IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF ILLINOIS
EASTERN DIVISION

THE FINNEY COMPANY, a Partnership, Plaintiff - vs JFD ELECTRONICS CORPORATION, a Corporation, and THE UNIVERSITY OF ILLINOIS FOUNDATION, a Non-profit Corporation, Defendants	CIVIL ACTION NOS. 65 C 220 and 65 C 671 (Cons.)

The deposition of Dr. Paul E. Mayes was taken in conference room 468, EEB, of the antenna laboratory . Electrical Engineering Department, University of Illinois, Urbana, Illinois, beginning at 9:00 A. M., January 17, 1967, continuing through January 18th and 19th before Marjorie W. Yelvington, Notary Public and CSR; said deposition being taken by Notice by the plaintiff.

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I N D E X

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DEPOSITION OF DR. PAUL E. MAYES

The witness being first duly sworn upon oath, testified as follows:

CROSS EXAMINATION
BY: MR. PEARNE

Q Dr. ~~Mann~~ Mayes, would you please give your name and residence address?

A Paul Eugene Mayes, 1506 Waverly Drive, Champaign, Illinois.

Q What is your occupation or profession?

A Professor of electrical engineering, University of Illinois.

Q In what department?

A Electrical engineering.

Q With what phase or aspect of electrical engineering are you most closely connected in your work?

A Electromagnetic theory and antennas.

Q Are you employed or retained in any manner by JFD, one of the defendants in this action?

A Yes.

Q Would you state the nature of that employment or retainer?

A Technical consultant to the JFD Research and Development

Laboratories in Champaign.

Q What are your principal duties and responsibilities in your position in the engineering department of the university?

A I teach in the electrical engineering department and also supervise graduate students in conducting their research for advanced degrees, and I am associate director of the Antenna Laboratory.

Q What are your duties and responsibilities in your work for JFD?

A I consult with their engineering staff with regard to design of prototype antennas, review data that has been taken in evaluation of these antennas, make suggestions about modifications of design. I review the test data on antennas which are produced in their manufacturing plant and consult with their engineering staff with regard to patent applications. I think those are the principal duties.

Q Do you from time to time have brought to your attention by JFD for study antenna performance problems encountered in the field for which instructions might be sought?

A Yes.

Q Do you consider work being done by JFD in the development of new antennas to meet any problems either technical or in the market?

A I don't understand the question.

(Question read by the reporter.)

A Yes.

Q Do you do any actual antenna work for JFD?

A I have.

Q In your work in the electrical engineering department at the university are you generally familiar with the work done by others in the matter of research and development in the antenna laboratory?

A Some that I have direct relationship with in a supervisory manner, I am more familiar with their work than others.

Q Is there any particular aspect of the work in the antenna laboratory which you are more closely associated with in that way in the sense of supervisory work, than others?

A Yes, in work on broad band and frequency independent antennas and the area of superdirective antennas.

Q I show you a copy of a patent to Dwight E. Isbell, #3210767; are you familiar with that patent?

A Yes, sir.

Q Are you familiar with the work on which that patent was based?

A Yes.

Q Were you familiar with it at the time it was going on?

A Yes.

Q Are you familiar with the records that were kept on that work as it was in progress?

A Yes.

Q Are you familiar with the practical applications of the subject matter of this patent?

A Yes.

Q Will you state generally to what the patent relates?

A The patent describes a method of obtaining frequency independent performance ~~of~~ over theoretically unlimited band widths by using a number of dipole elements in a simple linear form which are all connected to a two wire transmission line which is transposed between adjacent dipoles. The dipoles are of various lengths according to a proposed mathematical relationship and spaces between adjacent dipoles are predetermined in like fashion.

Q For convenience in the course of this deposition this patent will be referred to hereafter as Isbell patent 767, those numbers being the last three digits of the patent number. Are you familiar, Dr. Mayes, with the practical applications of the subject matter of the Isbell 767 patent to military needs?

A Yes, somewhat.

A Yes.

Q Prior to that did you try to keep yourself familiar with patents, publications, trade journals, and the like that were published in the area of antennas generally, or was your attention focused in a certain narrow area?

A Your question had about three parts to it.

Q I am afraid it did; shall we start over again?

A Yes, separate them.

Q Was there any particular field prior to 1960 in which you made an effort to be familiar with patents and publications that were issued and circulated?

A I'll still have to say yes and no with regard to patents and publications because publications in the antenna field, with respect to specific antenna theory, I made an attempt to be familiar with. Prior to filing of the patent applications I made no attempt to remain familiar with the patents in the antenna field.

Q And did you begin to follow and study patents that had been issued in the past and issued currently in the antenna fields along about 1960 when these patent applications were being processed?

A Yes.

Q Was a Dr. DuHamel associated with the antenna labora-

tory of the University of Illinois sometime prior to 1959?

A Yes.

Q Do you know roughly what period of time he was associated with the antenna laboratory?

A Roughly 1953, 1957.

Q Did he leave in 1957?

A I am not sure but it was approximately then.

Q In connection with your work for the antenna laboratory were you in the practice of familiarizing yourself with publications by the electrical engineering department relating to development work done in the antenna laboratory?

A Would you repeat that?

(Question read by the reporter.)

Q Strike the question; I'll rephrase it. Let me start off by asking you when you became associated with the antenna laboratory at the University?

A September 1, 1954.

Q After you became associated with the antenna laboratory did you develop the practice of familiarizing yourself with publications by the electrical engineering department of the University that related to antenna development work in the antenna laboratory?

A The term "familiarize", I don't know if that's appropriate. Some of these reports I actually participated in the preparation of them. Others I was involved in the review process for them, and still others I had very little to do with.

Q When did you have occasion to participate in any review process relating to such publications; when did you begin to do this?

A It was roughly at the time that Dr. DuHamel left the laboratory. There may have been some incidental contributions to the review process before that time, but I didn't have major responsibility in this area until he left.

Q Did you acquire that responsibility about 1957?

A Approximately, yes.

Q And did you continue to have that primary responsibility for a long period thereafter?

A Yes.

Q Do you still have it?

A Yes, with regard to some reports, not all.

Q In what particular areas or classifications would the reports fall that you did have such responsibility for?

A These were generally generated under research contracts, of which I was one of the supervisory personnel.

Q With whom would those research contracts have been made, presumably by the University with what other party?

A Do you want a list of all of the contracts?

Q No.

A There are various agencies, primarily the defense department, National Aeronautics and Space Administration.

Q Would the Air Force have been one?

A The Air Force is one, yes.

Q Referring to the Isbell 767 patent and the Mayes Reissue Patent and the Carrel 376 patent, was the work that gave rise to those three patents all done under a government contract with the University?

A Yes.

Q Was that contract a contract with the Air Force #AF 33 (616)-6079?

A I don't recall the contract number but it's a matter of record.

Q I show you one of the University publications and ask if that would enable you to confirm the contract on which the work of those three patents was done?

A It would confirm the work with respect to the Isbell patent. I am not sure the same contract number pertains to the others.

Q I show you another publication. Would that enable you to determine that the work on the Mayes, et al. Reissue Patent and Carrel 376 patent was also done under the same government contract?

A Not completely. I don't remember when the contract #6079 expired and the successor contract began.

Q Referring to the contract that I mentioned by number, and for brevity ~~am~~ referring to it as the 6079 contract, I show you a copy of that contract, commencing date May, 1961, and ask you if you can clarify from that under what contract the work was done that gave rise to these three patents?

A We have already established that the Isbell work was done under 6079. Then a part of the work on the Reissue 740 and Carrel, et al. 376 was also done under 6079, but there may have been some work on other succeeding contracts in the same areas, I don't recall.

Q I would like to ask the reporter to mark the 6079 contract for identification as Plaintiff's Exhibit 1.

(Plaintiff's Exhibit 1 marked for identification as of January 17, 1967.)

Q I would like to state for the record that this is a document consisting of twenty-seven sheets respectively bearing document numbers applied by counsel for pur-

poses of identification, 5001 to 5026 inclusive, except that the second page of the document bearing #1A was apparently inadvertently not stamped with a document number in the 5,000 series.

Dr. Mayes, I show you a copy of a letter produced by the University from C. C. DeLong to Wright Air Development Division of the Air Force of February 2, 1961, that refers to the inventions of Carrel & Mayes and of Mayes and Carrel and ask if that would indicate to you under what contract the work on the Mayes, et al. Re-issue patent and Carrel, et al. 376 patent was performed?

A That letter indicates that these were developed under Contract 6079.

Q I would like to ask that this letter be marked for identification as Plaintiff's Exhibit 2.

(Plaintiff's Exhibit 2 marked for identification as of January 17, 1967.)

Q That document having been stamped by counsel as Document #5262.

The document identified as Plaintiff's Exhibit 1 appears to be a supplemental agreement forming a part of 6079 and I would like now to ask the Notary to mark for identification as Plaintiff's Exhibit 1(a) another

document that appears to be the principal contract 6079, which document, Plaintiff's Exhibit 1 (a), consists of fourteen pages stamped by counsel with document numbers 5037 to 5049 inclusive, except that the fifth page was apparently inadvertently not stamped with a document number.

(Plaintiff's Exhibit 1 (a) marked for identification as of January 17, 1967.)

Will you refer to that document, Dr. Mayes, and particularly to the last page of it and tell me whether or not to the best of your understanding that last page describes work required to be performed under that contract?

A I would say that "the work required" is probably too strong with regard to the description of this statement of the work, this being a list of the projects upon which some research work was to be performed as personnel were available and subject to the interpretation of the supervisory people at the University.

