their own superior non-infringing processes, and by the summer of 1939 they had come together and drawn up an outline of a basis for cooperating in their common enterprise. This group was a veritable league of nations—American, English, Dutch and German. The outline of agreement among all the parties was completed just before the outbreak of the war in Europe, but this event broke commercial relations between the Germans and the British and Dutch parties, and the negotiations were therefore suspended to permit reframing the agreements. Limited technical exchanges continued, however, and the war situation placed a greater emphasis on the catalytic development because this cracking process was inherently better for the production of aviation gasoline components and synthetic rubber raw materials. The parties to these negotiations for a new catalytic cracking development and patent licensing group had no longer any illusions about the attitude of the Antitrust Division on matters of this kind. But since some practical patent arrangements were needed to speed the commercial development and widespread use of the best practical catalytic cracking process the problem landed on the desk of the Petroleum Coordinator for War. On July 24, 1942, after extensive negotiations with the many parties involved and with the Antitrust Division, he made a formal recommendation, No. 41, which in effect authorized setting up of a new broad patent license and cross-licensing system for catalytic cracking and related processes. Under this war-time authority the Chairman of the War Production Board approved this recommendation on August 7, 1942.

## SUMMARY

In giving you the bare facts as to the origin and course of each of these four stages in the growth of the present day gasoline production industry, I have not attempted to deal with legal questions at all, nor have I intended to express any criticism of the motives or policies of the antitrust officers. It is the nature of the problem not the personalities which create the problem. All I have tried to do is to take a long look at a large and complex industry to see how the patent system actually worked to make technical and economic progress in that industry and how it has been affected by the antitrust conflicts, which seem inevitable under our form of government.

It has worked very effectively as an incentive for technical and economic progress over the last generation. This progress has removed the limits of the yield of gasoline from a barrel of crude and also improved the quality so that two gallons do the work of three. Our motorized way of life is based upon this plentiful and cheap supply of fuel. This industry has been built upon the inventive contributions of many individuals and the pioneer engineering of many companies. To industrialize these technical advances it was necessary to reconcile conflicting and overlapping patent claims, to pool technical experience and supplementary patent rights on improvements, and to create new distribution patterns. Each major step along this road brought serious antitrust problems and the difficulties certainly did not diminish—they increased. Many progressive industries, perhaps most of the complex ones, have had similar experiences.

During the war it was possible to avoid many of these conflicts. War agencies of the Government took on the task of conciliation. Industrial companies yielded on details of their agreements or proposed agreements which were not essential from an economic standpoint, and the antitrust officers yielded on points which they did not consider absolutely necessary. This experience suggests that the public interest might be served by a permanent government conciliation office operating in the patent-antitrust area. The basic concept of our patent system was that of the British Statute of Monopolies of 1633—the award of a simple unitary monopoly, for a limited period, as incentive for the creation of a new industry. Actually we now grant, mainly, a host of fragmentary, overlapping, and conflicting patent monopolies which must be assembled and shared in new patterns to advance existing industries. The assembly operation is perforce carried out largely by agreements among competitors. These agreements, by their very nature, are a challenge to our antitrust enforcement officers.

This area of conflict seems to be in some respects like that of management-labor bargaining, and is perhaps inherent in our form of govenment. No court or legislature has been able to write an all-inclusive formula to end these controversies. We live and progress in these areas by the costly and time-consuming method of endless contest, and the only substitute is conciliation and compromise. The former Conciliation Service of the Department of Labor now the Bureau of Conciliation and Mediation has become an essential part of our machinery of government. Without prejudicing the position or legal rights of either side, it is usually able to guide the opposing parties toward a solution which is accepted by both as better than prolonged conflict.

I suggest that the Department of Commerce, the same agency which through its Patent Office necessarily creates fragmentary, conflicting and overlapping monopolies under patent rights, should also take on the task of conciliation in the patent-antitrust area, to permit these patent rights to be assembled by competitors in industry into workable patterns.

The paramount public interest is the acceleration of technical progress under a free economy, dominated neither by cartels nor by socialism. Legalistic procedures alone are inadequate to define rights and end conflict in some of these areas. To reduce the uncertainty and conflict in the patent-antitrust area, permanent government machinery of voluntary conciliation could be considered. It would seem useful for the Foundation to examine this possibility and promote discussion of it.

There are, of course, some wide implications of this suggestion. The patent-antitrust area is not the only region in which a legal jungle has grown up. Corporate mergers and, by the recent Du Pont case,[7] corporate investments which give one company a voice in the affairs of another with whom it has business relations, are quite obviously matters of grave economic concern and areas in which voluntary conciliation by the Department of Commerce, or by some other governmental agency, might well be urged as a useful means of preventing avoidable conflict between private enterprise and the antitrust enforcement officers.

I believe each of these possibilities presents its own special problems, however, and feel that it would be best for the patent-antitrust problem to be studied separately. If consideration of this problem throws any useful light on other antitrust problems, so much the better.

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[7]United States v. E. I. du Pont de Nemours & Co. *et al.* 353 U.S. 586, 1 L ed 2d 1057 June 3, 1957.

## Friday Morning Session

## June 14, 1957

The conference was reconvened at 9:35 A.M., Director O. S. Colclough presiding.

DIRECTOR COLCLOUGH: Well, gentlemen, perhaps the most obvious comment this morning, as we reconvene, is that I trust everybody has recovered from the interdisciplinary affair of last evening. In that connection someone raised a question yesterday about the use of the term "discipline" in our presentation. Mr. Morton of New York attributed his definition to his army experience. For the record, may I offer Webster's Unabridged which defines "discipline" as "a branch of knowledge acquired through study and research requiring scholarly training."

We begin this morning, having set a very fine record yesterday in many respects, including that of keeping to the schedule, with "The Value of the American Patent System: An Inquiry Into Possible Approaches to Its Measurement," our Project 2a.

This project has been led by Dr. Markham, who has combined a career in business as well as in the academic atmosphere, having been with Du Pont for four years, with the Chesapeake and Potomac Telephone Company, and he has since been engaged in teaching. He was at Vanderbilt, and he is now professor of economics at Princeton University.

He has also made his contributions in the field of governmental affairs, having headed the research project dealing with an evaluation of fertilizer policies for the Tennessee Valley Authority, and from 1953 to 1955 served as director of the Federal Trade Commission's Bureau of Economics.

He is the publisher of *Competition in the Rayon Industry* and *A Workbook in Economic Principles.*

He has been ably assisted by two graduate students, one of whom has gone on to Rice University, Mr. Brothers. He cannot be here, but Mr. Worley is here. Mr. Worley is a graduate of Vanderbilt University and is now doing graduate work at Princeton, or has been. He is an instructor of economics at Princeton now, and has received a Danforth Foundation fellowship for next year.

The discussion will be led by Dr. Markham, and then at the end, as yesterday, I will call upon the panel of discussants.

Dr. Markham.

## THE VALUE OF THE AMERICAN PATENT SYSTEM: AN INQUIRY INTO POSSIBLE APPROACHES TO ITS MEASUREMENT

### RESEARCH PROJECT REPORT

DR. JESSE W. MARKHAM: Thank you very much, Dean Colclough.

I approach this assignment with something of a confession, namely, if having anything entirely new, entirely original, to say on the topic that we have before us were a prerequisite for being on the program, I think I could safely have stayed at home, because in a sense Dr. Siegel, when he gave his introduction to Project 3a yesterday, for all practical purposes made my speech this morning for me.

My role in Project 2a has roughly paralleled his in Project 3a. That is, in general, my task was to outline the project, to direct the research connected with it, to edit the reports as they went through various editions as they were written, and to write some of the less inspiring parts of the report.[1]

This is all a rather lengthy way of saying that Mr. Worley and Mr. Brothers did most of the hard work, and for this reason Mr. Worley is going to address himself in a moment to several of the more factual findings of this report. But before he does so, I would like to deal for just a moment with some of the really difficult and what I consider the fundamental problems one encounters in evaluating the patent system.

And the first of these, which I consider the most fundamental problem, derives from the wide divergence between the social and private costs of patents and the social and private revenues derived from patents. Any given patent relies upon our total stock of human knowledge, a great deal of which flows out of universities and is, therefore, not completely borne by the patentee of that particular patent.

Similarly, all of the revenues cannot be translated into a system of private accounts. There is the problem of how one handles, for example, monopoly profits. These are private revenues; they are not regarded as social revenues. But on the other hand, patents accumulate in the Patent Office a stock of knowledge that can be worked on; this in a sense is a social revenue that is not recorded as a private revenue item.

A second fundamental problem connected with this project is that patent incomes by definition, or incomes to patentable inventions, relate to the very unpredictable future. This is the very essence of patent evaluation. For this reason firms do not try to account as accurately or precisely for the value of patents when they put them on their books as they do, for example, when they attempt to value inventories, where they can look to the market and find current market values. Indeed, we found in our interviews they do not try to value patents in the way that, for example, they value other capital assets such as plant and equipment, where at least they have historical costs.

And then a final problem connected with this project insofar as it is concerned with the patent *system* as distinct, let us say, from all of the live patents, is that many attributes of the system clearly are not measurable in economic terms. There is the desire for fame, the creative spark, much of which I think you would agree lies outside the realm of economic motivation. In this sense I would say evaluating the patent system is very much like trying to evaluate certain parts of the Constitution, or to place an economic value on George Washington University or, since I went to Harvard and teach at Princeton, perhaps I should add Yale. [Laughter]

Nevertheless, a first approximation to the value of the patent system could certainly

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[1]The presentation of Dr. Markham and Mr. Worley is based on a research project report published in the first issue of *The Patent, Trade-Mark, and Copyright Journal of Research and Education.* A copy of the published report was furnished the discussants.

be made if two very vital relationships could be statistically established. The first of these would be the relationship between national income and technological change. There have been a good number of studies done on this particular project. We're not quite satisfied with them. But, in any case, this is a relationship that surely would have to be established before one could get at the value of the patent system via this route. But we would need also to establish a second relationship, namely, that between technological change and the patent system. If by some means one could establish both of these relationships, we would then have a first approximation to the value of the patent system in terms of what it contributes to the national income, which is, after all, about the best index we have of the national welfare of the people of the United States.

Most of the measures contemplated in this project hang in one way or another on the establishment of these particular relationships. Mr. Worley, who spent most of his time on this particular aspect of the problem is going to discuss it in some detail. It is one of the four basic approaches to the problem this report develops and it's clearly one of the most important.

I have tried to outline the basic research problems rather than to give a summary of everything our report contains. However, because the relationship between the patent system and the national income is so basic to quantitative evaluation of the patent system Mr. Worley will deal with it in some detail. As I have said, he put in most of the blood, sweat and tears on this particular section of the report. Mr. Worley.

MR. JAMES S. WORLEY: Thank you, Professor Markham.

As Professor Markham pointed out, probably the ultimate goal of any attempt to measure the value of the patent system would be to relate it in some way to technological change. And he has pointed out that there are two things that need to be established. I would like to discuss some of the difficulties involved in trying to make a connection at either link, and this will indicate why we do not view with great favor attempts to make highly generalized, or aggregated, measures of the value of the patent system.

The most commonly used measure of technological change is a productivity index, and very frequently the particular factor selected is labor, labor being a universally used input.

Now, it is clear that labor productivity indexes do contain elements of technological change, but it is also clear that they contain other elements than those due to technological forces, and, in addition, labor productivity indexes exclude some rather important forces of technological change. I would like to elaborate on these points briefly and then go to the problem of trying to establish a relationship between patents and such an index.

Labor productivity may vary for reasons not due to technological change. For example, if, because of the circumstances that a particular firm or industry finds itself in, it increases its output from something less than full capacity to full capacity, it's quite likely that the productivity ratio will increase or at least change. This will be reflected in a labor productivity index. And yet in no sense can we say that this is due to technological change.

Also, the firms in a given industry may grow at different rates, and labor may move from one firm to another, say from a less efficient to a more efficient firm. And the labor productivity index will reflect this, yet this is not technological change.

There may be inter-industry movement of labor which will be reflected in the index, but once again is not due to the forces of technological change.

In our report we have quoted about six different ways in which a labor productivity index may vary, of which only one is associated with technological change.

It is well known that labor productivity indexes have a bias in that they do not represent new products adequately. This is somewhat akin to the cost-of-living problem. The Bureau of Labor Statistics used to speak of the cost-of-living index, but they had difficulty keeping up with the new products being developed and entering into consumers' budgets, so as a result I believe they now speak of the consumer price index instead of the cost-of-living index, because we are not sure that we really measure cost of living with it.

Well, in a similar way, we're not sure that we adequately represent new products in a labor productivity index, and yet there is every reason to believe that new products are an important ingredient of technological change.

There are statistical techniques that can be applied to improve the usefulness of a labor productivity index. But in the report we show that, despite these techniques, a labor productivity index is still inadequate though perhaps the best measure that we have.

There is, for our purposes, the more important problem of trying to relate patents to an index of technological change. Now, the most obvious choice is to seek to establish some sort of correlation between statistics of patents issued or patents applied for and a labor productivity index. This, however, raises some very serious problems, so great that we have concluded on a negative vein in this section.

In the first place, the numbers of patents issued or patents applied for are in a very real sense "rubber" indexes, because individual patents differ in the degree of their significance, in the degree of the complexity involved, and, therefore, they may very well differ in terms of the amount of research and development effort or social significance or whatever other measure you choose to apply to them than numbers alone.

There is another problem. We know now that the trend of patenting is down. Does this imply that invention is declining? The rather amazing growth in industrial research expenditures—I think we have computed that since 1930 research expenditures by industry have risen proportionately some five times more than the rise in national product—does not suggest that invention is declining. So there are certain inferences that you can draw from that:

One, is it possible that each patent today is on the average more complex, involving more research and development effort? If so, we need to know this before we try to establish a relationship between patents and technological change.

Another inference: Is it possible that corporations are patenting proportionately less inventions than before?

Well, you can see that one would have to get into this area and investigate it before going beyond, and to investigate this area would inevitably lead to the level of the individual firm and industry.

Despite the ambiguity of patents issued or patents applied for, there is the further danger that if you try to correlate patents with technological change you may be assuming what you set out to prove, namely, the casual relationship between patents and technological change. It's not enough to know that patents and technological change move together, for example, because this does not necessarily signify a casual relationship.

And so for these reasons—and we have some more in the report[2]—we at the moment do not recommend the development of measures of this sort.

We have considered other aggregate measures—one of which appears in the report, some others which did not appear—and these measures are even less promising.

But, of course, it's easier to state what you can't do than to state what you can do. So what are some of the more positive recommendations and findings that we have stated in our report?

It appears to us that promising approaches to the measurement of the value of the patent system must be directed to the impact of patents on particular firms, since in our economy the firm is the unit of action. Now, the patent system functions by affecting expectations of profitability from undertaking research and development effort and innovative effort as well. Therefore, we need to develop information on the way in which the patent system affects particular firms and particular industries.

It's likely that the patent system has a different impact, and perhaps in a different degree, on different firms or different industries. Some of the discussion yesterday indicated that this may be so. And various industry studies also indicate this. So it would be worthwhile to consider approaches which would shed some light on the strength of the patent system with respect to individual firms and industries and perhaps to shed some light on the difference in the degree of effect.

This sort of approach would at least give a gross index of the casual role of the patent system. That is why we have suggested in the study that questions be asked concerning the proportion of research expenditures or perhaps the proportion of sales that are involved in some way with patents.