Q Does Paragraph (1) on that last page of Plaintiff's Exhibit 1 (a) embrace the work that was done on the subject matter of the Isbell 767 Patent?

A Yes.

Q Is that also true, is that the work done on the sub-

ject matter of Mayes, et al. Re-issue patent?

A Yes.

Q And is that also true as to the work done on the subject matter of the Carrel, et al. 376 patent?

A Yes.

MR. FABER: I want to note my objection to this line of questioning. The document speaks for itself.

MR. PEARNE: I'll let the objection stand without comment.

MR. FABER: I didn't intend any comment.

MR. PEARNE: Was the work described in paragraph (b) of that page of the contract ever defined in any more detail in writing to your knowledge in the course of the performance under the contract by the University?

A I don't recall of any such further definition in writing.

Q Do you know of any documents that delineated in more detail what work was expected by the Air Force to be done by the University under that contract?

A No, sir.

Q Were there at any time during the performance of that contract any communications from the Air Force suggesting work that should be done under the contract?

A Written communications?

Q Yes.

A I don't recall of any.

Q If there were any, who would be most familiar with such communications and be able to produce and identify them, do you know?

A The originator of the communications I presume would be most familiar with them.

Q I mean at the University.

A So far as any person at the University is concerned, I think I would probably be as familiar as anyone here.

Q Is it true then that after the contract was entered into the University proceeded to perform its work under that contract without written suggestions or guidance or directives from the Air Force as to what should be done?

A I believe that's the case, yes.

Q The University merely proceeded to do what, in its judgment, it should do under the contract, made its reports and eventually finished its work on that basis?

A Yes.

Q How did the University or the antenna laboratory determine what specific programs or lines of investigation it would pursue in performing under that cont-

ract?

A The various research personnel have quite a bit of freedom in setting their own course of action, this being determined to be in our opinion the best policy or the way to pursue a research program. The individual research programs are, however, subject to review. The work is subject to review periodically by the supervisory personnel, and is subject to comment from other researchers in the laboratory periodically at research seminars and so forth, however there is no specific directive that a specific line of endeavor should be pursued.

Q How did the University decide what personnel would be assigned under that contract, development work?

A These assignments are usually made by the director of the antenna laboratory within the laboratory.

Q And would he not suggest any directive or instruction to such personnel as to the scope they would follow?

A He might issue some sort of boundary with respect to what area this particular person would work in.

Q Would this have normally been done in writing?

A No.

Q Was any work done by the antenna laboratory at the University in the area defined in the first paragraph of

the last page of Plaintiff's Exhibit 1(a) prior to the date of the contract which is indicated to be August 28, 1958? You may refer to that paragraph again if you wish.

A Well, the paragraph itself states "continued", so I presume in the preceding contract the work was already going on. I do know work with respect to log periodic antennas was under way prior to the time that Dr. DuHamel left the employ of the University.

Q I show you another document that appears to be a report of the antenna laboratory and ask you if the information on the cover page of that document would indicate what other contract prior work of that character may have been done under?

A This is work on log periodic antennas which was done under contract AF 33 (616)-3220.

Q The last referred to is identifiable as Antenna Laboratory Technical Report #19, and bears the contract number to which the witness referred in his answer.

Are you generally familiar with the work done under the last mentioned contract 3220?

A Yes.

Q Could you give us a brief summary of what that work involved so far as log periodic antennas are concerned?

A It's very difficult to remember exactly what happened with respect to these contract numbers. If there is some other way we could identify this work, the question would be much easier to answer. I don't know when this contract started or when it stopped and what was actually accomplished in that time period.

Q Let me approach the matter another way. Prior to the work by Mr. Isbell on which Isbell patent 767 was based, had work been done in the antenna laboratory on log periodic antennas?

A Yes.

Q Just for future reference, could you briefly describe the nature of that prior work as regards the character of the antennas that were worked on or worked with?

A The very first suggestive log periodic antennas were structures which were constructed from sheet metal. They were ~~plainer~~ planar in form but they had certain geometric relationships defining the outline of the sheet metal structures. The first antennas were linearly polarized and produced by directional beams.

Q What individuals in the antenna laboratory were most actively interested in the work you just mentioned?

A Dr. DuHamel and D. E. Isbell.

Q Did Dr. V. H. Rumsey, to your knowledge, have any part

in that work at that time?

A Yes, he had some part in it.

Q I would like to ask the reporter to mark for identification as Plaintiff's Exhibit 3 a paper headed University of Illinois disclosure of invention and letter of transmittal, comprising three pages that have been stamped by counsel as Documents 5254 through 5256.

(Plaintiff's Exhibit 3 marked for identification as of January 17, 1967.)

Dr. Mayes, are you familiar with the documents which have been identified as Plaintiff's Exhibit 3?

A Yes.

Q Could you tell me what that document is, please?

A This is a disclosure of invention and letter of transmittal to the University of Illinois patent committee made by Dwight Isbell with respect to the invention which resulted in the issuance of Isbell Patent 767.

Q Will you note part 3B of that document which covers the earliest conception date as September, 1958. Do you know of the existence of any documents or records made as early as September of 1958 that would disclose the subject matter of the invention of the Isbell Patent 767?

A No.

Q To the best of your recollection have you ever been aware of the existence of any such documents?

A No.

Q Mr. Mann, I would like to ask ifyou would agree to produce any such documents of that character that you would expect to rely upon to establish conception of the invention.

MR. MANN: Certainly. I might say incidentally, I wasn't planning to rely on any of those things unless there is a challenge that somebody has an earlier conception. As of the present time we have no such plan of going back and proving it up.

MR. PEARNE: I would like to ask the reporter to mark for identification as Plaintiff's Exhibit 4 a bound report headed Antenna Laboratory Quarterly Engineering Report, and additionally bearing the designation Report #2.

(Plaintiff's Exhibit #4 marked for identification as of January 17, 1967.)

Dr. Mayes, are you familiar with the report identified as Plaintiff's Exhibit 4?

A Yes.

Q I would like to ask the reporter to identify another report shown on the cover as Antenna Laboratory Report #1, as Plaintiff's Exhibit 5, and I would like to state for

log periodic type there described?"

"A. I believe that this is a description which would be sufficient for anyone with antenna design experience to construct a successful log period dipole antenna." Would you now agree with the statement you made in that deposition at that time?

A Yes, I think the statement I just made is in essential agreement with that statement also.

Q Referring again to the document Plaintiff's Exhibit 3, and particularly to Part 4(a) of that document on the second page, you will note a reference to disclosure of invention to others during "initial development" of the invention; do you know ~~that~~ when the invention as disclosed in the Isbell 767 patent was first disclosed to others by Isbell and to whom it might have been first disclosed?

A No.

Q You have already mentioned that you were in a supervisory capacity with reference to Mr. Isbell's work at that time; might the first disclosure have been made to you?

A No.

Q Mr. Mann, if you know of any documentary evidence as to when that first disclosure was made, would you agree

to produce it?

MR. MANN: I'll produce whatever we have.

MR. PEARNE: I would like you to refer to parts 4(b) and (c) of that same document.

MR. MANN: May I interrupt? Mr. Pearne, all we know about this aspect of the development of the invention by Mr. Isbell is the information that was gathered during the interference. All, to my knowledge, of the pertinent documents and testimony of people active in the field at the time is included in the record of the interference and I think that has been made available to you.

MR. PEARNE: Could we stipulate --

MR. MANN: We know of nothing other than that which would be contained in the interference file so far as either of these two requests you have made, evidence of earliest conception or evidence of first disclosure.

MR. PEARNE: Could we stipulate then that subject to your prompt disclosure to us of any evidence of earlier invention dates, when and if such dates should be uncovered, that we may introduce the record from the interference of Isbell invention dates as evidence taken in this law suit?

MR. MANN: Yes. If you introduce a portion, we can intro-

duce another portion, of course.

MR. PEARNE: Yes.

MR. MANN: In general our entire knowledge of the subject is that which has been developed for the interference and we have nothing in addition to that.

MR. PEARNE: If we can agree to that extent.

MR. MANN: I think we can agree to that extent.

MR. PEARNE: Dr. Mayes, I would like you to refer to parts 4 (b) and (c) of that same document pertaining to the first operating model of the Isbell invention and stating that it was made in December of 1958. Is that model still available to the best of your knowledge?

A I believe it is.

Q Could it be produced here?

A I am not sure that I could locate it right now. Parts of it perhaps, but I am not sure I know where all of it is.

Q Would you make an effort to locate it between now and Thursday morning when probably we will be resuming your deposition?

A Yes.

Q Will the reporter please identify these two photographs as Plaintiff's Exhibits 6 and 7 respectively, that bear document numbers applied by counsel A150

and A151 respectively. I would like to note that the two are stapled together with a small slip bearing the document number A149, and a notation regarding the two photographs.

(Plaintiff's Exhibits #6 and #7 marked for identification as of January 17, 1967.)

Dr. Mayes, are you familiar with the two photographs, Plaintiff's Exhibits 6 and 7 and with the antennas depicted there in?

A Yes.

Q Are they different views of the same antenna, can you tell?

A I don't know.

Q Do you know if either of them is a photo of the first model referred to by Isbell in Plaintiff's Exhibit 3?

A No.

Q Do you know if either of those photos closely resembles the first model referred to in Plaintiff's Exhibit 3?

A Any description of this particular antenna - it was a model that was used for radiation pattern tests and it's my recollection these were made subsequent to the development of the antenna.

Q Subsequent to what date as nearly as you can pinpoint it?

A I would say subsequent to probably February 1st, and that these are not the photographs of the first operating model of the antenna.