One can say at least that if patents are involved they perform some causal role. The degree of causation will vary. But at least you come out with a gross index of the causal role of the patent system.

These measures also circumvent the problem associated with dealing with individual patents. But, more importantly, they may serve also to specify those firms or industries in which more intensive studies would be quite fruitful and provide rather sizable returns.

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[2]*Supra* note 1.

In the preliminary stages of our study, we made a survey of existing literature, textbooks, periodicals, and so forth, in economics and the other social sciences, and from our examinations we can concur very heartily with Professor Kahn's remark yesterday that there is a dearth of empirically-based material on the patent system. However, there are a number of industry studies at present which do consider to some extent the role of the patent system in particular firms and particular industries.

We selected three of those in the study and summarized them as a means of showing the type of information that might be developed, and we feel that, if other studies more specifically directed to the role of patents could be undertaken, even greater returns could flow from them.

So it's heartening to see that this Foundation is sponsoring studies such as those mentioned yesterday in connection with the creation and growth of small units, because it seems to us that this is the type of information that must necessarily be developed.

In closing, I think I would like to make three general comments that summarize in a broad sense our study.

First of all, we do not at the present view the prospect of developing highly general or aggregated measures with great favor.

Secondly, we feel that we cannot rely on existing data but that instead the data must be developed.

Finally, we feel that the data so developed would not only be intrinsically interesting but might also serve as the basis for making more general estimates at some later date.

Thank you. [Applause]

DIRECTOR COLCLOUGH: As I listened to Mr. Worley, I could not help thinking of the number of times we say to ourselves in the Foundation's work how interestingly the various projects become integrated. As you will find in the *Journal,* in our discussion of this integration problem, the bringing together of the staff for discussions of their respective projects is one of the strength elements. As you just heard Mr. Worley say, the small business unit project and this project have a definite common denominator and community of interest. That is so to varying degrees with practically all of the projects.

I only emphasize this point because I think it's well for us to remember that these projects of ours cannot be treated as separate and distinct. I believe you would expect that, of course. I am merely affirming that we find it so. Each one bears a relation to the other. And, therefore, we have to look upon our research as a whole. It revolves around the patent system, which is a whole.

Now, we are privileged this morning to have a distinguished panel of discussants with respect to this project. The first member of the panel whom it is my privilege to introduce is Dr. Gerhard Colm. He was a lecturer and associate professor in economics at Kiel University from 1927 to 1932, and during the same period staff member and chief of business cycle research at the Institute of World Economics at Kiel. He was professor of economics of the graduate faculty of the New School for Social Research from 1933 to 1939. He has had extensive service in the Federal government, in the Commerce Department, the Budget Bureau, the Council of Economic Advisors, for some 13 years.

He is at present chief economist of the National Planning Association and a member of the teaching staff of The George Washington University. He has published such significant contributions to the field as the *Essays in Public Finance and Fiscal Policy,* 1955, *Economic Consequences of Recent American Tax Policies,* 1938, and others.

Dr. Colm.

DISCUSSION

DR. GERHARD COLM: Thank you, Dean.

I don't know anything about patents. The reason why Mr. Harris could talk me into joining this panel was the following: He said this project is concerned with studying the relationship of patents to national income and national wealth. Now, I'm a student of these topics, and I never knew how to handle patents and similar intangible assets in these national accounts. I thought if these people know how to do it, then I want to come and learn and possibly criticize their method.

Now, I'm somewhat trapped because they have reached exactly the same conclusion I reached—a negative conclusion—and I have nothing to criticize. [Laughter]

But I think if a study clearly sets forth its negative conclusions, than I know I have to deal with intellectual integrity, and that I respect. It's much nicer to put forward spectacular findings. However you say, "We have tried this, and we have tried that, but we didn't get any results." Nevertheless, I believe this study is right. And Mr. Worley has emphasized that he did reach some positive conclusions. Let me make just a few very brief remarks with respect to these various attempts.

When I read the study I found a sentence right at the beginning which says that it's surely worthwhile to attempt to measure the value of the patent system. That sentence is, however, not really elaborated in the study. I would like to know what that statement means.

Now, I'll tell you what perhaps might have been in the back of the minds of the authors, although this particular point has not been stated clearly. There are those who believe that the patent system is geared to conditions in existence when it was created about 120 years ago and that it was designed to provide maximum incentive and protection to the lone inventor who tinkered in his basement or barn; these people think then that today, where most technological advances originate in organized research work of public and private laboratories, that this system does not really meet the requirements of large-scale and small-scale, but organized, research.

I have the impression that the authors started their project seeking a method by which they could with mathematical certainty answer those who believe that the patent system is obsolete.

Now, I think they have failed to prove that, but that failure doesn't mean at all that therefore the patent system is obsolete. This would be like somebody undertakes to measure mathematically the beauty of a lady, and since he can't find the right mathematical formula he reaches the conclusion that there is no beauty. So I think we have to recognize that very often the most important things in life—I regard that as at least one of the more important things in life—[laughter]—cannot be measured. That we can't measure the value of the patent system as an aggregate does not mean that there's no value in it.

Now, the authors don't give up, and they come to the second approach, on which Mr. Worley elaborated today, namely, the relationship of national income to technological change. I think this is a very important aspect. We are always measuring, as economists, the relation of the national product to gross investment. And that we relate to economic growth in comparisons between various countries. We say that the higher that ratio of total product to investment is, the more a nation contributes to its economic growth.

While that is an important aspect, it is not the whole story. Last year we spent in the United States about $8 billion for research and economic development, half of which was public money, half private, approximately. Now, I believe that the investment in research adds as much to growth as anything we produce in iron, steel, and concrete. So this is an extremely important aspect, also with respect to international comparisons particularly at a time of "competitive co-existence" of various economic systems.

A difficulty arises when the authors relate technology to the subject under discussion, namely, to the patent system. Mr. Worley has pointed out that we have increased the research expenditures by industry fivefold over a few years. Has the significance of the patent system increased correspondingly?

In 1950 we spent one billion for private research. Now it's four billion.

In 1950 we had 3,300 commercial laboratories. In 1955, the latest figure I have, it is 5,300.

In these laboratories we had in 1950, 70,000 professional research people. There are more than 140,000 now (1955). And this excludes all university and government laboratories. That's just commercial.

But at the same time, during those five years, patent applications have increased by only 10 per cent, and patents issued have very substantially declined—apparently backlog and other factors.

So, on an over-all basis, it is not possible to establish a correlation between the rise in research activity and the contribution to technological knowledge on the one hand, and what happens with respect to patents, on the other.

I agree entirely here with the authors that the way to analyze the changes in that relationship is by industrial case studies. These over-all figures are meaningless unless you come down to cases. I was glad that Mr. Worley today emphasized somewhat less than in the study the interviews and mail questionnaires. If he had emphasized them much as a tool of research, I would have made the point which I'm now only alluding to, namely, that the questions which were used in the pilot study are more suitable for getting opinions rather than facts.

Some experiments have been made with asking people whether they like taxes. They were not asked quite like that. They were asked, "Do taxes impede economic progress?" or something like that. And, strangely enough, most of the answers were, "Yes, they do impede." As a matter of fact, our tax system provides a subsidy and incentive for organized research, because with 52 per cent corporate taxes and research activities tax deductible the government pays about one-half of these outlays.

Now, my time is up. Let me mention one last point which is made in the study but was not mentioned in the summary today. There is a very interesting aspect which deserves in my judgment special attention and adds to the importance of this project.

When I went through the list of the authorities who are connected with this Foundation either on the research staff or the Advisory Council, I ran across the names of Vannevar Bush and George Frost. Now, it happened that, looking through the reports written for one of the Congressional committees, I found two reports, one by Vannevar Bush and one by George Frost. Vannevar Bush makes a point not quite as extreme as what I said in introducing my remarks, but he does say that the patent system as we have it today is geared to an entirely different kind of invention activity and should be revised—not very drastically, but substantially in many respects. He has in his report a long list of proposals for legislative changes.

Mr. Frost in his submission says something like this, "Well, somehow or other, the patent system in its real life has been adaptable, has adapated itself to these changes, and it works very well, by and large, and you'd better leave it alone. You don't need to make any changes."

So I would say that any statistical study of various industries should have this particular aspect: What can we learn—that is the last point in the report which I emphasize very much—what can we learn from statistical analysis with respect to the actual or alleged deficiencies of the patent system? I mean such questions as cross-licensing and to what extent it is used for keeping progress within a family of four or five and not letting the outsiders get in. And what is the significance of the particular 17 years as contrasted with any other figure? I think specific statistical studies can make a real contribution with respect to many of these problems, which are under legislative review.

After all, in art, I believe in art for art's sake. When it comes to measurement I don't believe in measurement for measurement's sake. I was very glad that the authors of this report also step by step asked the question: What is this good for?

Thank you. [Applause]

DIRECTOR COLCLOUGH: Thank you, Doctor.

Our next discussant received his doctorate at the University of Califorinia and is presently on leave from Washington State College where he is associate professor of economics and now serving as a research associate for the Brookings Institution, working on a series of case studies on pricing policies and practices of large industrial organizations.

He is a publisher of books and articles generally in the fields of industrial organizations, trust policy and price theory.

Dr. Lanzillotti.

DR. ROBERT F. LANZILLOTTI: Thank you, Dean Colclough.

Having heard the earlier papers presented here, I'm afraid that in some of the remarks that I'll make here you people may suspect that there is a little bit of collusion among the economists present. Let me assure you that, while it is a temptation to contact other discussants on a panel, in this case I did not do so.

It would seem to me at the outset that in attempting to appraise the value of the American patent system that it is important to recognize and consider the nature and the impact of all facets of the system—the Federal statutes under which the system operates, the procedures for patent application, the decisions of the Patent Office examiners, and the decisions of the Appeals Courts as well as the Supreme Court.

Over the years we have all observed criticisms of various aspects of the patent system by natural scientists, political scientists, economists, lawyers, and sociologists.

The complaints usually range from a concern over "the distortion of the original purposes of the patent right," pleas for less directed and more basic research, and criticism of large-scale corporate research and the professional "science for sale" types of institutes, to a fear of the "eclipse" of the independent inventor who allegedly "has lost incentive with the advance of the corporation laboratory," concern over the steady weakening of patent protection, and criticisms of the so-called judicial confusion, which is said to have prompted the late Justice Jackson's comment in a dissenting opinion to the effect that "the only patent that is a valid one is one which this Court has not been able to get its hands on."[3]

That the economist finds unpalatable the grant of a patent monopoly to a large corporation already enjoying other monopolistic powers, that the sociologist deplores the disappearance of the independent inventor or his replacement by a salaried professional researcher, that the patent lawyer blames the courts for the uncertain value of patents, and so on, reflects the increasing need, which the authors emphasized, to reappraise the patent system's objectives and its functioning in today's economy.

In the efforts of Dr. Markham and his associates to marshal economic logic toward this end, I believe they have undertaken a very difficult assignment and have provided some very valuable insights into the most fruitful approaches for appraising the value of the system.

They reject as not very promising, and justifiably I believe, various quantitative approaches to the problem on the grounds that essentially non-quantifiable considerations are involved—such things as expectations, incentives, urge to create, a desire to patent and to add to the stock of knowledge.

The authors suggest as an alternative approach one which, "while still based on

[3]Jungerson v. Ostby and Barton Co., 335 U.S. 560, 572, (1949).

the assumption that the system is socially desirable, does not require the determination of the effectiveness of the economic incentive which it offers." Further, whatever amount of incentive is afforded by the patent system and however effective it may be in stimulating technological progress, they would have us view the issue in terms of this question: "Is the incentive provided in the best possible manner?" That is, *how well* the patent system affords the economic incentive, rather than *how much* incentive is afforded. Thus, they have reduced the problem, in my estimation, to the one major question: How efficiently is the incentive motive of the patent system functioning?

This, in turn, poses a number of collateral questions, such as the probable impact of modification of the 17-year monopoly grant in accordance with usage and type of innovation, the desirability of outright compulsory licensing, the improvement of Patent Office procedures, and the requisite criteria for entitlement to a patent. Conceptually, this approach strikes me as sound. Operationally, I am sure it would inevitably lead to many political and economic difficulties from a standpoint of putting it into effect.

The need cited by the authors for extended empirical research has been reiterated here many times, and I would just like to add my comment to the effect that it does reflect indeed the dearth of empirical materials on the role of the patent system as well as many other questions of economics on which we would like to have more data. The findings of their own exploratory interviews with company managements disclose the difficulties associated with the attempts to measure the value of the system as a stimulant to industrial research and invention.

I have been working on a study at Brookings Institution which is focused on pricing policies and practices involving extensive interviews with corporate managements. Inevitably we got into questions of patents and patent policy whenever we were discussing prices and price policies. In general, our findings would tend to confirm the exploratory interviews of Dr. Markham and associates, namely, that the patent system plays a significant role in industry. Our information likewise indicated that there is a great range and variation in the impact of the patent system on company motivation, on policies, and on investment decisions.

Virtually all of the companies with which I conducted interviews indicated the necessity of engaging in continuing research and development. Findings run somewhere about one per cent to two per cent of sales. Not much basic research was involved; most research was narrowly circumscribed to a particular area of company specialization.

Also, there was no general uniformity on patent policy. Some companies followed a general policy to take out patents for almost anything that was invented for the company's own protection. Some engaged in industry patent pools as a matter of policy, or they had automatic cross-licensing arrangements. Others did not patent items which, while having definite value, they felt they could keep under wraps, having chosen this means to avoid disclosure of something they had developed. Still others preferred to make developments generally available and only rarely sought a patent grant.

While no sweeping generalizations would be justified from this study regarding the relationship between incentives and patents (inasmuch as it was directed primarily toward other aspects), the management officials interviewed did indicate that pricing decisions, investment decisions, and patents were closely interrelated and that quite distinct investment and pricing decisions were pursued where a patent was held by the company.

In this connection, the theoretical framework of the authors' alternative approach might be spelled out in somewhat greater detail. For example, apropos the questions posed in the interest of developing an operational theory to evaluate the efficiency of the system, there is the general question implicit throughout: Is the patent system in its present form necessary as an *insulation* for firms against infringement by unlicensed competitors?

Since research and invention, as we have heard repeatedly here, have become increasingly routinized under the auspices of large corporations to the point where the corporate sector of the economy is now the dominant source of invention, we cannot avoid facing squarely the question raised by Wilcox and others as to whether the function of the patent system has changed from the stimulation of invention to the promotion of corporate research and development. Having taken on a new and different rationale, should not the role of patents and the appropriate criteria for patent qualification be subjected to a thorough reexamination?

In order to answer such questions, I believe we should not consider the incentive to do research, to invest, to innovate in a vacuum. Rather, I believe that this incentive is part of over-all market strategy of the firm in which market structure considerations are carefully weighed by the decision-making units of management along with other factors.

In an atomistic type of economy, monopoly grants to individuals and firms could well be justified as a necessary and proper stimulation to invention, to innovation, and to progress. In the Schumpeterian vein, these monopoly grants no doubt increased the incentives of individuals and firms to engage in research. But the insulation and protection afforded by patents was in the context of an economy in which firms had little or no insulation from competition and imitation.

Today, with a structure of industrial enterprise generally regarded as imperfectly competitive, or monopolistic—depending upon the emphasis one wishes to give—it can be argued that firms appear to have generally recognized that certain kinds of competitive behavior are frowned upon while others are fair game. Price competition, price cutting, special discounting, and so forth, are examples of the former and, although sometimes more honored in the breach, are generally taboo among manufacturers.

Following this logic, firms have been pursuing a market strategy of channeling their competitive efforts largely into technological competition via cost-saving processes and product improvement. Theoretical treatises and empirical studies leave little doubt that these drives receive major emphasis in industry today.

This brings us once again to the question: Within this type of industrial framework which I have briefly sketched, wherein a certain degree of insulation already exists and where firms evidently have great incentives to "steal a march" on competitors via product development, more efficient processes, and novel products, is the patent system in its present form needed to stimulate such incentives, and, if so, what changes can be made to prevent such abuses as suppression of inventions and the monopolization of certain product areas around basic patent grants? Should the courts insist more firmly than ever before on Justice Black's criterion mentioned in the famous A. & P. case[4] regarding a supermarket check-out counter, I believe, that "The invention to justify a patent had to serve the ends of science—to push back the frontiers of chemistry, physics, and the like: to make a distinctive contribution to scientific knowledge?"

To raise these questions is not to gainsay the contribution of the patent system to technological progress, despite the abuses which have prevailed. But neither should we close our eyes to the desirability of making changes in the system, which would be conducive to even greater progress.

In the interest of helping to simplify and expedite patent procedures, without impairment to incentives, perhaps it would be useful to explore the feasibility of a more flexible system following the lines of the authors. In this vein, I believe, the German prewar patent system might be worth exploring in terms of the arrangement under which an inventor made the choice as to whether he wished to qualify for a seven-year grant with less stringent conditions, or for the 17-year grant under which he assumed the burden of proof against the "lack of invention" criterion.

The general approach suggested by the authors for uncovering handles to help answer these and related questions represents in my view an important step forward in understanding the functioning of the patent system and in helping to make it a more efficient institution for servicing the needs of the economy and society.

Thank you. [Applause]

DIRECTOR COLCLOUGH: The third and final discussant has been very active in the Foundation, having attended its meetings of the Advisory Council and having made a great contribution to it. He is an engineer graduate of the Massachusetts Institute of Technology, a graduate in law from New York University, and is now secretary of the Esso Research and Engineering Company.

Mr. Philip L. Young.

MR. PHILIP L. YOUNG: Thank you, Mr. Moderator.

Ladies and Gentlemen: As the only legal rose in this array of economic thorns—[laughter]—I suspect maybe I was put on here for a little comic relief. But, in any case, I'm going to avail myself of the old gag of "being reminded of a story." It's about a patent attorney, so it has some logical relation to this thing.

It seems that one day the local bar association got a call and some man wanted to know if they could recommend some patent attorneys. And so they said, "Oh, yes," they could.

[4]Great Atlantic & Pacific Tea Co. v. Supermarket Equipment Corp., 340 U.S. 149, 154 (1950).

Well, it seems that he wanted a one-armed patent attorney. He said, "I want a one-armed patent attorney."

"Well," they said, "we don't have that. We have them by their names, by their specialties, and so forth, but a one-armed patent attorney we just don't know. Why do you want one?"

"Well," he said, "the ones we've had have always said 'on the one hand this, and on the other hand this.' Now," he said, "if he only had one hand we think we could follow his advice." [Laughter]

When I first heard of this project, namely, to really put a value on the American patent system, I was delighted with the idea. But, as I say, I'm no economist, and I haven't the slightest idea how it could possibly be done. I saw lots of difficulties, but I never doubted that an attempt would be of value.

After reading this paper,[5] I'm still enthusiastic about it and full of admiration particularly for the very many methods that have been proposed. It's true the authors have examined one after the other and most of them have been discarded either as unfruitful or unproductive, either permanently or at least for the time being. But I believe that this study has been eminently worthwhile.

Now, with all of this economic discussion, I think I might translate it, gentlemen, in this way: I conclude that at least for the present the authors do not think it's possible to put a dollars-and-cents value on the patent system. And it's no more measurable, as they say, than the color of a sunset or of the last theme in a Beethoven concerto. It cannot be measured at the present time by any of these methods.

In reading the paper, however, I was reassured that the patent system does have value, and to all of you I'm sure that that must be heartening. I have spent most of my working life in the patent system, and I'm glad to see it wasn't entirely wasted, and I suppose most of you feel the same way.

I might think it might be productive in the future if the emphasis were shifted from a single value to the values of the patent system. I think it has a great many values, and I conclude that one of the chief troubles in this is finding a common denominator for the values, and, of course, the debits, so that we can't get a single value. But, nevertheless, there could be developed the various values that the patent system does have, and I hope that it will be done.

Perhaps all of these can't be reduced to a common denominator, but in the future that might be done sometime, and if it is, then we would have truly a single value for the system.

Now, the authors have concluded to approach the problem of the values of the patent system by questionnaires to various firms. I'm confident myself that they will find that in the opinion of most people it does have a value and that they will find also that that value is in direct proportion to the use made by these various firms. I think they will find that those who use the system value it and those who don't use it should be induced to use it so as to make their contribution not only to their own values but to the value of the system as a whole.

[5] *Supra* note 1.

Such a study of these questionnaires will bring up clearly the various values of the system and will show the influence of the separate factors in the patent system, such as the debits and the values that are apparent to inventors as to what the separate values of these things are, and that should be a great help in revising the patent system.

It might be worthwhile to see for a minute what value this report has as it stands. Well, I don't believe that any industrial firm can really use the report just as it is. I doubt that we can get any direct benefit from it right now. But it has swept away a lot of unproductive and probably misleading approaches to the value of the system, and I would very much oppose a discontinuance of studies along this same line.

This is the first time that the value of the patent system has ever been really put to a test, and with the facilities and the entire lack of bias that these gentlemen have shown, and I think a continuation should be made.

There are several things that the continued study might do. It might convince those who make the decisions in our industrial world that the system has a value at least for them, and I believe if they use it it will have a value to all of us, inducing them to use it more freely than they do at the present time. It would also give us a weapon against the many attacks on the patent system by those who are trying to pervert it and destroy it.

Third, it's quite possible that a study itself would bring forth some valuable changes in the system that we have. And it might even direct a technique which would be of use to our lawmakers in deciding between the good proposals and the bad ones. There are many proposals which are just on an opinion level. Some people like them; some people don't. It's surprising how much controversy there is in the patent bar over proposed changes in the system. I hope that some new technique may be designed to weigh clearly the advantages and disadvantages of new proposals so that it may be applied by the legislators.

Thank you. [Applause]

DIRECTOR COLCLOUGH: Thank you, Mr. Young.

Quite a number of questions have been presented, and some of them are rather long. Consequently, I have handed them to the discussants in order that they might read them in advance.

While they are looking at them, I was going to ask Dr. Markham if he would like to comment on the remarks of the discussants.

DR. MARKHAM: Thank you, Dean.

Well, Mr. Worley and I up to now have been singing a non-overlapping duet, so I think we will proceed along those lines.

I'd like to take up Dr. Colm's comment and elaborate on the usefulness of measuring the patent system. It seems to me that one cannot help but be impressed with the two bodies of literature in the general field of patents. On the one hand, there is a body of literature that more or less equates the patent system with institutions at least on par with motherhood. On the other hand, there is a body of literature which more or less regards the patent system as a device for redistributing the income in favor of huge corporations.

It seems to me it's worthwhile to document the fact that neither of these bodies of literature are empirically based. A study such as this may enable the reading public to question critically extreme viewpoints on the patent system. That is, a reliable conclusion that there is no way one can empirically document the fact that the patent system is either altogether evil or that it is, as I have said, something tantamount to the institution of motherhood, lends objectivity to exploration into the general area of patents.

I should like to say to Dr. Colm that we didn't make this observation in our study because it looked self-serving, but just among us here today we don't mind confessing our complete objectivity about all this.

As to Mr. Lanzillotti's comment on the observation made by Mr. Clair Wilcox—that is, that perhaps what is most important today is really an incentive for corporate research rather than an incentive to invent and therefore perhaps the patent system might be revised in the light of this shift in emphasis. We tackled this problem, and, to the extent that we could solve it, we reached the decision that this seems to be a distinction without any substantial difference.

What I mean to say is that if you go into the research laboratories of corporations and throw at them the words, say, "incentive for corporate research," they do not differentiate this from the "incentive to invent"—at least if you define invention rather broadly.

I don't believe that using different words automatically creates a new situation—that is, that the difference between the incentive for corporate research and the incentive to invent is quite as great as the simple statement that they differ would seem to imply.

Another comment made by Professor Lanzillotti—that is, that he thought perhaps the study might have inquired into the area of patent abuses. This has been fairly well documented elsewhere, and we regarded our study more or less as a methodological study. Patent abuses as such are essentially an administrative problem. It is not, in the last analysis, a problem in methodology.

Finally, I can't help but add this one note: If I could have thought of the greatest plaudit that could ever have been given this particular piece of research, it would have been that of drawing some analogy between it and a Beethoven concerto. I therefore thank Mr. Young very much for his final comment. [Laughter and applause]

DIRECTOR COLCLOUGH: Now, I'm going to ask the discussants to whom I have given the questions if they will take all the questions addressed to them at one standing. And will they please read them for the benefit of the listeners before answering them.

Mr. Worley.

MR. WORLEY: I have a question from Mr. Ball. "Are you looking at changes in technological output in countries which have adopted patent systems after being without them?"

This gives me an opportunity to tell a joke too. Our study is somewhat like an iceberg, in that only a portion of it appears, and there is a lot of material that we did investigate that does not appear in the study. I hope, however, that it does not fit the definition of an iceberg that I once heard—as a "big block of ice with one-third of its bulk above water, two-thirds below water, and completely at sea." [Laughter]

Yes, we investigated the possibility of making some comparisons between United States performance and performance in other countries which have either temporarily gone without a patent system or adopted one later. But we found, or at least it was our belief that there was a great time dimension problem. That is, you would have to go far back in time in many cases, in which the economic conditions were so different that we were not sure that it would have any current usefulness.

And, furthermore, there is always the possibility that one nation even without a patent system may not be completely insulated from the effects of patent systems in other countries.

So in order to make a good comparison, it would seem to us that you would have to look for an insulated economy—that is, a closed economy, not dependent on foreign trade, and one roughly in the twentieth century—and we could not find one. So we abandoned that approach.

Another question: "I suggest that a measure of the broad social value of the patent system may arise from the inventive activity of Company A in seeking to avoid use of—that is, design around—patents of Company B. Do you have any thoughts on how to measure such activity?"

We have some thoughts. We don't know how you could quantify it. We were very much impressed in our interviews with this type of stimulation that the patent system apparently gives to different companies, and we do devote some space to that in the summary of the interview material, suggesting that there is a very definite value of the patent system in stimulating competition in research.

This question has been considered by others. Rupert Maclaurin in his study of the radio and television industry regards this as a very highly important aspect of the patent system, and he thinks that it exerted very significant influences on the development of the radio and television industry.

I think that this needs to be considered. I'm not sure how it could be quantified. But I don't think it needs to be quantified. I think it can be pointed out and documented in many, many cases.

The final question I have: "I would suppose that the present study intended to clarify the value of the patent system to our social and economic system as a whole. Do you expect that a study of the value of patents to particular patent owners—that is, individual firms—will be revealing in that connection?"

Yes, we do. It's an indirect connection, of course. We did consider the direct relationship such as the relation of patents to national wealth, the relation of patents to technological change. These relationships would be more ideal, but we don't think you can do it, so we do state that you need to get down to the level of the firm.

Now, it would seem that if the patent is valuable to the firm it is because it's important in the firm's operations. And the profitability of the firm depends upon the wishes of those people who trade with the firm. So in that connection we think if you focus on the firm you can then reason from the firm to the market, and this reduces the problem of numbers somewhat. It would be very much more difficult to go to consumers, for example, and find out about the value of the patent system in any quantifiable sense.

DIRECTOR COLCLOUGH: Dr. Lanzillotti, are you ready to diagnose that question of suppression?

DR. LANZILLOTTI: I have two questions here. One is: "How can you make a significant distinction between individual invention and corporate research? Are these not merely different names for sources of patentable inventions?"

Well, I think the last part of it is definitely correct. These are different names for *sources* of patentable inventions. But, as the authors have indicated, there is an important distinction to be made here between research and invention conducted under the auspices of a corporation and that done by an individual in his own right where he is patenting for his own rewards rather than as an employee of a corporation.

I think that we have all been impressed with the fact that the bulk of inventions —I believe the figure 60 per cent is mentioned in the study—is attributable to corporations, that is, patents which have been assigned to corporations.

We do not know enough about this question really, that is, we do not have enough detail on it. The matter is related to the second question, which reads as follows:

"Do you know of an example of suppression of invention by use of patents which you can cite?"

As Dr. Markham mentioned just a moment ago, the question of patent suppression and abuses has been well documented elsewhere. It does raise this additional question, however, and which I believe may be behind the question which was sent up here: Do we really know enough about suppression? What do we mean by suppression? Do we mean suppression of invention? Suppression of ideas? Suppression of developments?

I don't think we have enough information on this, but we do have to bear in mind that in certain industries the withholding of some development may have very definite, measurable impact on that particular industry. The economy-wide effects may not be as apparent. But I do think we need to consider it in terms of the effects on the economic performance of particular industries.

I would say we need more study on this question of suppression, just what we mean by it, and its general economic impact. But there already have been a number of studies on abuses of the patent system which have well documented the use of the patent privilege as a device to control whole industries, to suppress competition, restrict output, enhance prices, to suppress inventions, and discourage inventiveness. (See especially testimony before T.N.E.C.).

DIRECTOR COLCLOUGH: Thank you.

Dr. Colm, please.

DR. COLM: I have two questions, and if I am permitted, Mr. Chairman, I'd like to add to those two one myself.

One question is very long and very important. By the end of reading it I hope I know how to answer. I still don't know. Mr. Whitney asks:

"When a corporation feels that the government will pay 52 per cent of its research costs"—I knew I was getting into something; I shouldn't have said it—[laughter]—"does it forget that government will take 52 per cent of the resulting profit?

"If the government encourages research by its threat to take 52 per cent of the income not thus spent, isn't it similarly encouraging or subsidizing every other expenditure, whether prudent or wasteful?

"Doesn't the fact that the personal income tax forces a company to offer a higher return, in order to raise the same amount of money, make it harder to finance expansion, thus slowing down progress?

"P. S. The above does not mean that I oppose taxes."

That's Mr. Whitney talking.

Well, I am tempted to go into the details of this. This question is a little closer to my work than patents, so I'm in danger. However, I want to keep my answer short.

First, I say there's a lot of validity in this question, and I don't know the full answer. A high tax has both a discouraging effect and also a certain incentive effect if you have types of expenditures which are deductible. And it is not, a priori, certain whether the discouraging or the incentive effect is higher.

Of course, a 52 per cent tax also invites wasteful expenditures, because you share your waste with the government. But I don't think that many corporations just love to engage in waste for waste's sake. If you can make the same tax saving for something which adds to your intangible assets, I think you'd rather do that than waste the money.

So I'm assuming that the corporation finds an incentive to spend money on something which creates assets and gives them future returns, even though they know that on future returns also a 52 per cent tax has to be paid, than just to waste the money with no future returns, simply enjoying that the Treasury joins in the waste.

While both sides—the incentive and the disincentive side of taxes—have to be recognized, which I did not do in my short remark, I think the net result is an incentive to engage in research outlays.