Q Would you be able to state a date by which that antenna would have been built and tested?

A This particular antenna?

Q Yes, the one shown in the photographs, Plaintiff's Exhibits 6 and 7.

A Not very accurately.

Q Roughly?

A By reference to some documents I could establish it approximately with much more accuracy. Now all I can say is that it was constructed some time between the 1st of January, 1959 and the time that Mr. Isbell left the employ of the University on June 1st of that year.

Q Could you determine this from available records?

A Yes, not exactly the date because I have no identification of this particular antenna, but we do have a test date on which radiation pattern performance was tested and it was the purpose of this model to test such performance.

Q In the course of your answers to questions so far you have made reference from time to time to a dipole; would you state what a dipole is in the technical ter-

minology you use?

A It's an antenna composed, usually, of two linear conductors which are approximately one-quarter wave length in the operating frequency, the two linear conductors being colinear with each other and have a gap between them which is a small fraction of the wave length of operation of the dipole.

Q When you refer to the wave length of operation of the dipole, if the dipole is operated on what is called its fundamental frequency, would that wave length be one-half the length?

A The length of the dipole from tip to tip would be approximately one-half wave length in fundamental mode of operation.

Q You mentioned that the dipole has a center gap; if there were no center gap and the dipoles were continuous from its opposite extremities, might it not be connected to a transmission line so as to operate in essentially the same manner as the dipole you described?

A I wouldn't say essentially the same manner. It could be made to operate in some fashion, but I would want to restrict the terminology of dipole to the combination of the two previously mentioned with a center gap.

Q And is that the sense in which you have used the word dipole in your prior testimony today?

A I believe so.

Q What characterizes the energy induced in a dipole in a one-half wave dipole when it's operating at its fundamental frequency as regards distribution of voltage and distribution of current?

A The current is Zero in the extremities of the dipole and very nearly maximum at the gap.

Q And is it commonly represented as one-half of a sine wave?

A Yes.

Q What's the voltage characteristic at the same time?

A It's maximum at the extremities and Zero in the center.

Q And that would be commonly represented diagramatically as a portion of the sine wave where the wave crosses the horizontal axis of the graph?

A Of the center, yes.

Q Are dipoles commonly made with considerable variation in their physical dimensions as regards length, width, and cross section?

A There are many different variations of antennas which are referred to as dipoles and I think the one we have been discussing is simply a more or less conventional

and the generally widely used dipole.

Q Of what kind of material would such a common dipole be made?

A Any good conductor such as copper, aluminum --

Q In the form of a rod?

A Or tubing.

Q Or thin wire?

A Yes.

Q Or flat sheet metal?

A Possibly.

Q If it were made of flat sheet metal is there any limitation on the relative dimensions of length and width that would be normal, as it were, to be called a dipole?

A I would say the aspect ratio should be fairly large to apply to the terminology of dipole.

Q What do you mean by aspect ratio?

A The ratio of length to the width.

Q Do I understand that the length should be relatively long compared to the width?

A Yes.

Q Are there any particular recognized limitations in that regard?

A Limitations - there are differences in performance in

respect to changes in aspect ratio.

Q Might a dipole made of flat sheet metal have a tip to tip length of say four times its width?

A Are you asking whether I would refer to such a structure as a dipole?

Q Yes.

A I might and I might not. I don't know whether I would want to draw any line as to what would be considered to be a dipole in a type of structure.

Q Have dipoles been used and referred to as dipoles when the two parts or opposite sides of the center gap are each made of an elongated loop of wire or rod or tubing?

A Yes.

Q Are those commonly called hairpin dipoles?

A Yes.

Q Are dipoles commonly used and referred to as dipoles where the portions on opposite sides of the center gap are generally triangular in form with one apex adjacent to the center gap and the width of the dipole increasing out toward the tips in each direction?

A Yes, but also other terminology is used for such a configuration.

Q Are those commonly called fan dipoles to your knowledge?

A This name has been used for that, yes.

Q Basically as to their mode of operation, do all of these physical forms of dipoles operate essentially the same?

A No, I wouldn't say essentially the same; there are differences enough between the operation and some are appropriate for some things and others are appropriate for others.

Q Would you describe the more significant respects in which their characteristics would differ?

A The triangular configuration you mentioned, the fan dipole also referred to as a bow tie, has a significant difference in input impedance with frequency as compared to some of the other dipoles with constant cross section.

Q Would the same be true as regards the dipoles on which the separate halves are made of elongated loop or wire or rod?

A To a lesser degree.

Q The same would be true also, would it not, with respect to a dipole made of flat sheets as compared to dipoles made of thin wire?

A To some degree, yes, depending on the aspect ratio of the flat sheet structure.

Q Namely the length to width ratio?

A Yes.

Q The aspect ratio would also to some degree involve the thickness of the sheet, would it not?

A I was presuming the thickness was thin enough it wouldn't really enter into consideration.

Q You are familiar also, I am sure, with what are called folded dipoles?

A Yes.

Q Might a folded dipole be described as a simple dipole of the type you first described in which the conductor continues from the extreme ends of the simple dipole but being bent at each end in the same direction and around and back toward the center to form a continuous conductor from the gap out to one end, around back parallel to the simple dipole portion, out to the other end and connected to the other end, and back to the center gap?

A Yes.

Q Such folded dipoles are commonly referred to as dipoles in the art, are they not?

A Yes.

Q When used in an antenna does a folded dipole perform basically the same function as a simple dipole?

A Yes.

Q What are its principal differences in operating characteristics?

A The input impedance is approximately four times the impedance at resonance of the simple linear dipole, and this relationship, four to one ratio, is also only one of the possible of several resonances which the folded dipoles ~~displace~~ displayed.

Q When one is concerned with an antenna of a plurality of dipoles that are connected in one way or another, one to another and to a transmission line, is it not practical to make - or has it not long been practical for many years, to make the same antenna either with simple dipoles of the type you first described or folded dipoles by making several adjustments in the connecting circuitry for differences in impedance value?

A I am not sure I understand the question. Do you mean is it possible to make an antenna which has been designed specifically to connect several simple dipoles and to replace those simple linear dipoles with folded dipoles?

A Yes, by making adjustments in the conductors that interconnect the dipoles and connect them to the trans-

mission line and by making adjustments in the relative spacing of the dipoles and other structural characteristics of the dipoles?

A It seems to me you have practically redesigned the antenna array. I would not want to say you could take simple linear dipoles and replace them with a folded dipole. Certainly you could not expect the same performance.

Q Are there not ~~any~~ many instances in which the same dipole array made of simple dipoles can be readily reconstructed by one skilled in the art to use folded dipoles?

A Yes.

Q Is it not well known in the art how to compensate in the interconnection of the dipoles and in relative spacings and in their connection to a transmission line for the differences in impedance you have pointed out?

A For some antenna designs this is a well known procedure.

Q Are you also familiar with what are called V-dipoles?

A Yes.

Q Is a V-dipole essentially, or may a V-dipole be essentially a simple dipole with the opposite halves on

either side of the center gap flared forwardly in the direction in which the antenna would operate as a transmitting antenna?

A The last restriction, the last part of your restriction I think is a little bit too specific with regard to directional operation.

Q Would you care to restate what you understand to be a V-dipole?

A I would say it's a simple linear dipole with the elements lying in a plane, the elements being disposed with respect to one another so that the angle ~~of~~ the plane between the two elements is less than 180 degrees.

Q And with such a dipole what's the direction of maximum energy transmission when used as a transmitting antenna?

A There may be no prevailing direction of operation.

Q Suppose it is operating at its fundamental one-half wave length mode?

A There may be no prevailing direction of radiation roughly speaking. The pattern may not be a perfect circle, but it can be very close to that, omni directional pattern, in other words.

Q In a simple dipole antenna containing only a simple dipole, would it not normally be practical to substitute what you have described as a V-dipole?

A Well, certainly you could substitute it, I don't know for what purpose or what you would expect in the way of results.

Q Do you know whether such substitution has commonly been made in the antenna art, say prior to 1950?

A Well, there are many antennas which use ~~the~~ V- dipoles. I don't know if I would describe them as being too much where a specific dipole has been substituted, but rather antennas designed to make use of the peculiar properties of the V-dipole.

Q Were there not prior to 1957 a wide variety of antennas made of simple dipoles and a wide variety of antennas made with v-dipoles that were essentially the same in their basic design as those made with the simple dipoles.

A No, I wouldn't agree with your evaluation of the equivalents because if they had been equivalent in design there would be little reason to use a V-dipole. I think a V-dipole has been used on those antennas for a specific purpose, in which case a substitution of a simple dipole would not have accomplished the same purpose.

Q When antennas are basically similar in design except one is made with a simple straight dipole and one is made with a V-dipole, what would the differences in

operation be expected to be?

A First of all in the vicinity of the first resonance, and there would be a broadening of the radiation pattern by substitution of the V-dipole for the simple linear dipole. In the vicinity of the second resonance there would be a marked difference between the radiation patterns of a simple dipole as compared to the V-dipole of appropriate dimensions and angle.

Q And in the vicinity of the second resonance, that would be when the dipole is operating at a wave length which is approximately three times the tip to tip length of the dipole?

A No, three halves.

Q It would be where the dipole is approximately three times the wave length of the frequency to which it is responding?

A No, 1.5 times the wave length.

Q Correct. This was well known, was it not, prior to 1958 in the antenna art?

A Yes.

Q Was it not also well known in the art prior to 1958 that various simple dipole antenna arrays could be redesigned to operate in the three half wave mode by substituting V-dipoles for simple dipoles?

A The term "redesigning" may imply a number of different modifications which would be necessary in the antenna in order to make this substitution possible.

Q But with that implication is it not true that that was frequently done prior to 1958?

A Yes.

Q And was not the purpose of doing that to enable the antenna to operate effectively on what would be called the third harmonic of the fundamental frequency?

A This is one purpose, yes.

Q Some questions back we discussed the similarities and differences between simple dipoles, hairpin dipoles, fan dipoles, and folded dipoles; those similarities and differences were also well known prior to 1958, were they not?

A Yes.

Q And the fact that all of them performed basically the same type of operation in an array was known prior to 1958, with the differences that you pointed out?

A It's difficult to know what you mean by basically the same. There are differences in operation of the dipoles and --

Q As you pointed out.

A And they are certainly all antennas if you mean by be-

ing basically similar, I have no reason to differ, but they are not all identical antennas and there are some differences in the performance that have to be taken into account with design of the array.

Q But those similarities and differences were well known prior to 1958?

A Yes, and I would say they were better known probably for the hairpin dipoles or what you could refer to as fat dipoles than they are known and we do recognize so far as the folded dipole is concerned.

Q Referring now again to the work on which the Isbell 767 patent was based, was that work based upon or performed in the light of any specific prior developments in the antenna laboratory?

A Well, it certainly was based upon the research done on log periodic antennas up to this time.

Q Was it based upon and performed in the light of the prior work that Dr. DuHamel did on the earlier log periodic antennas that you previously described?

A Yes.

Q Will the reporter please identify these four bound documents as Plaintiff's Exhibits 8, 9, 10 and 11. Plaintiff's Exhibit 8 being entitled Antenna Laboratory Quarterly Engineering Report, Report #9, and referring

to Contract #3220 - those are only the last four digits of the contract number. Plaintiff's Exhibit 9 is similarly entitled and designated Report #10 and refers to the same contract. Plaintiff's Exhibit 10 is entitled Antenna Laboratory Technical Report #19 and refers to the same contract. Plaintiff's Exhibit 11 is entitled Antenna Laboratory Technical Report #30, and refers to the same contract.

(Plaintiff's Exhibits 8, 9, 10 and 11 marked for identification as of January 17, 1967.)

Dr. Mayes, do the reports identified as Plaintiff's Exhibits 8, 9, 10 and 11 describe antenna development work in the antenna laboratory on log periodic antennas that preceded the work by Isbell on which his 767 patent was granted?

A Yes, although I would prefer you call it antenna research rather than antenna development.

Q Was the work on which the Isbell 767 patent was based performed primarily as an effort to provide more practical physical forms of antennas of the log periodic type described in those four reports?

A This was one aspect of the investigation. I would say it was also performed for the purpose of obtaining a wider variety of different types of operation than had

been present in some of the previous antennas that had been objects of investigation in the laboratory.

Q Prior to the work on which Isbell patent 767 was based, was work done elsewhere on log periodic antennas of the types described in Plaintiff's Exhibits 8, 9, 10 and 11?

A Yes.

Q I would like the reporter to identify this document as Plaintiff's Exhibit 12. It is entitled Logarithmically periodic Antenna Designs, and bears the authors' names, R. H. DuHamel and F. R. ~~Ore~~ Ore, and a date, 31-3-58.

(Plaintiff's Exhibit 12 marked for identification as of January 17, 1967.)

Dr. Mayes, are you familiar with the contents identified as Plaintiff's Exhibit 12?

A Yes, sir.

Q Does that report cover work, which at least in part, was performed elsewhere than the antenna laboratory?

A Yes.

Q And do you know if that work was done at Collins Radio Company?

A Yes, it was.

Q Going back to the reports identified as Plaintiff's Exhibits 8, 9, 10 and 11, were copies of those reports

produced in quantity by the antenna laboratory of the University at the time they were prepared individually?

A I believe about 250 copies perhaps were printed of these reports.

Q And were a considerable number of copies of each such report transmitted to the Air Force?

A Yes.

Q And do these reports contain distribution lists at the ends of these reports?

A Yes.

Q And were copies of the reports transmitted to the various parties named in the distribution lists?

A I presume they were.

Q Do you know if that was the normal practice?

A This was thenormal practice, yes.

Q Were other copies of the same reports commonly sent to other people by you or others in the antenna laboratory?

A People that are not listed in the distribution list?

Q Yes.

A Yes, in some instances subsequent to request by some people for information.

Q Did you commonly receive requests from outsiders for information regarding the work of the antenna laboratory on log periodic antennas?

A Yes.

Q And the antenna laboratory supplies of reports such as plaintiff's Exhibits 8, 9, 10 and 11, were commonly used to fill these requests for copies?

A So far as they were available.

Q And were copies of such reports normally placed in various libraries of the University?

A I don't believe so.

Q Don't you know as a fact that copies are on deposit currently in a number of libraries on the campus of the University, sir?

A I don't know that, no.

Q You don't know that? Were copies of such reports freely supplied to interested parties who wrote and asked for them as long as there was a supply?

A Not in all instances, no.

Q Was there any particular restrictive policy in that regard?

A There was not any very well defined policy, but in some instances reports were not supplied even though requested.

Q For what reasons would they not be supplied?

A In instances where it was considered that the organization had no research facilities or production facilities

or any personnel that could have made use of the information. In some instances the reports were of limited supply and it was felt it was best to conserve the supply for the people who would make best use of the information.

Q The objective of the restriction was insofar as was possible to see that the available supply went to the people most genuinely and seriously interested in the subject matter?

A Yes.

Q Two of those reports, plaintiff's Exhibits 8 and 9, are entitled Quarterly Engineering Reports and two are entitled Technical Reports; could you explain the difference in the classification and the reason for it?

A Quarterly Engineering Reports are issued periodically and are brief summaries which contain information about all of the work that has been done on the contract during a quarterly period of time.

Q On the contracts to which the reports pertain?

A Right. The technical reports are issued as material of a specific reportable nature is obtained and there is no definite scheduling for the technical reports.

Q Do you know if the preparation of the technical reports was required by the contracts to which they refer or was

simply done voluntarily by the University?

A I believe it's a stipulation in the contract that reports of both types plus some other reports are to be prepared in fulfilling the contract terms.

Q Now, do the same remarks about the handling of the reports, Plaintiff's Exhibits 8, 9, 10 and 11, also apply to the reports, Plaintiff's Exhibits 4 and 5?

A Yes.

Q And so far as the preparation and printing of copies and distribution of copies is concerned, would those remarks also apply to all of the Quarterly Engineering Reports and Technical Reports prepared by the antenna laboratory under the 3220 contract and the 6079 contract?

A There is some difference perhaps I should clarify between the way in which the technical reports are distributed and the quarterly engineering reports are distributed. I think it is the exception that we would send a quarterly engineering report to an individual who has asked for information about our research program, but rather we would send the technical report in response to such requests.

Q What would have been the reason for that choice?

A Generally the quarterly engineering reports are of such abbreviated nature that they are not very useful for

someone trying to make use of them in their work of some of the work we have done.

Q This was not because of any policy of limiting the distribution, but rather of supplying the most helpful information?

A Yes.

Q If a party having a legitimate reason for wanting a quarterly engineering report asked for one and you had available copies, he would be given one?

A In general we would honor such a request except as we are restricted by the Air Force, like overseas distribution and things like that.

Q But those terms don't apply to distribution within the United States?

A No.

Q In your deposition in the Isbell interference when asked about the frequency with which reports were issued by the antenna laboratory, you stated, "the so-called quarterly engineering reports were prepared of course every three months. There were more frequent reports of a more eminent nature that were prepared monthly." What were those monthly reports and for what purpose were they prepared and how were they handled?

A Monthly reports or letter reports, they are not pub-

lished as such, but merely typed in sufficient copies to satisfy the Air Force contractual requirements.

Q What generally was the nature of the contents of the monthly reports as compared to the quarterly engineering and technical reports?

A The monthly reports were again an abbreviated description of the work which has been performed on the contract during the preceding month and also contained some financial data in respect to the contract.

MR. PEARNE: This, so far as I am concerned, would be a very convenient time to adjourn for lunch.

(Whereupon this deposition was adjourned at 12:00 Noon and resumed at 1:00 P. M. on the same day.)

MR. PEARNE: On the record, may we stipulate that counsel for the respective parties may retain the original copies of exhibits being introduced on behalf of their clients subject to production for inspection and copying by the other party at any time and they will be supplied at the trial?

MR. MANN: That is agreeable to us.

MR. PEARNE: Dr. Mayes, I would like to go back for a moment and try to clarify the relationship between simple dipoles and V-dipoles in one respect that I failed to bring out. Would you agree that V-dipoles operate most

effectively on the fundamental one-half wave mode and odd higher harmonics of this mode, namely the three half wave mode, five half wave mode and seven half wave mode, depending on the included angle between the two elements of the V-dipole?

A Do I understand you to mean there are optimal angles of operation for each of these different modes?

Q I didn't mean to suggest that; I meant subject to any required variation of the included angle, a V-dipole would operate most effectively on frequencies corresponding to the one-half wave mode, three half wave mode, five half wave mode, etc.

A I would say the simple linear V-dipole has resonances to each one of the wave length to length relationships which you have mentioned, however will operate at various other frequencies as well but not in a resonant manner.

Q And that for most radio and television transmission and reception purposes, and speaking in a broad general way, you would say that its operating characteristics are best at those various resonant frequencies corresponding with these one-half, three half, five half wave modes, etc.?