As a matter of fact, there is the experience of the postwar period with the very high taxes and the tremendous increase in expenditures for research and development. If I jump to a causal conclusion from the simultaneous happening of two events, it suggests to me at least that the high taxes have not discouraged this particular type of productive spending.

The second question: "Might it be that the real value of the patent system resides in psychological factors such as incentive to invent or desire for personal prestige which can never be measured, like beauty?"

Well, when I made that argument and compared the patent system with beauty, I meant the patent system as a social and legal institution. I think that by and large a corporation incurs the expenditures for filing a patent and very often for litigation which is involved and all that not simply for prestige—I don't think our corporations are so irrational—perhaps this question has been written by a corporate executive, who would know better than I do —. Just whispering the question to my neighbor, Mr. Young, he said he had an answer, and I suggest, with the permission of the chairman, that he may add something to this.

But before doing that I would like to make a suggestion to Dr. Markham or Mr. Worley. It was said we should try to compare a situation without patents and a situation with patents. In that respect we have first, 25 years of experience without a patent system in the Netherlands. And, second, I wonder whether in the case studies, if you engage in further case studies, you shouldn't include a case study of the nuclear fuel industry. Here we have a case where under the 1946 Atomic Energy Act no patents were permitted, and under the 1954 Act patents are permitted. I wonder whether by studying the period before and after we cannot learn something?

I know, of course, the conclusions couldn't be generalized because there are very specific conditions in this industry because most of the research was done under government contract. So, in any case, in considering future case studies it might be worthwhile to look into that particular case of the nuclear fuel elements.

Thank you, Mr. Chairman.

DIRECTOR COLCLOUGH: Mr. Young.

MR. YOUNG: Dr. Colm simply asked me if I thought that a corporation would file a patent for prestige or just for the honor and glory of the affair. Well, the only answer I can think of are ones such as health, conservation and safety. Now, my company has filed those for a good many years, and we always turn them over, license them freely. So I think the only thing we really get out of it is prestige.

DIRECTOR COLCLOUGH: In connection with Dr. Colm's suggestion just then about the atomic energy field, we are happy to have that comment because Mr. Harris, Professor Oppenheim, and I have all been thinking about the atomic energy field as an area of investigation for the Foundation. We have attended the conferences under the Phoenix project of the University of Michigan. Quite frankly, as yet we have not found something to do in that field, in view of its peculiarities, which we think for the moment would be as fruitful as that to which we are now addressing ourselves. But we very definitely have our eyes open and are consulting people on the question of contributions we might make and lessons we might draw from a new field such as nuclear fuel.

We have managed to keep up with the fine example set by our moderator of yesterday, and, coming up to the hour of eleven, we shall terminate this discussion.

There is one more question from Judge Rich which I have been asked to answer. It's addressed to Dr. Markham, if I may read it:

"In throwing analogies around, may I suggest that it is not the patent system which is to be compared with the institution of motherhood but, rather, the phenomenon of making inventions. The patent system should be compared to the illusion known as 'falling in love.' " [Laughter]

The person to whom the question is addressed pleads *nolo contendere,* and I say, "Is there a doctor in the house?" [Laughter]

Gentlemen, may we take a brief five-minute recess?

[Whereupon, a short recess was taken.]

DIRECTOR COLCLOUGH: We now come to the last phase of the program, a series of brief progress reports on Foundation projects, and then, finally, a general discussion.

## BRIEF PROGRESS REPORTS ON FOUNDATION PROJECTS

In presenting to you the investigators on these projects on which progress reports are to be made, I would remind you that their present states of progress are such that progress reports are in order and, furthermore, that you will be hearing more from these gentlemen in the future. Hence a comprehensive report is not to be expected at this Conference.

The first project is that of the relation of American patents, trade-marks and techniques and American-owned foreign patents to foreign licensing. Its investigator is a professor of economics, formerly of Washington and Lee and now of the University of Delaware. He received his doctorate at Princeton University. He was research assistant in the International Labor Office in Montreal on postwar problems of the iron and steel industries. He taught at Davidson College, and was an instructor at Princeton. He is author and co-author of a number of books and articles. And, it doesn't say it here, but he is co-author of a recent very important volume in the field of international economics with Professor Wilson Schmidt of The George Washington University, a book only recently published and receiving wide acclaim.

Dr. Behrman.

### RELATION OF AMERICAN PATENTS, TRADE-MARKS AND TECHNIQUES AND AMERICAN-OWNED FOREIGN PATENTS TO FOREIGN LICENSING

DR. J. N. BEHRMAN: I would like to take the five minutes allotted to me to urge you first to read the report that is in the *Journal,* if you will, and use the rest of the time to put the project on foreign licensing in its particular setting within the Foundation's program.

As Dean Colclough mentioned yesterday, the patent system, based as it is on invention and private enterprise, reflects a given way of life which we in the United States have adopted. When you move into the international field, as foreign licensing does, you immediately raise the question of whether or not and how the American way of life may be adopted abroad.

We obviously feel that it is good. We also feel that it will profit others if they pursue the same sort of techniques.

I feel, and this is the reason why I accepted the assignment on the project, that the United States itself has a responsibility as a leader in economic growth, that its patent system, reflecting a resolution of problems through law, is something that we can help teach other countries. They themselves frequently do not have very refined patent systems. The protection which they afford our enterprise is not particularly great. At the same time, they can profit, and we can profit as a leader by extending to them proprietary rights under patents, trade-marks, and extending technical and managerial know-how.

This know-how is frequently transmitted through direct investment. Studies on investment have been made extensively, but very little has been done on the transmission of know-how or other proprietary rights. This is the purpose for our study.

Its appropriateness is signalled by the fact that licensing activity has expanded rapidly in the United States in the past 10 years. We have records of licensing over the past 40 or 50 years, but in the past 10 there has been a rapid expansion. As I have gone about talking with others concerning the project, spontaneous interest has arisen from various other organizations. I have received letters, for example, from the National Industrial Conference Board, from various United Nations agencies, from the International Management Association, Export Managers Club, and so on, all asking, "Where will the project's results be out? When can we hear from you?" I was really amazed to find such spontaneous interest.

Another justification for this project has arisen during my interviews with corporate officials; I began to find I was the recipient of questions rather than being the one to address them. They were asking me what I had already found, and I had only begun.

Finally, I found an almost complete lack of public information on the subject. This was why we have had to turn again to the interview method. To me this is one of the most signficant techniques which the Foundation is able to employ. As a private researcher myself, as a professor, I would not have doors open to me which the Foundation has been able to open through personal interview. Information of this sort is especially useful in providing empirical bases for judgments.

The basic problems which we have sought to investigate are motivational problems, No. 1. And here I found, very briefly, that the assumption of the economist that profit maximization is the businessman's prime motive is far too simple.

Legal aspects obviously are very important in the licensing field relating to exclusive provisions, to antitrust interpretation in various cases, and to the tax problem. These will be investigated in our report.

As a separate topic, we will consider the mechanism of the agreement. What are the ways in which businessmen have found it desirable or useful to transfer knowledge? How can they get protection? What are the various royalty provisions, et cetera?

Finally, how can we prove the value of licensing to various firms, and, ultimately, how do we know whether or not licensing or the transfer of know-how is useful both to the country of the licensee and to the country of the licensor? Now, this last is a problem which is broader than business policy and gets us into problems of balance of payments, economic growth, productivity, and, finally, into the problem of structure of industry and transfer of factors of production such as intellectual managerial know-how. All of these will be examined.

We hope to make available next year a fairly extensive report from the series of interviews and from our continuing investigation.

Thank you. [Applause]

DIRECTOR COLCLOUGH: The next member of our research staff on the program will give you progress reports on two projects—the "Public Attitudes Toward Patents, Trade-Marks, and Copyrights" being the first. You may recall my saying yesterday that one of the basic objectives of the Foundation is to bring the facts and an analysis of those facts before the American people, because our institutions in their final analysis should be, and I believe will be, what the American people want them to be. So this project was an obvious undertaking at the outset.

The other project concerns "Attitudes of American Inventors Toward Defense Invention." It was undertaken by the Foundation after being considered by the Advisory Council at the behest of the National Inventors Council. Its importance I believe is obvious from the title.

These two projects are directed by Professor Mosel of The George Washington University, an associate professor of industrial psychology. He received his education at Colgate and Columbia. He has been a consultant, and still is, in governmental agencies and services on a wide basis. He has had extensive experience abroad. He performed a very important research study for the United States Information Service in Thailand, and he is now the recipient of a Ford Foundation grant for further work in Thailand.

Professor Mosel.

## PUBLIC ATTITUDES TOWARD PATENTS, TRADE-MARKS, AND COPYRIGHTS

PROFESSOR JAMES N. MOSEL: The first project, "Public Attitudes Toward Patents, Trade-Marks, and Copyrights," has been undertaken for two reasons. The first is a very practical and pragmatic reason, namely, to provide guidance to the Foundation and other interested parties concerning the conduct of public information and public relations programs.

Obviously, one of the first prerequisites of such a program is to know something about the contour of public attitude and information. What are the kinds of ignorance, of misconception, and informational support? One thing we know about public attitudes is that they are dynamic affairs. Very often they operate in the absence of public information, and very often, whether public information is available or not, there are still attitudes.

The second major reason for undertaking this project is a little more scientific, a little more academic, and it's based on the notion that the patent system, as has been mentioned earlier today by Mr. Colm, is a social institution which exists in a climate of public opinion. The system is influenced by public opinion and also, in turn, modifies public opinion itself.

Part of our understanding of the patent system as a social institution must, therefore, take into consideration the interaction of the system of strategies which we call the patent system and public opinion in general.

This project was begun as a very modest preliminary study utilizing reasonably sophisticated groups of technically-trained students and recent graduates in the engineering and scientific fields. We have proceeded at first by means of extensive-depth interview with a somewhat guided questionnaire. Later it will be carried out as a questionnaire interview study using a larger and more representative cross-section of the general population in Washington and perhaps ultimately on other kinds of publics in other parts of the country.

Our objectives are to learn about the attitudes, the informational support which these attitudes have, and the mass media and personal media through which information on the patent system is communicated to people.

It's too early to give any decisive conclusions. I will give you just a few tidbits which seem to be implied by a qualitative analysis of the present data. Some of these will not surprise you.

The first may sound like a simple and obvious thing to say. But it has tremendous importance, more than my words can possibly imply. That finding is that for most people there are no attitudes toward the patent system. There is nevertheless a readiness to make judgments on the patent system.

In other words, if you go up to Henry Zilch and ask him questions about the patent system, he will give you answers—because it's part of American culture to give answers when you're asked questions. But he doesn't necessarily have much of what we call informational support. He doesn't know much, but he'll give you answers. And very frequently, I think, he would act on these answers if he were required to do so.

There are a small number of people in our sample who seem to have some informational support, and their attitudes do not seem to differ from those who lack informational support. In other words, whether you know anything doesn't make too much difference.

This is one rather cardinal finding. It puts a rather peculiar light upon the value of information in this area. We're not fully prepared to say what that value is. But one thing is very obvious, and this is my second point:

So far in terms of attitudes which can be said to exist it seems that the primary factor in the determination has not been the information conveyed by mass media, by radio, television, newspapers, magazines, journals, and so forth, memoranda. It seems to be determined more by the kind of people you associate with. If you know somebody who is in some way involved in the patent system, it seems that this acquaintance has far more significance for your attitude than what you read and hear through impersonal mass media. And the kind of influence which it has appears to be influenced by whether or not you identify with the person.

Say, for instance, that you know of an inventor who had an unfortunate experience with a patent. Assume also that you have the image that the inventor is a kind of a helpless creature, an idealist, and must be defended against the malevolence of plotting corporations. Under these circumstances you will have a somewhat critical attitude toward the patent system.

On the other hand, if you are a self-made man, a rugged individualist, and you hold this same image of the inventor, you would have no sympathies with such a disarmed inventor, and are likely to say, "Well, he got what was coming to him." Under these circumstances you will hold a different attitude on the patent system.

Identifications with the people who in some way or another have been exposed to the patent system seem to be, as far as we know, a very significant determiner of what kind of attitude people hold.

One last point. Persons who do not know anybody who has ever been involved directly or indirectly in the strategies of patenting, nevertheless have attitudes, or I might say judgments as a better word. In such cases their attitudes or judgments seem to be determined primarily by what other attitudes they hold in the social, political and economic spheres.

That is to say, a person may know nothing about the patent system, but if he holds certain political beliefs and holds certain economic premises and you sound out his attitudes on patents, he will resort to these other more generalized attitudes. He will bring them to bear upon the particular issue of patents, and give you an answer.

So what do we find? People don't know very much, but they still have attitudes, or at least they are able to make judgments, and these are determined by two things: what other attitudes they hold and what kind of people they have had contact with.

This means at this early stage that there is a tremendous opportunity for a systematic program to provide information and help formulate realistic, sound attitudes. The way it looks now, public attitudes are being determined by social happenstance—simply because there is no other means (such as systematic information) whereby attitudes can form.

If there's to be an enlightened public, if the patent system is to grow as a social institution with sound informational bases as presumed and required by the democratic process, then, obviously, there is great need for a sound program of public information.

### Attitudes of American Inventors Toward Defense Invention

The second project, "Attitudes of American Inventors Toward Defense Invention," might well be labeled "incentives and deterrents to inventing for national defense."

As has been previously said, this is conducted under agreement with the National Inventors Council. Its primary objective is to determine what are the incentives and deterrents on the part of individual inventors to produce inventions which have national defense implications.

One of the major problems here has been to define what we mean by "defense invention." There are two possible definitions, and we have adopted them both. The first involves the intention to produce a defense invention. The invention need not terminate as a defense invention. The second definition includes inventions which, regardless of initial intentions, end up as a defense invention. We have accepted both and are studying the incentives and deterrents which influence both.

The first work on this problem consisted of doing 29 rather intensive interviews using an interview guide. The interviews were with inventors chosen from a list provided to us by the National Inventors Council and the Patent Office. From this we developed a picture of the main determinants, and developed what we called an "accounting model," which identifies most of the variables which we ultimately will study more quantitatively.

On the basis of this model we developed a questionnaire used in 51 interviews to explore each of these factors that had been identified in the preliminary work.

The next phase has already been accomplished. This is the development of a questionnaire to be submitted by mail to a large sample of inventors, large enough to yield about 500 usable returns. It is from this group that the statistical analysis will take place and the major conclusions drawn.

In our approach we have chosen to study, on the basis of our accounting model, those factors which represent the chronology that an inventor goes through in producing a defense invention.

First of all, there is the process whereby he originates an invention which he perceives to have national defense implications. Here we must ask such questions as: What is his environment of work? Is he exposed to stimulation? Ideas? Is he aware of needs? Who are the people he's in touch with; who tells him about national defense needs? How does he make his decisions as to whether or not it would be profitable for him to work on an invention which has defense possibilities?

The second stage in the chronology is what the inventor does with his invention after he has developed it. This is a rather complicated series of decisions. We call it the "channeling" of the invention. He may take it to industry, or he may take it to a defense agency. We're interested in finding out what are the factors which influence this set of decisions. This involves very clearly an understanding of how he perceives each of the two possible channels, defense and industry, their relative merits, the ease of working with them, the dividends and returns, their availability, his knowledge about them. All these are determinants.

The third step in the chronology is the consequences, the "goodies" which might ensue from a choice of these channels. Here we must find out what he perceives these benefits and inconveniences to be, how he learns about them. Do they come to him by experience, or are they relayed to him by other people? What is the role of other individuals? What is the role of institutions and their organizations? All of these we're looking into.

At the present stage we are about ready to submit the mail questionnaire to the larger sample, and sometime during the fall we will have the returns. The final analysis of the data will be available toward the end of the fall and perhaps a little earlier.

You'll be hearing more on this project.

I think that it's perhaps unnecessary, but I'll do it anyway, to say a little bit about why this study is being done. As clearly stated in the *Journal* and as implied by the project itself, there is a general feeling that we must increase invention for national defense both in quality and in quantity. Now, whether or not these results will enable us to do that is another matter, but it will help provide some guides I think.

In conclusion I want to make this point very clear: We know this: why a man produces a defense invention can be explained by a lot of other factors apart from his own motivations, incentives, and deterrents. There are a lot of economic and social factors which are not individual "motivators" at all. If a man lives in Pennsylvania, the likelihood of producing a defense invention is greater than if he lives, let's say, in New Mexico, simply by virtue of his geographic position.

But we are not at this stage examining determinants resulting from the social or economic environment. We are examining those only which could be labeled individual motivational incentives or deterrents.

Thank you very much. [Applause]

DIRECTOR COLCLOUGH: Our next presentation is the third in the series of three, two of which were offered yesterday, as you recall, on patent factors in certain types of growing businesses. Now we have patents and other factors in the growth of the electronics industry in the Boston area.

Our research investigator, who received his doctorate at Princeton University, has taught at Minnesota and Duke. He is now chairman of the Department of Economics at Simmons College, where he's been since 1947, and chairman of the Division of Social Studies and Director of the School of Social Science of that institution.

He has been an industrial consultant with the American Institute of Banking. He has published extensively in such fields as savings banking in New York State, 1939; Money and Banking, 1947; Money and Banking, 1940. He has contributed, of course, many articles to economic journals.

It is my pleasure to introduce Dr. Welfling.

## PATENT AND OTHER FACTORS IN THE GROWTH OF THE ELECTRONICS INDUSTRY IN THE BOSTON AREA

DR. WELDON WELFLING: Mr. Chairman and Members of the Conference: I think it's going to be very difficult for a college professor, who's habituated to talking for 50 minutes, to talk for five. [Laughter]

I think the most fruitful thing I might be able to do in those five minutes is to state tentative conclusions which so far appear in this study.[6] Appropriately, I have jotted down five which gives me one minute for each.

But I want to use part of the first minute to make my contribution to the discussion of the interdisciplinary approach which has been discussed off and on during this conference. Like so many others on the staff, I at first protested that I knew absolutely nothing about patents and was told, "That's fine, because you have no preconceptions to get over." Since I'm addressing an audience that does, I'm tempted to think that perhaps this method is that of pooling ignorance in order to distill a drop of wisdom. [Laughter]

This may or may not be five drops of wisdom.

To insure that I get all five listed in the five minutes, I think I will list them and then explain them as time permits.

Incidentally, I might say that the very interesting background on this industry and why the Boston area was conducive to its rapid growth has been covered in the preliminary report that was published.

I would also like to say that in line with what many others have said this is certainly an area full of opinion and emotion, and I think all of us on the staff probably have to be careful to be sure whether we are making an opinion or attitude survey or whether we're trying to find the factors which lead to those opinions and surveys.

But, opinion or fact, I would list the first tentative conclusion that regardless of the role of the patent after a company starts, it is often practically essential in the formation of a new company. It carries a good deal of weight, justified or not, with the potential investors in a new company. And many apparently could not have been started without the weight of the patent to convince the investors that their money would be protected.

Second, in some lines of the electronics industry, patents clearly are no deterrent to any firm participating in production of specific items. That's particularly true in the radio and television industries, where the basic patents are held by a few large firms which license them freely.

Third, many of the people interviewed state that their reasons for patenting, whether they do it extensively or on a limited scale, are what they call "defensive." That is, they do not intend to profit from licensing the patent. What they have in mind is that they do not want somebody else to patent something which they are using and be in a position where they'd have to pay somebody else.

They're producing some rather specialized item for national defense perhaps, and possibly they have no competitors. There's no one to whom they could license it. But they just want to make sure they don't have to pay anybody else either.

Fourth, the patent seems to be frequently ignored or minimized in work for the government. As I understand it—I say this somewhat hesitantly—if a product or

[6]The progress report of Dr. Welfling is based on a research project interim report published in the first issue of *The Patent, Trade-Mark, and Copyright Journal of Research and Education* and material developed subsequently.

process is developed during work on a contract for the government, the developer may get a patent but the government will have free use of it. Consequently, there's very little profit in that way. If the developer does not, the government may take the patent, but in that case the developer can have free use of it. So, no matter who has it, no royalty will be involved.

And fifth, I have run across a few instances which could be cited as the patent having stimulated the rapid growth of a particular company and a few in which the holding of patents by others has deterred the growth of a new or small company, but too few cases to justify any kind of a pattern.

I might illustrate that last point in conclusion. In the first place, how it might deter a company's growth. I'm familiar with one little company in the field of optical instruments which developed an electronic blood scanner which apparently was the first one that worked. And as they were about to go into production on it, they discovered that part of the process was covered by a foreign patent although a really workable model had not yet been developed. Although there is considerable field for this particular product in doctors' offices and hospitals, apparently, they have been unable to come to what they consider reasonable arrangements with the holder of the foreign patent, and that work has definitely been deterred.

On the other hand, I must point out that this same company is now very busy as a result of a patent which somebody else holds. A large company in its research and development laboratory developed a process for which it itself had very little immediate use and did not want to develop, but they did want to get some benefit out of their patent, so they went to two small firms, including the one I'm talking about, and said that they would like to license them to produce this product.

The small company has found the arrangement profitable, the licensed process probably accounting for the bulk of its total sales of about $2.5 million. They are very delighted that the large company patented the process and then went to them and invited them to use it.

As I say, these are tentative conclusions so far. They will doubtless be modified and supplemented when a sample of about 12 more companies have been interviewed and the results collated and correlated.

Thank you. [Applause]

DIRECTOR COLCLOUGH: Thank you very much. Thank you, Dr. Welfling.

The next and last progress report on the agenda is the most recent to which the Foundation has given its attention—quite recent, in fact: "The Taxation of Patents." And to undertake this we are fortunate to have two scholars, Dr. Bangs, who received his Ph.D. at Brown and has worked for various governmental agencies, including the Treasury Department and the Department of Commerce. He too has had foreign experience when he served as an adviser to governments in Egypt and Burma from 1953 to 1956. He is at present with the International Finance Division of the Federal Reserve Board.

The other is Professor Joe Driscoll, having been educated at Harvard, both undergraduate and law, formerly a member of the legal advisory staff of the Treasury

Department, he has for the past few years served as an associate professor of law at The George Washington University. He is the co-author of *Merton's Law of Federal Income Taxation: 1954 Code Commentary,* and has contributed extensively to tax journals and conducted tax institutes at law schools and for bar associations throughout the country.

I think Dr. Bangs will speak first.

Dr. Bangs.

## THE TAXATION OF PATENTS

DR. ROBERT BANGS: This is a new project that has been under way only slightly more than one month. It is an exploratory study designed to identify problems in the effects of taxation on patent creation and utilization. Our aim is to pinpoint as many specific problems as possible, to gather some data bearing on the extent and nature of these problems by limited questionnaires and interviews, to analyze the data thus obtained, and to make recommendations to the Foundation as to whether further research is warranted.

The effects of taxation at the high rates now in force and likely to prevail for the foreseeable future are of considerable significance in many areas of business policy. In the special field of improving technology through the patent system there are many tax problems. We solicit your help and cooperation in identifying these problems, in quantifying their dimensions, and in assembling material for recommendations about constructive solutions.

We are concerned primarily with the Federal income tax rules applicable to research and development activities out of which many patents arise and the rules governing treatment of the proceeds from patent assignment or licensing. We plan also to look, as time permits, at the taxation of patents as property by State and local governments and at the bearing of estate, inheritance, and gift taxes on patent rights transferred by gift or death.

Finally, the effect of foreign tax provisions on the overseas exploitation of American patents will also be examined briefly.

As you are all undoubtedly aware, Section 174 of the 1954 Internal Revenue Code provides for more certain treatment of research and experimental outlays in determining taxable income, gives the taxpayer an option to expense or capitalize these outlays where related to his trade or business, and perhaps provide some additional incentive to undertake developmental work out of which patents may emerge. Research and development is a field of increasing concern to American business, an area in which outlays are already large and growing rapidly, and an activity where tax rates and tax rules can have significant effects on our future economic and industrial growth.

We hope in a small way by our questionnaires and interviews to examine business policy toward research and development, to sample the motivation of business management in undertaking research, and to determine whether tax considerations play any significant part in this motivation or in the use made of research and experimental findings.

Among the specific tax problems we have in mind in connection with research and development are: How are costs of new machinery and new plants allocated as between development expense and facilities investment? What changes have been made in accounting for research and development outlays since the 1954 tax changes? And how does this affect the values given to patents emerging from research and development work?

Other problems will emerge as our work progresses.

Our project ties in closely with other projects undertaken by the Foundation, and we expect to build on the findings of other studies as well as to coordinate our results with those obtained by other investigators.

Preliminary results obtained in the patent utilization study, the value of the patent system study, the foreign licensing study, and the industry case studies have already helped to direct and sharpen our efforts.

My colleague, Professor Driscoll, will speak on some of the tax problems that are involved in motivating individual inventors and in the exploitation of patents after they come into existence. [Applause]

PROFESSOR JOSEPH P. DRISCOLL: This project is an example of the interdisciplinary approach. Dr. Bangs is the economist and I'm the lawyer. We at one time worked together in the Treasury Department, and we are now going to work together exploring some of the effects of taxation upon the field of patents generally.

In so doing, we are undertaking a study in an entirely new area. There is almost no information available upon the impact of our Federal tax structure on the creation of patents and the various methods of utilizing patents. Dr. Bangs has indicated some of the problems in the corporate field. I also want to point out that taxes may have a very definite effect upon the creation of patents by the independent, individual inventor.

Some of the remarks heretofore in the conference have indicated that a decline may be setting in for the independent inventor. If so, it is all the more important that we evaluate some of the new tax provisions which were intended to provide an incentive for creation of inventions by individuals and the obtaining of patents based upon those inventions.

I am referring particularly to the provisions of the 1954 Code which allow capital gains treatment to the individual inventor. There are one or two important aspects of those provisions I want to mention to you.

For example, the new provisions which give favorable treatment to the income from patents are available only to individuals and not to corporations. They apply both to the creator of the invention and also to those investors who have helped finance it, provided they have come into the picture before the reduction of the invention to practice.

Finally, the provisions apply only if a certain method is employed in disposing of the patent. There must be a transfer of substantially all the rights in the patent. This means, in substance, an exclusive license or sale.

We want to consider the extent to which the new provisions will encourage invention by individuals, provide an incentive or stimulus to those who are interested financially in investing in patents, and affect the methods of utilizing patents.

It is quite apparent already there may be a new trend developing in which individuals and groups of inventors will work together in some form of syndicate or partnership with the aid of investors, who provide the funds for acquisition of facilities, payment of salaries, and exploitation of the patent. The entire group operation will be designed to qualify for the capital gains treatment.

We must also consider the fact that the new research and development provisions allow a deduction—available to individuals as well as corporations—of the amount spent on research and development. Hence, we have the possibility that the investors may deduct their costs and later realize possible capital gains on disposition of the patents.

That is merely one area we intend to explore. We want to see if there has been any definite effect on these tax provisions, since the enactment of the 1954 Code.

I should point out that corporations may still qualify for capital gains upon the sale of patents under the old rules provided they have not made so many sales in the past that they are disqualified as dealers and provided the circumstances of the sale do not amount in effect to license as distinguished from a sale.

In our work, we are going to call upon many of you in studying these tax aspects. Any of you who are interested in the subject should contact Dr. Bangs or myself at the end of our meeting here this morning. We'd very much like to see you, to get your views and suggestions, and to keep in touch with you. We realize that not everyone will be concerned with our subject. We are primarily interested in the financial aspects of patents—that is, the method of organizing the research budget, the impact of the tax system upon those budgets, the tax structure applicable to the licensing arrangements, and other tax effects. We would appreciate it if those of you who are concerned with those aspects of the patent system would contact Dr. Bangs or myself.

Thank you. [Applause]

DIRECTOR COLCLOUGH: Now, before asking Professor Oppenheim and Executive Director Harris to conclude this meeting, we have a period here called "General Discussion."

As I think has been pointed out already, one of the important benefits which we seek through a public conference such as this is to obtain guidance, thoughts, both specific and general, from those of you who have found the interest and the motivation to be with us. And, therefore, I'd like to start this period for general discussion of the Foundation with respect to specifics or generalities by claiming the privilege of calling upon the Commissioner of Patents, who has agreed that he would say a few words to us at this time.

The Commissioner, Mr. Watson. [Applause]

## GENERAL DISCUSSION

Commissioner Robert C. Watson: Dean Colclough and Ladies and Gentlemen: I am happy to have a few minutes, in view of the important objectives of this conference and the large number of interested persons who are here. First I would like to make an announcement. Senator O'Mahoney's Subcommittee has filed a number of bills. One of them is of great interest to the Patent Office and I would like to mention it particularly inasmuch as that bill may be taken up by the Subcommittee at an early hearing.

It purports to increase the membership of the Board of Appeals of the United States Patent Office. It would give the President the right to appoint not nine members, presently the maximum number, but up to 16. It purports also to authorize the payment to those gentlemen of salaries considerably in excess of those which they are now receiving. It also includes a provision which will increase the salary of the Commissioner and his assistants. That is not as important as the other provisions of the bill. Actually, the Commissioner's salary must be increased, however, in order to make it possible to raise the salaries of those of lower grades.

The pay scales of Patent Office are graduated, the Commissioner at the top, closely followed by the Assistant Commissioners, then the members of the Board of Appeals, the supervisors, the primary examiners, the assistant chiefs, and so on down.

We are experiencing the greatest difficulty in maintaining an adequate staff. Actually, even with the kindly assistance of a Congress which is favorable and an appropriation which is quite substantial, we are still in difficulty.

Last year, by the hardest work, we recruited about 288 examiner assistants. We were authorized to increase our staff by 300. We couldn't make it. This year we are likely to fall behind in our recruitment effort. And so the plan which we had carefully worked out for the reduction of the backlog and to render our operations more current may not be realizable unless we do meet with some favorable action on the bill which now is pending.

Therefore, I take this opportunity to suggest to each of you that you communicate with Senator Eastland and support S. 1864, and possibly, or preferably, send a copy of any letter that you may write to Senator Eastland, who is chairman of the Senate Committee on the Judiciary, to Senator O'Mahoney or Senator Wiley or both. This bill happens to be sponsored both by Senator O'Mahoney, who is a Democrat, and by Senator Wiley, who is a Republican.

There is a bill, hearings upon which are set for the coming week, H. R. 7151, dealing with fees payable to the Patent Office. I'm not going to attempt to discuss patent fees at this time. It is important to say, however, that the subjects which have been discussed yesterday and today at this meeting are of paramount importance and if the questions advanced can be answered, one who occupies the position of Patent Commissioner will be materially helped. Each year the Commissioner really has to justify the existence of the patent system by going before the Appropriation Committees. And without an adequate appropriation the Patent Office would wilt and the system would no longer be effective.