A Yes, but that may be altered. This is not essential,

but it's a customary practice.

Q And is the particular higher harmonic mode at which the V-dipole operates most effectively affected by the included angle between the two legs of the V?

A Yes.

Q Does there appear to be a different optimum angle for each of the different modes?

A Somewhat different, yes.

Q Now, if one took a simple rod dipole and V'd the two elements forwardly to produce a V-dipole, assuming you were selecting an appropriate included angle between the two elements, wouldn't it be expected there would be broad dual mode operation in its fundamental half wave resonant frequency and its three half wave resonant frequency?

A It certainly will operate in these two frequencies in a particular manner. I am not sure this would necessarily be appropriate for any and all applications of such a configuration.

Q Let's assume we are talking about an antenna of which the active elements consist of a single V-dipole made by V'ing the elements of a simple dipole forwardly, the effects being expected to provide dual mode operation in the half wave resonant mode and three half wave.

A It would operate without being on that too.

Q Yes, but it would operate on the three half wave mode?

A Are you saying that the operation on three half wave mode with respect to activity and gain would be improved by changing the angle from 180 degrees?

Q Yes. Now would V'ing the two elements of a simple dipole forwardly into a V-dipole form effect the operation ~~from~~ the fundamental half wave mode?

A It would broaden the radiation pattern.

Q Would it not slightly reduce the forward gain depending upon the aspect ratio of the elements?

A Yes.

Q And would it not provide a slight front to back ratio, the amount depending upon the aspect ratio of the elements?

A Yes.

Q One would never expect the operation of a simple dipole to be improved on its half wave mode by V'ing the elements forwardly, would one?

A It depends on the application. If one were looking for an omni directional, it would not be improved.

Q Were all of these characteristics and the relative characteristics of simple and V-dipoles that we have just discussed well known prior to 1958?

A Yes.

Q Isn't it also true that a simple rod dipole can be similarly affected in its ~~position~~ operation by changing its aspect ratio as by making it of larger diameter or smaller diameter?

A Yes.

Q If one made an antenna of the rod dipole type according to the instructions in the Isbell patent or the disclosure in the Isbell 767 patent, and used, say, six active dipoles and designed the antenna to cover the VHF low band of television, and if one selected appropriate values for the various parameters disclosed in the Isbell patent, would not that antenna operate essentially the same with very little difference in its directional gain and pattern if one simply substituted folded dipoles for simple dipoles?

A I don't believe so.

Q Why?

A The impedance characteristic of the folded dipoles is quite dissimilar from that of the simple linear dipole and when you have a number of different dipoles of different lengths connected together to a feed line in a configuration such as described in Isbell 767, it is the off resonant frequency impedance characteristics

A There is a possibility.

Q Would you expect it to?

A I would not like to conjecture; it would be a conjecture.

Q Referring to the DuHamel and ~~deer~~ Ore publication, Plaintiff's Exhibit 12, with which you previously said you were familiar, were any of the developments described in that publication made in the antenna laboratory of the University?

A Yes.

Q Prior to the March 31, 1955 date of publication?

A Yes.

Q I am not implying that this is necessarily the publication date in case you have an objection. Did Dwight E. Isbell participate in that work to your knowledge?

A Yes.

Q Referring to Figure 1(a), Plaintiff's Exhibit 12, does that figure show what might be called a toothed sheet conductor material ~~such as~~ with the material lying in a single plane?

A Yes.

Q And if the plane of the sheet were vertical would that antenna radiate in a horizontal direction or in horizontal directions normal to the plane of the sheet?

A Yes.

Q both forwardly and rearwardly with respect to the antenna as you are looking at it?

A Yes.

Q Could we characterize that antenna as being composed of two complimentary halves that are generally pie shaped with their apexes directed toward each other?

MR. MANN: Isn't it obvious what the shape of the antenna is?

MR. PEARNE: I am asking the question merely to provide reference for some further questions.

MR. MANN: I just wanted it understood to the extent that my question goes to claim language. We have patents covering those antennas and I do not want this to be, in effect, Dr. Mayes characterizing the claim language of any patents. He is not a lawyer and is not qualified to give opinions as to legal terms.

MR. PEARNE: If any of these words are present in the claims I was unaware of it, Mr. Mann.

A May I ask you to repeat the question?

(Question read by the reporter.)

Q And so that no resemblance to any patent claim language is employed - so far as I know, none exists in my question.

A There are two words in your description of the antenna which in a layman's point of view probably could be interpreted as you have described it. I have had discussions with patent attorneys about the use of the term "pie shaped" and I don't agree with it, but I would say generally with that minor modification, your description is agreeable.

Q Perhaps I could pick better language by saying that the complementary halves could be circumscribed by sectors of circles and would have straight sides converging to an apex in each case and the apexes would be closely adjacent but not touching in actual use.

A Yes. Perhaps it would be well to clarify what you mean by complementary. The technical term, I don't think it's utilized in this particular instance in that way.

Q Could I state it this way, in one of the halves teeth are formed which correspond in size, shape and configuration to the cut away portion of the opposite half?

A If you could describe exactly how they correspond because there is a symmetry involved in the structure and it's very difficult to place in words.

Q I think we have clarified this enough for the background I need. Would a pair of feeder conductors of

a two wire transmission line or a two wire coaxial transmission line be connected to the two halves of the antenna at their adjacent apexes?

A Generally, yes.

Q What would determine the lowest frequency or longest wave length to which that antenna would respond in normal operation as you previously described it?

A The dimension of the largest tooth.

Q What dimension?

A Length.

Q Measured from where?

A Well, as long as I don't say what frequency it could be measured from anywhere.

Q Would the lowest half wave resonant frequency have a one-half wave length roughly corresponding to the length of the tooth and perhaps extending at least partially in toward a center line bisecting the apex angle?

A I think the question is redundant; there is no question there.

Q May I rephrase the question by striking out my first reference to one-half wave and would you reread the question with those words eliminated?

(Question read by the reporter.)

A I replace the words "lowest resonance" - do you have

A Not necessarily.

Q Would the diameters of those conductors progressively increase from the front toward the rear of the antenna to conform more precisely to log periodic theory?

A No.

Q Referring again to Fig. 2 of the DuHamel & ~~the~~ the publication, Plaintiff's Exhibit 12, if the two complementary halves were moved closer together so that the angle Psi were close to Zero, is it not true that the resulting antenna would roughly approximate the antenna in Fig. 2 of the Isbell patent except for differences in the configuration and spacing of the teeth compared to configuration and teeth of the Isbell patent?

A There is superficial physical resemblance between the two antennas but marked difference between electrical performance.

Q Could you state what those differences are generally, the nature of the differences?

A Yes, the impedance of the antenna of Figure 2 in Exhibit 12 varies with frequency to a great degree as opposed to variation with frequency of an appropriate design of the type described in Isbell 787.

~~Q Does that next with your approval, that change?~~

~~A That change?~~

MR. MANN: With frequency.

A Yes, I believe that's the way I stated it originally.

MR. PEARNE: If your last answer is correct, isn't that inconsistent with any characterisation of the antenna of Fig. 2 of Plaintiff's Exhibit 12 as a frequency independent antenna?

MR. MANN: I object to that question. I think the characterisation is the characterisation in the report, I assume. I don't think Dr. Mayes has characterised that as having any particular properties. Incidentally he hasn't worked on that particular antenna, or not to the extent involved here.

MR. PEARNE: Are you aware that the antennas of Figures 1(a), 1(b) and 2 of Plaintiff's Exhibit 12 are characterized as a class of frequency independent antennas?

A They have been called that, yes.

Q Then may I repeat my former question? Isn't the variation in impedance with frequency that you referred to in the antenna of Figure 2 inconsistent with characterising it as a frequency independent antenna?

MR. MANN: Isn't that clearly a question of opinion?

MR. PEARNE: I think it is a pure question of fact.

MR. MANN: I think you would have to ask the question clearly asking for Dr. Mayes opinion as an abonna ex-

part, whether he agrees with this purported characterization.

MR. PEARNE: Would you characterize the antenna of Figure 1(a) or1(b) or 2 of Plaintiff's Exhibit 12 as a frequency independent antenna?

A I would say antennas constructed according to these figures can be very nearly frequency independent in some of their operations and it's been customary to refer to them as that because of this possibility.

Q And just so we understand what we mean here, isn't it true that whenever one characterizes an antenna, a practical physical antenna as being a frequency independent antenna he merely means it is to a very great degree independent of frequency in its operating characteristics, not completely independent?

A True.

Q Now, your answer about the comparative impedance changes of the antenna of Figure 2 of Plaintiff's Exhibit 12, and the antenna of Figure 2 of the Isbell Patent would seem to me, if I understand your answer, that the antenna of the Isbell patent is somewhat more frequency independent in that particular respect at least than the one in Fig. 2 of the publication.

A We are not comparing - if you recall your earlier ques-

tion, on the antenna of Figure 2 we were comparing the antenna of Figure 2 with psi equal to zero to the antenna of Isbell 767.

Q That clarifies the point I was driving at. Referring to the first paragraph of the specification of the Isbell 767 patent, you will note the reference to the patented antenna as having "unidirectional radiation patterns that are essentially independent of frequency over wide bandwidths," and in the next paragraph that it refers to the antennas of the patent as having "unidirectional radiation patterns of constant beam width and nearly constant input impedances over any desired bandwidth." Isn't it correct to say that those statements are just one way of stating that the antennas of the patent are essentially frequency independent antennas?

A Yes.

Q In order to further clarify what we are talking about, can we say frequency independent antennas - or could you state your own definition of what is a frequency independent antenna in terms of its operating characteristics and also in terms of its structure?

A It would be impossible to do the latter. But in terms of performance the two principal operating characteristics which are of concern are the input impedance and

the radiation pattern and these vary with frequency to a degree which is considered negligible over any bandwidth that can be extended in the design in fairly simple manner by adding to the geometry of the structure. Then I would say this is a good description of what is meant by the term frequency independent applied to an antenna.

Q In the latter part of your answer you referred to extending the geometry of the antenna to cover greater bandwidths.

A Yes.

Q By that you would mean extending the antenna physically while following the same geometrical pattern of the structure?

A Yes.

Q And to the best of your knowledge is that a characteristic of all frequency indpendent antennas?

A I would say that probably there is a possibility that frequency independent antennas could exist that would not have the latter characteristic, but I can't think of any examples with regard to this extension of geometry.

Q The design of the antennas disclosed in the Isbell 767 patent as described in the patent would conform to

your definition of a frequency independent antenna in its operating characteristics, would it not?

A Yes.

Q And in the ability of the antenna to be extended following a pattern of its geometry to cover broader bandwidths?

A Yes.

Q In the antennas disclosed in the Isbell patent what limitations are there in practice on the spacing of each pair of adjacent dipoles in terms of their one-half wave resonant lengths; is there a limitation in that regard?

A With respect to retaining frequency independent or log periodic performance?

Q Right, and might I add, while retaining the unidirectional characteristics.

A Yes, there would be certain restrictions.

Q Would one of those limitations, at least one of them, be that the spacing should not closely approach the one-half wave resonant lengths of the two dipoles separated by such spacing?

A I don't know that to be a fact. I would say that it's primarily a limitation for practical reasons rather than actual operating performance of the antenna would

of January 17, 1967.)

Q I would like to have the reporter mark for identification as Plaintiff's Exhibit 14 a three page document headed, University of Illinois Disclosure of Invention, and letter of transmittal, the pages being stamped by counsel with page numbers 5109 to 5111 inclusive.

(Plaintiff's Exhibit 14 marked for identification as of January 17, 1967.)

Dr. Hayes, are you familiar with the document identified as Plaintiff's Exhibit 14?

A Yes, sir.

Q Does that document provide a record of the development of the subject matter of the Hayes, et al. Re-issue Patent and the original Hayes, et al. Patent 3108280?

A Yes.

Q I'll ask the reporter to identify as Plaintiff's Exhibit 15 a two page document headed Office of Naval Research, and in the upper lefthand corner, Record of Invention, the pages of this document being stamped by counsel as 5278 and 5279.

(Plaintiff's Exhibit 15 marked for identification as of January 17, 1967.)

Dr. Hayes, are you familiar with the document, Plain-

tiff's Exhibit 15?

A Yes.

Q And do you recognize the signature of Robert L. Carrel as being his signature?

A Yes.

Q Referring to Plaintiff's Exhibit 15, in Item 9 of the printed form in the middle of the first page, it is stated, "On June 11, 1959, Mr. E. M. Turner of Wright Air Development Center asked if the angle of dipoles on a log-periodic dipole array had been used as a design parameter. This was tried with no significant change in performance. The idea of operating at higher frequencies so that a change would be obtained then led to the present invention."

Did that question asked by Mr. Turner as indicated in the above come to you orally?

A Yes.

Q From him personally?

A Yes.

Q And did this occur at a meeting between you and Mr. Turner here in the antenna laboratory?

A Yes.

Q On the date June 11, 1959?

A According to the record.

Q This was your best knowledge of that date at the time you signed Plaintiff's Exhibit 15?

A Yes.

Q Did you have any record of your own from which you may have fixed the date, do you know?

A I don't remember whether there was any record or not.

Q In any event, is it your clear recollection that the sequence of events stated in that part I quoted above is correct?

A Yes.

Q Do you recall the exact substance of the question asked by Mr. Turner with regard to using the angle of dipoles as a design parameter?

A No, not any more than what's stated in this.

Q Would you agree with what I learned from Mr. Turner that in asking that question he was referring to moving the dipole arms of the simple dipoles in antennas of the type disclosed in the Isbell 767 patent, forwardly so that they would be in effect a V-dipole?

A This was our understanding of his question, yes.

Q Did he state in connection with the asking of that question that a suitable included angle between the two dipole halves would be 120 degrees?

A I don't recall that any figure was mentioned for the

angle at all.

Q Or that the angle that the dipoles would be swung forwardly through would be thirty degrees on either side?

A I don't recall that he made any mention of any angle at all.

Q Did you understand at the time that his suggestion had reference only to operation of the antenna on the fundamental one-half wave mode?

A Yes.

Q Didn't you previously testify that it would not be expected that such a change in the dipoles would improve the gain of the antenna on the one-half wave mode?

A I did.

Q And prior to June 11, 1959, wouldn't it have been apparent to anyone familiar with V-dipoles and their operation that this would not improve the gain on the one-half wave mode operation?

A I think so.

Q One reason being as given frequently in the literature in this field that the effective aperture of the antenna is reduced by V'ing the elements forwardly, is that correct?

A Yes.

Q But nevertheless, I gather from this quoted statement you tested such an antenna after V'ing the elements forwardly on the one-half wave fundamental mode and verified there was no significant difference?

A That's right.

Q In any event you verified, I assume, there was no improvement in gain?

A That's right.

Q Or in radiation pattern?

A There was a broadening of the beam.

Q Which was, for purposes of a unidirectional antenna, a deteriorating effect if the beam were broadened.

A It would have no application.

Q It would be less directional?

A Yes.

Q And then youtook the same antenna you had modified in accordance with the suggestion of his question and tested it on a higher mode or higher modes?

A I don't recall if it was the same antenna or not.

Q A similar antenna?

A Similar antennas, yes.

Q Then you tested that similar antenna on higher modes, and what did you learn from that?

A Our first tests were, as usual in new areas like this,

rather nonconclusive, but at the same time we began to run into the matter of the operation of a single V-dipole and by comparing some of the references of previous literature with experimental data obtained, we were able to change the parameter of the antenna in such a fashion as to obtain an operation which we thought would be useful.

Q In doing this was it necessary to depart from any of the principles disclosed in the Isbell 767 Patent with reference to the dipole lengths and spacings?

A Yes.

Q In what respects were departures required?

A The spacings that were permissible in terms of wave lengths for the Isbell fundamental mode operation were not permissible in all cases for the higher mode operation of the V-dipole antenna.

Q Does Isbell 767 patent to your knowledge disclose how to select particular values for those parameters other than by cut and try with the principles of using the log periodic formula?

A I am not sure about the patent. I can say some of the parameters that had been successfully applied to Isbell's antenna could not be successfully applied to the V-dipole.

Q Would you state what those particular parameters were?

A The spacing between dipoles in terms of the operating wave length.

Q And what prompted you to test such an antenna on a higher mode of operation than the one-half wave mode?

A The possibility of realising a higher value of advance of gain.

Q On the higher mode?

A Yes.

Q Perhaps I misunderstood your answer. May I restate my understanding of it; that your purpose was to verify that the operation of the array with V-dipoles on the three one-half wave mode or a higher mode would be better than the operation of the straight dipoles on the three one-half wave or higher mode?

A No, on the fundamental mode, it would be better than the operation of the Isbell antenna using one-half wave dipoles.

Q Particularly in what sense?

A Higher gain.

Q Sharper for directional pattern?

A Yes.

Q This was generally true in the operation prior to June, 1959 in the operation of V-dipoles generally

compared to corresponding simple dipoles, was it not?

A Yes.

Q And such characteristics of V-dipoles compared to simple dipoles were well known prior to June of 1959?

A Yes.

Q Do you know if there is anything in the Mayes, et al. Re-issue Patent or the original patent on which it was based to suggest any departure in the design parameters from those which would be required for an antenna constructed under the Isbell 767 patent?

A Well, certainly the change in angle with respect to the V-dipoles as compared tothe Isbell patent.

Q Is there any suggestion that there would be a difference in the selection of the appropriate spacings for the V-dipole array than for the straight dipole array of the Isbell 767 patent?

A I couldn't say whether that is covered in the patent itself; I don't remember.

Q And when you tested the V-dipole type of array shown in the Mayes, et al. Re-issue patent, you did find the increased gain and sharper directivity on the higher modes as expected, as compared to the directivity and gain of the straight dipoles of the Isbell 767 patent?

A With appropriate design parameters.

Q Do you know if there is anything in the disclosure of the Mayes, et al. Re-issue patent or the prior original patent on which it was based, that would indicate the desirability or feasibility of departing from the log periodic formula shown in Column 2 of those patents at Line 25, either as regards the constancy of the Tau values for lengths or the constancy of the Tau values for spacings or implying different Tau values for lengths and spacings?

A Was your question with regard to the entire patent or some portion of the patent?

Q Anything in the disclosure of the patent which would suggest any such departure from the log periodic formula given in the patent.

A I don't recall any such suggestions.

Q In Column 2 beginning at Line 44 of the Mayes, et al. Re-issue patent, and in the corresponding portion of the original patent on which it was based, this is stated: "The angle formed by the arms of a V-element is designated as ψ. It will be seen that when the angle ψ is equal to 180 °, the antennas of the invention are identical with those described by Isbell in the application mentioned above. In the instant invention, how-

ever, the angle ψ preferably has a value between about 50° and 150°."

Do I understand that paragraph correctly as meaning that the two antenna are identical other than for the smaller included angle between the two center elements of each dipole in the antennas of the Mayes, et al. patents?