During the four years which I have been in the Patent Office I have not been confronted with any major challenge to our patent system. It is assumed by the members of the Sub-committee on Appropriations of the Appropriation Committee of the House that there is justification for the existence of the patent system. But there may be extensive argument as to the amount which the Patent Office should receive. And there are but few and very scanty facts which the Commissioner can present to the committee to show that, for instance, if the appropriation for the Patent Office is materially cut and he is forced to issue fewer patents as a result of the cut, the effect upon the economy of the country will be not good.

Now, we have a favorable attitude in the Congress at this time. I think that we have the best opportunity to secure the passage of favorable legislation which has existed in a long time. The several bills which have been introduced, having been sponsored by a Republican as well as by a Democratic Senator, have more backing than the usual bills, and I recommend to each of you that you follow closely the activities of the committees of Congress which have these several bills before them and, insofar as you are able to do so, to put your weight behind them.

I will only say in conclusion that, as a practicing lawyer and long before I came to the Patent Office, I was of the belief that the work which was then proposed and is now being done by this Foundation is absolutely vital and essential. Since I have been in the Patent Office I have become increasingly of the belief that, if we are to place the patent system in the position in which we hope to see it, continuation of the work of these various committees and individuals who are working for the Foundation is absolutely essential, and I trust that nothing will occur which will necessitate any decrease in that activity. It is my hope that the Foundation will receive the widest support, popular support as well as the support of the members of the patent bar and the support of inventors and of industry.

Thank you very much, Dean Colclough, for having given me this opportunity. [Applause]

DIRECTOR COLCLOUGH: Thank you, Mr. Commissioner.

Now, we would be very gratified to hear what is on the minds of any of you at this time. We actually solicit it. General Semmes?*

GENERAL SEMMES: I want to congratulate the officers, yourself, Dean Colclough and Mr. Harris, for the very splendid way you have worked up this program and the research that's being done.

The patent system is a hard thing to analyze, and a great deal of fine thought has gone into this work, and I think it is going to give a boost to the profession which is closest to our hearts better than has ever been done before.

And I want to say a word, of course, about Professor Oppenheim, who conceived

*Harry H. Semmes of Washington, D.C., who is a National Director of the Area Committee of the Foundation.

the original idea. It's a very fine thing, and I appreciate the chance of being able to say so. [Applause]

DIRECTOR COLCLOUGH: Thank you, General Semmes.

There are many men sitting out there who had a lot to do with this Foundation coming into being, and if one or two of them don't stand up I'm going to call upon them. All right. I wonder if Mr. Woodcock* wouldn't say just a word since he was one of my closest advisers in the early stages of this undertaking.

MR. WOODCOCK: Dean Colclough, I have been highly impressed with the conference here, because I was involved in the early stages—when many patent lawyers were quite suspect of those who would be carrying on the investigations—and I feel that some lawyers who have attended the last two days may have carried those suspicions into this room. I think the economists who have participated had the same suspicions toward the patent bar, because much of the laudatory literature had the authorship of patent lawyers.

I think this has been dissipated both ways. First, the economists have a little more trust in the patent lawyer, and I think the patent lawyers now know from being here, visiting with your research staff, that that staff including the economists have their feet on the ground.

The only discussion which would have confirmed our disbelief came from a participant not a member of your staff, one who did not have at hand any material on which to base his prejudiced conclusions.

That's the thing that has impressed me during the conference. You are not drawing general conclusions in the absence of facts. When you are not sure of your facts, you are trying mighty hard to get reliable ones. That has been the keynote that has been most gratifying to all of us and which has carried out the original, the basic objective of the Foundation. Yours is an independent study, independent of the biases and prejudices of the bar and of the economists.

There is only one thing we haven't really heard here—I think we haven't because it's the first conference—and that is rugged criticism of what has been said. I mean helpful, constructive criticism. I feel it hasn't been said because this is the first conference, and the vocabulary is new to some of us. The facts presented have been so striking, remarkable, and unexpected that a little time will be required to evaluate the conclusions.

So I think it might be appropriate, sir, to suggest that when we have returned and read some of these papers with greater care that we might send in our reactions to you rather than express them here.

I have my own feeling that some of the papers already presented contain most significant findings. I will just mention the paper on utilization. That certainly has been an area in which we have not been well informed. I certainly hope the preliminary findings after the further study you contemplate can be presented as solid facts on which we can draw conclusions.

*Virgil E. Woodcock, patent attorney, Philadelphia.

May I add my final word of appreciation for the fine work of all who have participated in organizing this conference and in presenting papers. [Applause]

DIRECTOR COLCLOUGH: Thank you, Mr. Woodcock, for that analysis. And I want publicly and immediately to endorse Mr. Woodcock's suggestion that as you review the papers and as you review the proceedings of this conference you will do just what he said—you will analyze and criticize and diagnose. Because that will be the most valuable perhaps of all the values that can come out of this conference.

Is there anyone else who has something he'd like to say? Mr. Jo Baily Brown,* would I dare ask you just to give us a pungent observation? I talked to you about this in your office in Pittsburgh four or five years ago when it was only a gleam in our eyes.

MR. BROWN: I have been greatly interested in this meeting. I think that anybody interested in the patent system must be interested in a research work of this kind. That I'm interested in it and that the people with whom I work are interested is shown by the fact that three partners of our five-partner firm, which practices general patent law, are present at this meeting.

I'm sorry that there are not more of what we might call the "litigating patent lawyers" here. I think more of them should be here, because in a way they carry back to their clients an impression of the kind of work that is being done in an organization of this kind. And in the long run the continuation of this study I believe will depend upon contribution of finance from corporate sources. Individuals will give some, but the corporations and foundations will have to finance this work if it's to be carried on. I would go further into this point except that doing so would repeat what has already been said better by other people.

It seems to me that this kind of research by disinterested persons is worthwhile. So far as I know, it is unique. Study of the patent system is not new. Under President Theodore Roosevelt one of the best studies that I know of, of the Patent Office practice and of the patent system generally, was made by a presidential commission. That report is out of print, and copies are as scarce as hen's teeth. If you don't have one now you'll probably never see it. It was a very exhaustive and a very fine report.

And we have, of course, the report of the T.N.E.C.—Temporary National Economic Commission. In my opinion, and it's only mine, I think it was destructive, and that some of the trouble the patent system has had since stems from that partial and biased study.

There was a committee appointed in 1923 or 1924 by President Coolidge through the then Secretary of the Interior. It had 10 men on it, and they spent over a year studying the patent system and the Patent Office. I happened to be a member. I don't know why, except I think I was so young that the older men wanted somebody to do the actual work of the committee—that is, the paper work, collecting the papers and digesting the details. But, anyhow, we met at least once a month and usually spent several days, and we did a careful job. I don't think that report was ever published.

*Jo Baily Brown, patent attorney, Pittsburgh.

Now, what I'm getting at is this: There have been many—not many, but a number of studies of the patent system, but none of them has been, you might say, from the academic point of view, from the unprejudiced point of view, and from the university point of view. Men that are trained researchers and trained students are here working on something which heretofore has been done either by Congress or by the patent lawyers themselves.

The Patent, Trademark and Copyright Section of the American Bar Association spends two or three days every year, and has done it for the past 25 or 30 years to my personal knowledge, debating changes that might be made in the patent law and the patent practice, and so forth. But the section comprises only lawyers. They don't have the unbiased status of the gentlemen who have been here today.

Now, there's one other thing I'd like to say, and that is that, intensely interested as I am in this study and in the very careful and thorough and admirable work that has been exhibited to us here by these gentlemen who have spoken to us, I wonder what is coming out of such studies. I doubt very much whether this research organization will arrive at many if any concrete suggestions.

As I understand it, it is primarily a fact-finding and study group. That is very valuable because of the kind of people who are doing it, and the purpose they have in doing it, which is disinterested, impartial, with no advocacy in their objectives.

I believe thoroughly in the patent system. On the other hand, there is no doubt that economic conditions have changed since the system came into effect, and that the patent system must change with those conditions. And whether the laws change with economic changes or not, the effect and treatment of patents will change regardless of what the courts do, and regardless of what Congress does. It will change. It has changed. It will in any event be gradually modified by economic changes.

I doubt whether you can by your reports do more than educate people, give them more factual background to think about and work with. Changes of statute must be made in Congress. And I think Congressmen do not pay a great deal of attention to documentation. They go largely upon the feel of the public. When they think something is demanded by the public, they will give it to the public. When the public is not interested in it, they're not particularly interested. Your work will be to inform the public and give background for public interest.

So the question arises in my mind as to where this study is going. I believe it should go on. I warn the gentlemen who are spending so much time on it, such valuable time, that they must maintain their unbiased report of facts based on accurate study, that they will have to have patience, and hope, and charity from other people, and that they have a long, hard row ahead of them to get to a point which will make the whole thing really worthwhile.

The great danger of this Foundation will be that for financial reasons at some stage it may break down by not having funds to pay the men, the very valuable men, and the very highly trained men, to permit them to give the necessary time to carry on the research now started.

I think one thing that the lawyers must do—and I'm speaking more of the patent-practicing lawyers and also of the men who are salaried lawyers with corporations—is to try to keep up the interest at the source of funds for a foundation of this kind, so that it may go on. If it were to stop now it would not have accomplished its object. It must go on for a number of years to really have made itself worthwhile.

And I certainly, for my part, will carry back from this meeting a feeling that I can advise our clients that it has been worthwhile to contribute to this study. I can sincerely tell them that I believe the Foundation is well worthwhile, that it is in good hands, that it is being admirably staffed, admirably directed, and is doing a better job, frankly, than I thought they could, or would appear at this stage.

Thank you very much. [Applause]

DIRECTOR COLCLOUGH: Thank you, Mr. Brown.

Now, I'm going to turn the meeting over briefly to Professor Oppenheim and the Executive Director, Mr. Harris, to bring it to a successful, I hope, conclusion.

## FUTURE PROSPECT

PROFESSOR OPPENHEIM: Mr. Chairman—and I think, after being here, I can only add Partners in a Common Enterprise: In the program you will notice that there was a designation "Present Status and Future Prospect" which was to be the subject of comments by Mr. Harris and myself. After the experience of yesterday and today, it seems to me that all I could say properly is something that has nothing to do with the evaluation of the conference.

After all, in a way, we have presented not the case for the Foundation but the evidence for your evaluation of what the Foundation has been doing. I personally have always felt reluctant to witness a combination of what you'd call the prosecutor, judge and jury function—in this case the pleading is by the Foundation and to you is committed judge and jury function. So I think from that point of view we are committing to you a judgment about what the Foundation has been doing.

I heard this morning that we might be misguided to identify this Foundation work with symbols of motherhood and love. I don't know. I sort of feel like a novice in knowledge of those areas. But then I also fear there is such a thing as self-love—what they call the "Narcissus reaction." And I certainly don't think that Mr. Harris and I want to indulge in self-love about the Foundation.

What I have to say will be, I hope, an additive to what has already been said, so I won't be guilty of repeating.

I appreciate deeply the suggestion, and the gracious comment of General Semmes that I was responsible for the conception of the Foundation. I know what was meant and I am grateful for it. But let me say that there are situations where in the course of time a good many persons throw some, let's say, tinder in a pile.

Whatever some of us may have contributed to the Foundation, I think it is a partnership enterprise we have been talking about. In other words, there are occasions when someone, like I, is fortunate enough to come along at a point where all he does is to add some fuel and strike the match to the tinder pile.

I have had a little experience with a garden grill, and the charcoal to do the broiling. Then you get something that you spray on the charcoal to make it ignite. And it's all a very useful combination. All you do is put a little paper on the grill and you light a match and off it goes.

Well, maybe I just happened to be at a certain place at a certain time that gave me the honor and privilege of starting the fire. And that's about all that I would claim for the happy memory I've had of that little part in the Foundation.

The one additive thought I have that perhaps hasn't been brought to the surface is this: Years ago it was my lot to have been in the beginnings of a field known as trade regulation law. I remember how it was then regarded—a sort of a luxury or semi-luxury law school course. It had little to do with the bar examination. Some persons had forged ahead in this field of specialization. My colleague, Milton Handler, at Columbia was in that area, I was in it, and some others joined later. And, lo and behold, before we knew it or realized it, the development of the law of unfair competition and antitrust law produced a generally recognized area of specialization.

Similarly, we know that patent law, historically and traditionally, far beyond anything that can be claimed for these newer areas, has always been an area of specialization. We have had patent lawyers as a segment of the bar specialized in the law of patents and the associated or cognate areas like trademarks and copyrights.

The thought I would like to leave with you is that perhaps we shall be witnessing —and I hope we will—the development of a group of persons in research and education who will parallel perhaps what happened in these other fields in the new phases of the Foundation's work beyond the conventional patent law. Let me make this a little more concrete by pointing out that, after trade regulation law, let us say, had become a specialty like patent law, there developed a group of lawyers and maybe a group of persons from the other social science areas—I shall not use the word "discipline" again; we've heard it enough—[laughter]—who became specialists in that field.

Let me illustrate further. You have no doubt thought about this. We have a group of persons today whom we call antitrust economists. These gentlemen, like the patent lawyers, like taxation lawyers, are not narrow-visioned specialists. They are competent economists generally and so are the lawyers generally competent. But they devote a major part of their time and thought and effort to something that engages and fascinates them more specifically. And so, in a short period of time, these economists found that they were focusing on the impact, let us say, of the antitrust laws on the economic system.

We may be witnessing a parallel to that here. We may have perhaps some day a group of economists who will be interested in patent system economics, and they will be known as patent system economists. If you look at the program, it might occur to you that my dear friend and colleague, Dr. Barkev Sanders, may find himself unexpectedly involved in this special area as a lifetime career. He might suddenly decide: "Well, this is statistics too, but I'm going to continue with my explorations on patent system statistics."

And my colleague, Professor James N. Mosel, might find that here is a new area for the psychologist to prove. He'll probably hope that it will have some special psychological implications applicable to the patent system.

In the same vein we may have sociologists who might be interested in the sociology of the patent system. We have witnessed today the budding of interest in the taxation of patents. We might have patent taxation specialists.

That is what I should like to leave with you as a thought. In the antitrust field, for example, today we have men like Professor M. A. Edelman of M.I.T. Edelman is an excellent economist, but the economists know him and he has a sort of trade name, you might say, as particularly an antitrust economist. The same may be said of Clair Wilcox of Swarthmore, or my colleague Griffin at Michigan; or Fred Kahn, who was here yesterday, is primarily interested an antitrust economics. Corwin Edwards, Walter Adams, George Stocking are also so identified—to be sure I get in all shades of viewpoints of economists.

Years ago Professor Floyd Vaughan was the first one to write on *The Economics of Our Patent System.* This was in 1925.

Then in 1943 Professor Bennett of the University of Oklahoma wrote a book stressing the economics of the patent system.

In the Foundation context this specialization may have more meaning to a group of persons. So we may find we can woo and keep on enticing Dr. Jesse Markham and his associates to become patent system economists, along with Dr. Irving Siegel, Professors Weidenhammer, Welfling, Belfer, and Behrman. And maybe that's what may happen.

Finally, it may be appropriate for me to do something not part of the planned program. I am the Foundation's Adviser on Research. In that capacity I have observed various aspects of the Foundation's operations. You will notice in the Foundation's *Journal,* in addition to the persons and groups that have been already mentioned, there is a group designated as the "office staff." Yesterday, I think it was Barkev Sanders who called your attention to the psychoanalytic instincts of the Executive Director, L. James Harris. I envy him for a good many of his qualities in getting others to feel as dedicated as he. But I particularly envy him in the expertise that he has manifested in building up an office staff that has been as truly dedicated in this partnership enterprise as he has.