A describing the family of antennas, yes.

Q And beginning at Column 4, line 9 of the Mayes, et al. Re-issue patent states: "Except with respect to the angle of inclination of the arms of the V-elements, the parameters which define the antennas of the invention are essentially similar as to those of the corresponding straight dipole arrays in which the arms extend at right angles from the feeder lines. Thus, the parameter λ preferably has a value between about 0.8 and 0.95, and the angle ψ suitable ranges between 20° and 100°. Moreover, the upper and lower limits of the bandwidth one-half wave length mode of operation can be adjusted as desired by making the longest V-element correspond in length to about one-half wave length at the lower limit and the shortest V-element to about 3/8 wave length at the upper frequency limit."

Dr. Mayes, the last sentence in that quotation re-

forming to the element lengths of the longest and shortest elements in terms of wave lengths is essentially a restatement of what was disclosed in the Kebell patent I believe for the same purpose, is that your recollection?

A Yes.

Q And in other respects does not that quotation merely refer to the other design parameters of the Kebell patent for a disclosure of the corresponding design parameters to be used in designing antennas of the type of the Mayes Re-issue patent?

A For a definition --

Q Can you point to anything in the patent that discloses or suggests the necessity for any departure or mentions any considerations that might require departures of the parameters?

A I haven't read this patent for quite some time and I would have to read this.

Q To save the time of everybody concerned, could you give him a copy and let him refresh his recollection overnight?

MR. MANN: Sure, if you will give me back my copy. Let's have a restatement of the thing you want him to determine by examining the patent overnight.

not the way an antenna is designed in practice. This is hypothetical. I think you are asking another opinion question.

MR. PEARNE: I think we can dispense with any further questioning in regard to those two exhibits. I'll withdraw the last question.

Toward the latter part of your testimony yesterday, Dr. Mayes, I asked if you would review the Mayes, et al. Re-issue patent before we resumed today so that you would be able to state whether or not there is anything in the disclosure of that patent that explains how to determine the magnitude of the spacing parameters to be used in the designing of the antennas of that patent, other than by referring the reader to the disclosure of the log periodic dipole antennas of the Isbell 767 patent. Have you reviewed the Mayes, et al. Patent for that purpose?

A Yes, I have.

Q Could you state whether it does or does not disclose how to select such spacing parameters other than by referring to the Isbell 767 patent?

A Yes, I believe it does.

Q Could you point out where that occurs?

A In column 5, lines 59 through 64; again in column 6,

lines 48 through 53; column 7, lines 32 through 39; column 6, lines 48 through 52; column 9, lines 12 through 15.

Q The portions of the Mayes, et al. Re-issue patent to which you referred are portions of the numbered paragraphs in the ~~number~~ context of the patent we commonly refer to as claims, are they not?

A Yes.

Q Do you know whether or not the first of the portions of the patent you referred to, namely the portion in column 5, lines 59 through 64, was a part of the Mayes, et al Re-issue patent application as filed or was it added later?

A I don't know.

Q Do you know whether it was a part of the application for the Mayes, et al. patent 3108280 as filed?

A No, I don't know.

Q You did not find in the Mayes, et al. Re-issue patent specifications that precedes the claims any suggestions of the type that are teachings of the type that I asked about this?

A No.

(Whereupon the deposition was adjourned at 9:30 A. M., January 10, 1967, and continued at 10:00

A. M., January 19, 1967.)

MR. PHAMNE: Dr. Mayes, I hand you a report entitled Antenna Laboratory Technical Report #52, which I'll ask the reporter to mark for identification as Plaintiff's Exhibit 24, and ask if this is the report that you called to my attention shortly after the conclusion of your testimony on Thursday?

(Plaintiff's Exhibit 24 marked for identification as of January 19, 1967.)

A Yes.

Q I gather that you are fairly familiar with the contents of that report?

A Yes.

Q Did you work with Mr. Carrel to any extent in the preparation of that report?

A Yes, I did.

Q Was his work in the preparation of that report to any extent under your supervision?

A To some extent, yes.

Q By the way, my question implied that Mr. Carrel was the author of the report; that is correct is it not?

A That is correct.

Q Do you disagree with any part of that report or challenge its soundness as to antenna theory in operation?

A Correct.

Q I would like to preface my next few questions with an explanation of what I will be using in the questions. I shall shortly be referring to an abstract of the file history in the patent office of the Mayes, et al. application, serial #59671, on which the Mayes, et al. original patent was granted, which patent was later re-issued as the Mayes, et al. Re-issue patent in suit. Since I do not propose to have this abstract identified as an exhibit and I am using it only because I neglected to bring with me an actual copy of the application which I do propose to use as an exhibit, I would like to just clarify by this statement in advance the reason for using the abstract, which is a word for word duplication of the patent office file of the application in all respects as regards those portions of the abstract to which I will refer.

As shown in the abstract an affidavit by Paul E. Mayes was filed in the Mayes, et al. application, serial #59671, as Paper #8 in the application, and this was done as was shown by the abstract simultaneously with the filing of an amendment, Paper #9, containing an argument for patentability of the claims, and that the affidavit and amendment were filed in response to

a patent office action of November 6, 1962, which is Paper #7 in the application file. That patent office action had cited a new reference an IRE transactions article by Isbell and the publication date of the article was May, 1960, and that action had rejected all of the claims of the application except claim 8 on that article as new reference in view of a Roland patent. Claim 8 was rejected for a different reason, that it was an informal claim not complying with claim requirements. With that explanation of what I will be referring to in the abstract and why I am using the abstract, I would like to have this copy of an IRE transactions article in the publication mentioned of May, 1960, marked for identification as Plaintiff's Exhibit 25. This article, or this copy of the article runs from page 260 of the publication through 267 inclusive and comprises eight pages.

(Plaintiff's Exhibit 25 marked for identification as of January 19, 1967.)

Dr. Mayes, are you familiar with that article and its contents?

A Yes.

Q Does that article, Plaintiff's Exhibit 25, disclose the subject matter of the Isbell 767 patent?

A Yes.

Q And does it also disclose the advantages and operating characteristics of the antennas to which the Isbell 767 patent is directed?

A Yes.

Q And does it do so essentially as fully as the 767 Isbell patent itself?

A I believe so.

Q Were you informed during the prosecution of the Mayes, et al. application 59671, on which the original Mayes, et al. patent was granted, of the patent office action of November 6, 1962 in which the article, Plaintiff's Exhibit 25, was cited as new reference?

A I presume so, I don't recall the specific instance.

Q Do you recall having executed an affidavit identifying that Mayes, et al. application, of which I show you a copy, in the abstract that I mentioned earlier?

A Is your question directed to whether or not I remember the actual circumstances under which I signed this affidavit?

Q First, do you remember that you did sign such an affidavit?

A I presume I did but so far as actually remembering the action itself in signing it, I do not.

Q Do you remember the circumstances under which that affidavit was brought to you for signature?

A What do you mean by circumstances?

Q The reason for an affidavit having been prepared for your signature.

A This was done during the course of pursuing the application for this patent during the course of that action before the patent office, and there were any number of times when amendments or other types of documents were prepared at the request of the patent attorneys in pursuit of this application.

Q Do you remember that this affidavit was prepared for the purpose of establishing that the V-dipole invention of the particular Mayes, et al. application was made by a certain date or by some date in 1959?

A I didn't remember that until I just this moment read the affidavit.

Q That was one of the objectives of the affidavit?

A Yes.

Q Were you aware at the time the affidavit was prepared or presented to you for signature that the purpose of it was to show that the V-dipole invention of the application was made prior to the May, 1960 date of the Isbell article in Plaintiff's Exhibit 25?

A I think that's apparent from reading the affidavit.

Q And it is also apparent from the reading of the affidavit, is it not, that that was done by attaching to the affidavit and referring in the affidavit to a quarterly engineering report bearing a date 31-12-59, and purporting to cover work during the period from 1-9-59 to 1-12-59?

A Yes.

Q And does not that attached report disclose the V-dipole invention of this Hayes and Carrel application we have been discussing?

A Yes.

Q Isn't it also the case, as I recall your prior testimony, that you and Mr. Carrel actually made the V-dipole development considerably prior to the period covered by that report, namely about June of 1959?

A That's correct.

Q And that you had actually made a model of the V-dipole antenna by June 23, 1959 as indicated by the invention record, Plaintiff's Exhibit 14? Perhaps that question had better be reread.

(Question read by the reporter.)

A Yes.

Q Do you know why the quarterly engineering report dated

31-12-59 was used to show that this invention antedated the Isbell IRE transactions articles rather than somesother material of an earlier date of invention?

A No.

Q At the time you made the affidavit on January 4, 1963, you were aware, of course, that the invention or subject matter of the Isbell 767 Patent involving log periodic dipole arrays had been the subject of published applications considerably earlier than 31-12-59 as shown in Quarterly Engineering Report #2, Plaintiff's Exhibit 4, and Antenna Laboratory Technical Report #39, Plaintiff's Exhibit 17, copies of which I show you?

MR. MANN: Is that a question?

MR. PEARNE: Yes.

MR. MANN: May I hear it?

(Question read by the reporter.)

MR. PEARNE: Is that correct?

A Yes, sir.

Q And just as a comment on the record, I would like to note it has been stipulated that a copy of the latter of these two reports, Technical Report #39, Plaintiff's Exhibit 17, had actually been deposited in the Library of Congress on September 21, 1959.

Dr. Mayes, diverging now for a moment, are you generally aware of the requirement for patentability of an invention in the United States that the application for the patent must be filed within one year of the date of first public use of the subject matter of the application?