I have witnessed this office staff in action, and I want to close on this note—by pointing out to you that this office staff, as Dean Colclough said, is part of the "all hands" enterprise.

If I may be permitted, I would like to make this public acknowledgement of their vital contribution. I haven't forewarned anyone about this. Maybe it is a particular pleasure I reserved for myself as an expression of my own appreciation based on my observations.

So I will ask that the members of the office staff whose names I shall read to please rise at least so that we may acknowledge them.

Dorothy Koch Pierce. [Applause]

Robert L. Carter. He isn't present. In absentia we acknowledge him.

Robert E. Grindle. [Applause]

Pauline Kartalos. [Applause]

Ruth McCluney. [Applause]

Barbara Jean West. [Applause]

Sara Blair Wilson. [Applause]

Thank you very much. [Applause]

EXECUTIVE-DIRECTOR HARRIS: I want to thank Professor Oppenheim for his kind words about the office staff, and I want to thank you all for your cooperation and your very generous attention.

Last night after the dinner Dean Colclough, Professor Oppenheim, and I talked a little about today's program, and we agreed that you have all been so wonderful and so cooperative that we ought to reciprocate by making our closing statements rather brief. Accordingly, Professor Oppenheim and I decided that we would limit ourselves to one point apiece.

Professor Oppenheim made his point. It was in relation to the possible development of a group of patent specialists from various disciplines, and my point has to do with the broad educational program of the Foundation.

You will notice that our research staff comes from various parts of the country. This was planned. We felt that this would be a good way to establish various nuclei at other universities and research centers. There they would generate and encourage the interest of other specialists and students. Thus, with the heart of the work being carried on here at George Washington, in keeping with the national character of the Foundation, we are encouraging specialists and students located in different parts of the country to join in our investigations.

We also plan in the future to work with other universities on certain research and educational programs in these fields, under the auspices and direction, of course, of the Foundation.

I would like to direct your attention to *The Patent, Trade-Mark, and Copyright Journal of Research and Education*[11] and to point out three items relating to our educational function.

Under the section on Programs, the reference to the student research assistantships, we believe, is quite important. A limited number of student research assistantships, a means of training students in original research, are available to candidates for degrees at our university and to graduate students at other universities in cases where the field of specialization of a student is pertinent to the research program of the Foundation.

We also conduct a seminar and lecture series jointly with the faculty of The George

Washington University Law School. In this series students are introduced to the patent, trade-mark, and copyright systems as functioning legal, social, and economic institutions. In this way they get the full benefit of the research work of the Foundation. That is one of the primary objectives in this type of teaching—to achieve the advancement of the students with the progress of research.

This we think is something very worthwhile. We think this is something new in the field of teaching, especially in this area.

And then, finally, I want to point to the establishment of the Charles F. Kettering Award for meritorious work in patent, trade-mark, and copyright research and education. This is an annual award, and the first will be presented by the Foundation at the end of this year.

Again I want to say how much we appreciate your cooperation, your generous attention. We hope you will carry what you heard here to other men—other men who might interest themselves in, and support our work—and, as the Dean so well said, make this an "all hands" job.

Thank you very much. [Applause]

DIRECTOR COLCLOUGH: I apologize for the fact that for the first time we have run over the time schedule a little, but I did feel that I wanted you to go away with a sense of the dedication of these two distinguished men who contribute so much to this effort.

So thank you ever so much for being here. We depend on you to spread the news, because, as Mr. Brown said, we must have support. But, most of all, we want you to think about us, to write to us, to criticize us, to make suggestions, because this is only the first of a series of public conferences. The distribution of the *Journal* and the proceedings of the public conferences of the future shall be the media for making the entire country more conscious of this institution known as the patent system in the context of our dynamic economy.

The meeting stands adjourned.

[Whereupon, at 12:45 P.M., the conference was adjourned.]

# Appendices to the Proceedings

## APPENDIX I

### TABLES FOR THE PATENT UTILIZATION STUDY

### TABLE A

NUMBER AND PERCENTAGE DISTRIBUTION OF ASSIGNED PATENTS IN DIFFERENT SUB-SAMPLES DISTRIBUTED ACCORDING TO UTILIZATION STATUS ON THE BASIS OF INVENTOR REPLIES, COMPARING GROUPS WITH INVENTOR QUESTIONNAIRE ONLY WITH THOSE WITH BOTH ASSIGNEE AND INVENTOR QUESTIONNAIRES—ALL QUESTIONNAIRES RETURNED BY 5/21/57.

PRELIMINARY

| Utilization Status | Inventor Questionnaires Only | | | | | | | | Assignee and Inventor Questionnaires | | | | | | | | Total | | Total Including Interviews | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre-pilot | | Oct.-Jan. | | Feb.-May* | | Combined | | Pre-pilot | | Oct.-Jan. | | Feb.-May* | | Combined | | | | | |
| | No. | Per Cent | No. | Per Cent | No. | Per Cent | No. | Per Cent | No. | Per Cent | No. | Per Cent | No. | Per Cent | No. | Per Cent | No. | Per Cent | No. | Per Cent |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) | (20) | (21) |
| Total..... | 33 | 100.0 | 271 | 100.0 | 61 | 100.0 | 365 | 100.0 | 43 | 100.0 | 93 | 100.0 | 61 | 100.0 | 197 | 100.0 | 562 | 100.0 | 586 | 100.0 |
| Patents used at any time | 18 | 54.6 | 165 | 60.8 | 32 | 52.4 | 215 | 59.0 | 23 | 53.5 | 51 | 54.8 | 37 | 60.7 | 111 | 56.3 | 326 | 58.0 | 339 | 57.8 |
| Current use.. | 10 | 30.3 | 108 | 39.8 | 22 | 36.0 | 140 | 38.4 | 18 | 41.9 | 44 | 47.3 | 24 | 39.3 | 86 | 43.6 | 226 | 40.2 | † | † |
| Past use..... | 8 | 24.3 | 57 | 21.0 | 10 | 16.3 | 75 | 20.5 | 5 | 11.6 | 7 | 7.5 | 13 | 21.3 | 25 | 12.7 | 100 | 17.8 | † | † |
| Expected use. | 1 | 3.0 | 4 | 1.5 | 2 | 3.3 | 7 | 1.9 | 1 | 2.3 | ... | .... | ... | .... | 1 | .5 | 8 | 1.4 | 12 | 2.0 |
| Don't know.. | 4 | 12.1 | 46 | 17.0 | 9 | 14.8 | 59 | 16.2 | 10 | 23.3 | 19 | 20.4 | 4 | 6.6 | 33 | 16.8 | 92 | 16.4 | 93 | 15.9 |
| Never used.. | 9 | 27.3 | 52 | 19.2 | 13 | 21.3 | 74 | 20.3 | 9 | 20.9 | 21 | 22.6 | 20 | 32.8 | 50 | 25.4 | 124 | 22.1 | 129 | 22.0 |
| Unanswered. | 1 | 3.0 | 4 | 1.5 | 5 | 8.2 | 10 | 2.7 | ... | .... | 2 | 2.2 | ... | .... | 2 | 1.0 | 12 | 2.1 | 13 | 2.2 |

*Questionnaires received after February 18, 1957, and before May 21.

†In the initial interviews utilization in terms of current use as against past use only was not differentiated.

TABLE B

NUMBER AND PERCENTAGE DISTRIBUTION OF ASSIGNED PATENTS IN DIFFERENT SUB-SAMPLES DISTRIBUTED ACCORDING TO UTILIZATION STATUS ON THE BASIS OF ASSIGNEE REPLIES, COMPARING GROUPS WITH ASSIGNEE QUESTIONNAIRE ONLY WITH THOSE WITH BOTH ASSIGNEE AND INVENTOR QUESTIONNAIRES—ALL QUESTIONNAIRES RETURNED BY 5/21/57.

PRELIMINARY

| Utilization Status | Assignee Questionnaires Only | | | | | | | | Assignee and Inventor Questionnaires | | | | | | | | Total | | Total Including Interviews | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre-pilot | | Oct.-Jan. | | Feb.-May* | | Combined | | Pre-pilot | | Oct.-Jan. | | Feb.-May* | | Combined | | | | | |
| | No. | Per Cent | No. | Per Cent | No. | Per Cent | No. | Per Cent | No. | Per Cent | No. | Per Cent | No. | Per Cent | No. | Per Cent | No. | Per Cent | No. | Per Cent |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) | (20) | (21) |
| Total..... | 16 | 100.0 | 104 | 100.0 | 60 | 100.0 | 180 | 100.0 | 43 | 100.0 | 93 | 100.0 | 61 | 100.0 | 197 | 100.0 | 377 | 100.0 | 396 | 100.0 |
| Patents used at any time | 8 | 50.0 | 52 | 50.0 | 27 | 45.0 | 87 | 48.3 | 20 | 46.6 | 47 | 50.5 | 38 | 62.3 | 105 | 53.3 | 192 | 50.9 | 202 | 51.0 |
| Current use.. | 6 | 37.5 | 30 | 28.9 | 13 | 21.7 | 49 | 27.2 | 11 | 25.6 | 36 | 38.7 | 24 | 39.3 | 71 | 36.0 | 120 | 31.8 | † | † |
| Past use..... | 2 | 12.5 | 22 | 21.1 | 14 | 23.3 | 38 | 21.1 | 9 | 21.0 | 11 | 11.8 | 14 | 22.9 | 34 | 17.3 | 72 | 19.1 | † | † |
| Expected use. | 1 | 6.3 | 4 | 3.8 | ... | .... | 5 | 2.8 | 6 | 13.9 | 14 | 15.1 | 4 | 6.6 | 24 | 12.2 | 29 | 7.7 | 30 | 7.6 |
| Don't know.. | 1 | 6.3 | ... | .... | 1 | 1.7 | 2 | 1.1 | ... | .... | ... | .... | 4 | 6.6 | 4 | 2.0 | 6 | 1.6 | 6 | 1.5 |
| Never used.. | 6 | 37.5 | 47 | 45.2 | 31 | 51.7 | 84 | 46.7 | 17 | 39.6 | 32 | 34.4 | 15 | 24.6 | 64 | 32.5 | 148 | 39.2 | 156 | 39.3 |
| Unanswered. | ... | .... | 1 | 1.0 | 1 | 1.7 | 2 | 1.1 | ... | .... | ... | .... | ... | .... | ... | .... | 2 | .5 | 2 | .5 |

*Questionnaires received after February 18, 1957, and before May 21.
†In the initial interviews utilization in terms of current use as against past use only was not differentiated.

TABLE C

TABULAR SUMMARY OF REASONS FOR CURRENT NON-USE OF THE SAMPLED PATENT IN THE ORDER OF RELATIVE FREQUENCY WITH WHICH THEY WERE MENTIONED.

| Rank | Assigned Patents | | Unassigned Patents |
|---|---|---|---|
| | Based on Inventor Replies | Based on Assignee Replies | Inventor Replies |
| First | Lack of Market Demand | Lack of Market Demand | Shortage or Lack of Venture Capital |
| Second | Development of Art Has Taken a Different Course | * "Other" | Neglect to Exploit the Patent |
| Third | Patent Competitively at a Disadvantage | Patent Competitively at a Disadvantage | Lack of Market Demand |
| Fourth | Rapid Obsolescence | Rapid Obsolescence | † "Other" |

*The "development of the art has taken a different course" and the patent "competitively at a disadvantage" are two of the specific reasons listed in question 32 for inventors' questionnaire, that were not listed separately in question 12 for assignees. Analysis of entries under "other" by assignees leads us to suspect that had this been done, these two replies would have ranked high in assignee returns.

†The fifth reason for unassigned patent was "development of the art has taken a different course," which is ranked second on the basis of inventors of assigned patents.

TABLE D

SUMMARY STATISTICS OF AGE DISTRIBUTION OF INVENTORS AS OF 1/1/57, BASED ON QUESTIONNAIRES RETURNED PRIOR TO 2/18/57, COMPARING THE SUB-SAMPLES AND COMBINATIONS OF THE SUB-SAMPLES FOR INVENTORS OF ASSIGNED AND UNASSIGNED SAMPLED PATENTS, SEPARATELY AND COMBINED. PRELIMINARY

| Statistics | Pre-pilot | | | Pre-pilot and Initial Interviews | | | October-January Mailings | | | Combined | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Assigned | Unassigned | Combined | Assigned | Unassigned | Combined | Assigned | Unassigned | Combined | Assigned | Unassigned | Combined |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| Mean | 52.3 | 56.3 | 53.1 | 52.1 | 55.6 | 52.9 | 53.4 | 57.8 | 54.4 | 53.1 | 57.3 | 54.1 |
| Median | 50.8 | 56.9 | 52.1 | 50.9 | 56.5 | 52.5 | 52.5 | 58.5 | 53.6 | 52.2 | 57.9 | 53.4 |
| Mode | 47.8 | 58.1 | 50.1 | 48.5 | 58.3 | 51.7 | 50.7 | 59.9 | 52.0 | 50.4 | 59.1 | 52.0 |
| Standard deviation | 10.73 | 11.89 | 10.94 | 10.20 | 11.67 | 10.78 | 10.20 | 12.91 | 11.40 | 10.27 | 12.69 | 10.91 |
| Standard error of the mean | 1.14 | 2.60 | 1.05 | .96 | 1.97 | .88 | .51 | 1.18 | .50 | .45 | 1.02 | .42 |
| Expected range of the mean at the 5% level* | 50.1–54.5 | 51.2–61.4 | 50.9–55.3 | 50.2–54.0 | 51.7–59.5 | 51.2–54.6 | 52.4–54.4 | 54.5–60.1 | 53.4–55.4 | 52.2–54.0 | 55.3–59.3 | 53.3–54.9 |
| Coefficient of variation | 20.5 | 21.1 | 20.6 | 19.6 | 21.0 | 20.4 | 19.1 | 22.3 | 21.0 | 19.3 | 22.1 | 20.2 |
| Standard error of the difference of two means multiplied by 1.96 (5% level)† | 5.21 (not significant) | | | 4.08 (not significant) | | | 2.33 (significant) | | | 2.22 (significant) | | |

*This shows the 95 per cent confidence limit of the mean age of inventors in the samples. The sub-samples of the assigned and unassigned patents *inter se* could be regarded as random samples of the same population.

†This is the standard error of the difference of two percentages, assigned versus unassigned, multiplied by 1.96, given as the test of significance at the 5 per cent level. Where the difference is significant the standard error of the difference of the two means, multiplied by 1.96 is smaller than the observed difference.

## TABLE E

SUMMARY STATISTICS OF AGE DISTRIBUTION OF INVENTORS AT THE TIME WHEN THEY RECEIVED THEIR FIRST UNITED STATES PATENT, BASED ON QUESTIONNAIRES RECEIVED PRIOR TO 2/18/57, COMPARING THE SUB-SAMPLES AND COMBINATIONS OF SUB-SAMPLES FOR INVENTORS OF ASSIGNED AND UNASSIGNED SAMPLED PATENTS, SEPARATELY AND COMBINED.

PRELIMINARY

| Statistics | Pre-pilot | | | Pre-pilot and Initial Interviews | | | October-January Mailings | | | Combined | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Assigned | Unassigned | Combined | Assigned | Unassigned | Combined | Assigned | Unassigned | Combined | Assigned | Unassigned | Combined |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| Mean | 33.9 | 43.5 | 35.7 | 33.8 | 42.4 | 35.8 | 34.0 | 40.2 | 35.5 | 34.0 | 40.7 | 35.5 |
| Median | 33.1 | 41.2 | 34.4 | 32.6 | 41.7 | 33.9 | 32.9 | 38.4 | 33.5 | 32.8 | 39.0 | 33.6 |
| Mode | 31.5 | 36.6 | 31.8 | 30.2 | 40.3 | 30.1 | 30.7 | 34.8 | 29.5 | 30.6 | 35.6 | 29.8 |
| Standard deviation | 7.43 | 12.40 | 9.58 | 7.96 | 12.82 | 10.13 | 7.70 | 12.45 | 9.40 | 7.80 | 12.60 | 9.55 |
| Expected range of the mean at the 5% level* | 32.3–35.5 | 39.1–47.9 | 33.9–37.5 | 32.8–35.3 | 38.1–46.7 | 34.0–37.6 | 33.2–34.8 | 37.9–42.5 | 34.7–35.3 | 33.3–34.7 | 38.7–42.7 | 34.8–36.2 |
| Coefficient of variation | 21.9 | 28.5 | 26.8 | 23.6 | 30.2 | 28.3 | 22.6 | 31.0 | 26.5 | 22.9 | 31.0 | 26.9 |
| Standard error of the difference of two means multiplied by 1.96 (at the 5% level)† | 4.66 (significant) | | | 3.90 (significant) | | | 1.96 (significant) | | | 1.76 (significant) | | |

*This shows the 95 per cent confidence limit of the mean age of inventors in the samples. The sub-samples of the assigned and unassigned patents *inter se* could be regarded as random samples of the same population.

†This is the standard error of the difference of two percentages, assigned versus unassigned, multiplied by 1.96, given as the test of significance at the 5 per cent level. Where the difference is significant the standard error of the difference of the two means, multiplied by 1.96 is smaller than the observed difference.

## TABLE F

SUMMARY STATISTICS OF THE DISTRIBUTION OF THE HIGHEST SCHOOL GRADE COMPLETED BY INVENTORS, BASED ON QUESTIONNAIRES RECEIVED PRIOR TO 2/18/57, COMPARING THE SUB-SAMPLE AND COMBINATIONS OF SUCH SAMPLES FOR INVENTORS OF ASSIGNED AND UNASSIGNED SAMPLED PATENTS, SEPARATELY AND COMBINED.

PRELIMINARY

| Statistics | Pre-pilot | | | Pre-pilot and Initial Interviews | | | October-January Mailings | | | Combined | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Assigned | Unassigned | Combined | Assigned | Unassigned | Combined | Assigned | Unassigned | Combined | Assigned | Unassigned | Combined |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| Mean | 15.5 | 11.8 | 14.8 | 15.7 | 12.2 | 14.9 | 16.0 | 12.4 | 15.2 | 16.0 | 12.3 | 15.1 |
| Median | 16.8 | 10.8 | 16.5 | 16.8 | 12.4 | 16.5 | 16.7 | 12.5 | 16.5 | 16.7 | 12.5 | 16.5 |
| Mode | 19.4 | 8.8 | 19.9 | 19.0 | 12.8 | 19.7 | 18.1 | 12.7 | 19.1 | 18.1 | 12.9 | 19.3 |
| Standard deviation | 4.20 | 3.80 | 4.38 | 4.11 | 3.93 | 4.29 | 3.28 | 4.33 | 3.81 | 3.36 | 4.25 | 3.91 |
| Standard error of the mean | .44 | .83 | .42 | .35 | .66 | .33 | .17 | .41 | .17 | .15 | .35 | .15 |
| Expected range of the mean (at the 5% level)* | 14.6–16.4 | 10.2–13.4 | 14.0–15.6 | 15.0–16.4 | 10.9–13.5 | 14.3–15.5 | 15.7–16.3 | 11.6–13.2 | 14.9–15.5 | 15.7–16.3 | 11.6–13.0 | 14.8–15.4 |
| Coefficient of variation | 27.1 | 32.2 | 29.6 | 26.2 | 32.2 | 28.8 | 20.5 | 34.9 | 25.1 | 21.0 | 34.6 | 25.9 |
| Standard error of the difference of two means multiplied by 1.96 (at the 5% level)† | 2.08 (significant) | | | 1.63 (significant) | | | .78 (significant) | | | .71 (significant) | | |

*This shows the 95 per cent confidence limit of the mean years of schooling of inventors in the samples. The sub-samples of the assigned and unassigned patents *inter se* could be regarded as random samples of the same population.

†This is the standard error of the difference of two percentages, assigned versus unassigned, multiplied by 1.96, given as the test of significance at the 5 per cent level. Where the difference is significant, the standard error of the difference of the two means multiplied by 1.96 is smaller than the observed difference.

## APPENDIX II

### TECHNICAL ASPECTS OF THE HEAT TREATING OF METALS

Both the practice and the theory of the heat treatment of metals cover a very diversified field and, due to the many alloys and purposes involved, cannot be discussed completely and consistently in a few words. While a very old art, the underlying theory has only recently become understood and much still remains to be learned. The following therefore may be taken as a reasonable approximation, for the convenience of the layman.

Metals in the solid state are crystalline, individual crystals being known as "grains" which are of irregular shape and usually of microscopic size. Each grain consists of molecules or atoms arranged in orderly lines and planes. At the grain boundary the material is somewhat disorganized, that is, not perfectly crystalline.

The metal is capable of taking into solid solution certain materials which are added and this solubility increases with temperature. For example, iron in the solid state will dissolve a certain amount of carbon, making "steel." Aluminum will dissolve a certain amount of copper, and so forth.

### *Solution and Precipitation*

The simplest phenomena of hardening occur in the non-ferrous alloys. This is known as "solution and precipitation." The hardening additive, for example, copper, reacts chemically with a certain amount of the parent metal aluminum, forming hard particles of $CuAl_2$. Upon heating, this dissolves in the parent metal up to a maximum amount just below the melting temperature, and is then present in the form of atoms or molecules distributed through the crystalline grains. As such, the material has a perceptible but moderate hardening effect.

Upon cooling to room temperature, solubility decreases and the hardening constituent tends to precipitate out in the form of fine particles. When these particles are of a critical minimum size and maximum number, they exert a keying effect upon the crystalline planes of the grains.

Force exerted upon a metal tends to cause permanent deformation by "slip" along the crystalline planes. This takes place quite easily in pure metals which are consequently soft. The presence of key particles tends to resist deformation and therefore to increase the hardness and strength of the material.

If the key particles are too large and consequently fewer in number, more crystalline plane areas are unkeyed and therefore slip becomes easier and the metal less hard.

In hardening a metallic alloy of this type, it is therefore necessary to get the hardening constituent into solid solution to a maximum degree, then cool rapidly to prevent its precipitation in relatively large particles. At first, the alloy element may remain in atomic or molecular suspension, having a moderate keying effect.

Reheating to a moderate temperature (for some materials atmospheric temperatures are adequate), the suspended material tends to form minute key particles of maximum number and hardening effect. This is known as "age hardening."

If heating is continued too long or done at too high a temperature, key particles are oversize and have less keying effect on the metal which is then more soft. Depending to the degree to which this takes place, the operation is known as "tempering" or "annealing."

Crystalline grains tend to grow in size when heated. The larger grains tend to absorb the smaller ones by adapting material at the grain boundaries to their own orientation.

Grain boundary material itself being less crystalline tends to oppose deformation. Hardness of metal is therefore affected by the grain size, being harder the finer and more numerous the grains.

Annealing and tempering therefore, in addition to the effect above described, tend to cause grain growth and consequently softening.

### *Recrystallization*

Steel and most other ferrous alloys present an additional phenomenon which is extremely important in hardening. When heated above a certain critical temperature, the crystalline pattern or atomic arrangement of iron undergoes a change. Old crystals are obliterated and new very small ones take their place. At elevated temperatures, these new fine grains tend to grow rapidly. However, if cooled promptly after the transformation, grain growth is prevented and a very fine grained matrix is obtained, which is consequently hard.

Non-ferrous alloys do not have this characteristic of recrystallization. Therefore, steel has *two* hardening effects: (1) Solution and precipitation as above described, and (2) Extreme grain refinement due to recrystallization. These comments will help to clarify the explanation of various heat treating operations which follows:

### *Hardening*

A *non-ferrous* alloy is heated to the highest allowable temperature without causing incipient fusion, thereby putting a maximum of the hardening constituent into solid solution, then rapidly cooled. In this condition it is not fully hard because the hardening constituents are in suspension. The next step therefore is "age hardening" consisting in reheating to some specified moderate temperature which results in precipitation of a maximum number of hardening particles of critical size. In some alloys this takes place spontaneously at room temperature. Hardening of such alloys can be prevented by keeping them at a low temperature, as in dry ice. Age hardening is then suppressed until the material is removed from this refrigeration, whereupon it takes place spontaneously, or at a specified moderate temperature.

For *steel,* hardening consists in heating above the "transformation" temperature, at which the crystalline change of atomic arrangement takes place. At this temperature steel or iron has a maximum power to dissolve the hardening constituent, carbon.

Upon rapid cooling, the carbon is retained in suspension and a very fine grained structure is created when the metal returns to its normal atomic pattern at room temperature.

Additional hardness takes place either spontaneously or by moderate heating, resulting in the creation of critical hardening particles, of the compound "carbide" ($Fe_3C$).

Rapid cooling also tends to retain some of the high temperature constituent, known as "austenite," which is soft. This, like the suspended hardening constituent, is unstable at room temperature and slight heating tends to convert it, resulting in an increase in hardness.

For some purposes, it is necessary to cool to very low temperature as in dry ice, to complete the transformation.

### *Hardening Stresses*

Upon heating a metal there is normally thermal expansion, and equivalent contraction when the metal is cooled. Steel tends to expand up to the critical range, then during transformation, to *contract* in volume. When transformation is complete, expansion takes place at a more rapid rate than before. Upon recooling, contraction takes place down to the critical temperature, whereupon there is a sudden expansion, after which there is normal contraction.

Obviously, therefore, severe internal stresses are caused in steel when hardened, because the outside will cool more rapidly than the interior, and therefore there will be opposing contracting and expanding effects within the piece. This phenomenon calls for considerable skill in hardening to avoid deformation or rupture.

When finally cooled, the piece may contain large residual stresses. Tempering, (in addition to stabilizing the material causing a moderate increase in critical hardening particle size, and slight grain growth), permits internal adjustment of the crystals to relieve residual stresses. The presence of internal stresses detracts from the external strength of the material and their removal therefore increases its useful strength. Failure to temper may even result in spontaneous rupture at room temperature.

### *Case Hardening*

Steel has the ability to absorb hardening constituents at elevated temperature by solution into its surface. These tend to penetrate to a moderate extent, depending upon time and temperature. A part then consists of a "core" of the original material, which is ordinarily relatively low in hardening constitutents, and a surface layer known as a "case," which is high in hardening constituents.

### *Carburizing*

A common form of this process is known as "carburizing." It may be done by surrounding the metal with solid carbonaceous material, such as charcoal, or by a gas having the ability to release carbon, or by molten salts including cyanide, for a shallow case.

Such a carburized steel must be hardened. Sometimes this is done in a single operation for the case only or for the case and core combined, and sometimes in two successive operations, one to harden the core and the other to harden the case. Such parts should have a hard wear-resisting surface and a tough, ductile, strong core.

### *Nitriding*

Certain alloy steels can also be surface hardened by the absorption of atomic nitrogen which combines with certain elements in the steel, forming "nitrides." These have a similar hardening effect to the carbides in carbon steel. An important difference is that this absorption of nitrogen takes place at a relatively low temperature, about 1000°F, and confers hardness *without necessity* for *quenching.* This process is known as "nitriding."

### *Annealing*

When steel or non-ferrous alloys are heated to an elevated temperature but safely below the melting point and slowly cooled, grain growth takes place and hardening constituents are precipitated in particles or layers of maximum size. Both of these phenomena contribute to maximum softness.

There are various intermediate annealing operations intended to control grain size and the size and distribution of hardening particles for best machinability, cold working capacity and so forth.

### *Stress Relieving*

Another form of annealing is "stress relieving." This consists in heating to a moderate temperature, usually in the neighborhood of 1000-1200° F and holding long enough to relieve residual stresses due to previous cold working, welding or other causes, then cooling slowly, as in the furnace.

### *Retarded Quench*

"Austempering" and "martempering" consist in quenching into a liquid medium at elevated temperatures in the range 200-600°F, (adjusted for the particular alloy and mass of which the part is made) to avoid the severe effects of rapid quenching down to room temperature. The transformation may be partially or fully completed during immersion in the hot bath, or at room temperature after removing therefrom. This contributes to toughness of material and minimizes deformation.

### *High Speed Steels*

Namely, those which retain their hardness when cutting speeds are so great as to make the tool edge red hot, must be hardened from temperatures in the neighborhood of 2150-2400°F. This is followed by a suitable tempering treatment, which by the phenomena above described, brings the hardness of the metal up to a maximum, where it will remain at operating temperatures of approximately 1000-1200°F.

### *Normalizing*

"Normalizing" is a specialized form of "hardening-annealing" in which the steel is heated above its critical range, held long enough for saturation and then allowed to cool freely in air. For plain carbon steels, this gives a reasonably fine grained, tough and moderately strong structure. For some alloy steels, it will be equivalent to full hardening and will give a steel of high strength and tool hardness. (Air hardening steel)

The use of the term "normalizing" to cover the operations of annealing, stress annealing, etc., is incorrect.

*Cooling Curves or S-Curves*

Modern research has made available "cooling curves" showing the reaction of a particular steel to various rates of cooling from above the critical range to room temperature. These are complex but highly useful to the skilled metallurgist in determining procedure.

*Stainless Steels*

Certain alloy steels, known as stainless steels, require a "full annealing" which consists in heating to a temperature where maximum solution of corrosion-resistant elements takes place, namly 2150-2250°F followed by cooling at sufficient speed to prevent precipitation of the hardening constituents, usually to blackness within three minutes or less. This type of alloy, known as "austenitic," is not hardenable by heat treatment. It is non-magnetic.

There is another type of stainless steel which is hardenable by heating to approximately 1800° and cooling rapidly, for example, in air, followed by tempering. These are known as "martensitic" stainless steels and are magnetic.

If either of these steels are overheated by welding or other operations, corrosion resistance will be reduced. Full re-heat treatment is necessary to restore it.

*Selective Hardening*

Instead of case hardening, certain steels may be hardened to a desired depth by heating the surface only, and then cooling. One method is "flame hardening" which is ordinarily done with the oxy-acetylene flame. Another method is "induction," whereby the surface is heated to the desired depth by eddy-currents induced in the metal by means of high frequency alternating currents carried in a surrounding conductor. The conductor is ordinarily of copper tubing through which cooling water passes to prevent it from being heated.

These methods permit hardening a material to a desired depth and at isolated areas. For example, a certain length of a shaft may be hardened for bearing purposes or the teeth only of a gear may be hardened without disturbing the dimensions of the body of the gear.

*Much to Be Learned*

While the heat treatment of steels is older than history (at least 10,000 years) more has been learned during the last 25 years than in all of the preceding time as to the nature of the hardening phenomena and the control thereof. Much remains to be learned.

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