MR. MANN: I'll permit an answer to that question but if this line of inquiry continues, I'll object to the whole line.

A Yes. Let me qualify that. You said public use. I am familiar with the requirement that the application must be made within one year of date of publication; I am not sure about the use of the term "public use."

MR. PEARNE: All right, that answer is satisfactory.

Do you know the date on which your application of the Mayes, et al application, serial #59671, on which the original Mayes, et al V-dipole patent was based, was filed in the patent office?

A It's a matter of record; I don't remember it.

Q As indicated by a copy of the patent, I believe that date was September 30, 1960, is that correct?

A That's correct.

Q Then isn't it also correct that the subject matter disclosed in the IRE transactions article of Isbell,

Plaintiff's Exhibit 25, was published in Technical Report #2, Plaintiff's Exhibit 4, and Technical Report #39, Plaintiff's Exhibit 17, more than a year prior to that filing date of September 30, 1960?

A Yes.

Q And that affidavit that we have been discussing appears to have been filed inthe patent office to show that Mayes and Carrel made the V-dipole invention prior to the May, 1960 date of that publication, of that Isbell IRE transactions publication, isn't that correct?

A Would you restate the question?

(Question read by the reporter.)

A Yes.

Q Is there anything in the affidavit that discloses that the same material of that Isbell May, 1960 article was published well more than a year prior to your own filing date and well more than a year prior to the publication of the article that the affidavit was filed to overcome?

MR. MANN: I object to the question. I think the contents of the affidavit are self evident and you seem to be implying a need which was not satisfied by the affidavit, which in my opinion was nonexistent.

MR. PEARNE: I'll withdraw the question. Were you generally shown by the attorney handling applications in the patent office in which you were involved as an inventor, copies of amendments and arguments that were filed in those applications before they were sent to the patent office?

A Yes.

Q In the abstract of the Mayes, et al. application for the V-dipole invention, there is a copy of the attorney's argument in the amendment that accompanied your affidavit. That amendment is paper #9 as previously mentioned, and I show you a page of that argument, and doesn't that page indicate that the affidavit was filed to overcome the effect of the publication of Ishell's article, Plaintiff's Exhibit 25?

MR. MANN: I object. We are getting into the niceties of patent prosecution about which Dr. Mayes is not qualified to answer.

MR. PEARNE: I didn't ask about the standards of the patent office; I merely asked him if the content of the argument presented did not indicate that its purpose was to overcome that publication reference.

MR. MANN: All right. On rereading the affidavit I renew my objection. It is couched in entirely too technical

language for Dr. Mayes to have an opinion on it.

MR. PEARNE: You are stating Dr. Mayes does not have any opinion, but perhaps Dr. Mayes may disagree with you.

MR. MANN: He may have an opinion. The pertinency of his opinion, for what it's worth, he can give it.

MR. PEARNE: Thank you. You may give your opinion, if you have one.

(Question read by the reporter.)

A The way it's stated in this document is it's clearly for work back of the date of publication in the IRE and back of the application of ~~Isbell filed~~ Isbell's filing date of May 3, 1960.

Q But that was done with your knowledge, at least that the subject matter of the Isbell article, Plaintiff's Exhibit 25, had been published in the form of Plaintiff's Exhibit 17, much earlier back in September of 1959, and in the form of Plaintiff's Exhibit 4, still earlier than that?

MR. MANN: I object to the question. It has an insinuation of improper nature. It was done with the knowledge of millions of other facts also known, some of which appear in the affidavit.

MR. PEARNE: But the fact is a simple fact and I am not suggesting any particular conclusion would be drawn;

I am merely making the question whether or not what we have been talking about was done with his knowledge that certain things had been published as he had already stated.

MR. MANN: We are getting argumentative. If this affidavit was made at the time he has stated it was made, he undoubtedly had the knowledge of the publications in his mind unless he had forgotten them and I don't think he will testify that he has forgotten them.

MR. PEARNE: I am not meaning to imply any improper intentions in my questions to Dr. Mayes; I am merely trying to bring out the facts,but we can stop that line of examination at this point.

I noticed that a number of the publications that have been referred to in the course of your testimony have reference to what are called ECM antennas; could you tell me what ECM antennas are?

A Electronic counter measures.

Q Do electronic counter measures refer to some form of military operations to the best of your knowledge?

A Yes.

Q Could you tell me the nature of them, what they are?

A It's a very broad term.

Q Could you give me some examples of electronic counter

measures in which one might employ log periodic dipole antennas for example?

A Surveillance would be one example.

Q What kind of surveillance?

A Listening for electro magnetic radiation.

Q Possibly by an enemy country?

A Or any country or anybody.

Q And in such electronic counter measures one would like to use an antenna that would be capable of effectively picking up radio transmission over any frequency in a large band range?

A That's correct.

Q And as a practical matter does not such radio transmission sometimes cover very broad frequency ranges or fall ~~many~~ broad places within very broad frequency ranges?

A Yes.

Q And might one of the purposes of the antenna in electronic counter measures be to pick up radio broadcasts of any frequency over a very broad range so as to detect what an enemy might be talking about?

A Yes.

Q Or for the purpose of determining the frequency of an enemy's communications broadcast so steps can be taken to jam that radio communications operation, as the

term is commonly used?

A This requires much more equipment than just an antenna.

Q Yes, but in order tojan a broadcast, one should know approximately the frequency on which the broadcast is being made?

A The antenna does not enter into the determination of the frequency.

Q But the antenna would be used to determine that the broadcast is being made perhaps?

A It would be necessary for that purpose.

Q So again the antennas employed would be receptive to any frequency over very broad ranges?

A That would be desirable.

Q I gather from theuse of the term in the publications that have been referred to, to determine development of an antenna of that broad band character was an objective of the research program under the Air Force contract we have talked about.

A That's correct.

Q And it follows, does it not, that that kind of a result was one of the objectives of the Isbell 767 patent and the Mayes and Carrel original and re-issue patent and the Carrel & Mayes 376 patent?

A I belice that was already established.

state whether using different Tau values for length and spacing of dipole elements would materially depart from the log periodic theory and objectives of the patents in suit since that seemed to be a question for patent lawyers?

A I don't recall making that statement but I presume it's a matter of record.

Q I'll refer you again to Technical Report #39, Plaintiff's Exhibit 17, and ask if that report does not deal primarily with antennas forming the subject matter of the Isbell 707 patent?

A Yes.

Q Turning to page 2 of that report, Plaintiff's Exhibit 17, and in connection therewith, and noting Figure 1 on page 3, I would like to read the second paragraph on page 2: "If frequency independent performance is sought from a structure composed of resonant elements it is clear that the resonances must be staggered in order that as frequency is varied the function of the resonant element is transferred smoothly from one element to the next. In the case of an antenna array composed of similar discrete elements this means that the physical dimensions of the elements must be scaled from one to the next in such a way that the desired

frequency range is covered with elements of overlapping response characteristics. Since the characteristics of antenna elements are determined in part by their surroundings, it is necessary also to scale the environment."

Does the reference in the quotation I just read to scaling the environment mean scaling of factors such as the the relative spacing of successive dipoles?

A Yes.

Q Now, referring to the third paragraph on that same page 2, it further states: "Considering now a coplanar array of side by side dipoles in accordance with the above ideas, an arrangement of the type shown in Figure 1 is obtained. The lengths of the dipoles are related by a constant scale factor T as defined in the figure."

Does that statement set forth a characteristic of the antenna disclosed in the Isbell 767 patent?

A Yes.

Q Is that characteristic required by the log periodic formula in Column 1 of that patent?

A Yes.

Q Now, skipping to the next sentence which appears to be merely a statement of mathematical consequences of what

I just read, the next succeeding sentence reads: "Since it is also necessary to scale the environment, the spacings as between elements must be selected in the same manner."

Do not those quoted portions of the report, Plaintiff's Exhibit 17, clearly state that in order to obtain frequency independence in the type of antenna discussed, both length and spacing of the elements must vary by the same scale factor?

A Those requirements are accurate statements of theoretically ideal situations to which any practical antenna development should be pointed in order to achieve as closely as possible frequency independent performance.

Q And it would follow, of course, would it not, to the extent one departs from those conditions of scaling length and spacing by the same scale factor, one would to that extent depart from the ideal frequency independent antenna?

A Yes.

Q I would like to have the reporter mark for identification as Plaintiff's Exhibit 36 a letter of October 23, 1963, purporting to be from a Samuel B. Smith to Professor Paul E. Mayes, the letter having attached

A Yes.

Q And others that have worked on research and development under government contracts that give rise to patents?

A Yes.

Q I would like to have the reporter identify as Plaintiff's Exhibit 27 a copy of a report dated June 12, 1959, in the electrical engineering department of the University of Illinois, apparently made by Georges Deschamps, the copy having been stamped by counsel as document #s 5336 and 5337, it being a two page document.

(Plaintiff's Exhibit 27 marked for identification as of January 19, 1967.)

Dr. Mayes, can you identify the report which is Plaintiff's Exhibit 27 and tell why a report of this type was prepared and for what purpose?

A This report was prepared to summarize the activities under a given research contract to assist the engineering publications department in preparation of the research summary which is issued annually.

Q Do you know whether Dr. Deschamps or someone else in the antenna laboratory or associated with the antenna laboratory might have compiled the bibliography that follows the fourth paragraph of the body of the report?

A I can't be sure, but I suspect I probably compiled it.

Q I call your attention to the last item in the bibliography identifying an article entitled "Research Studies on Problems Related to Antennas," and identified as Quarterly Engineering Report #1, January, 1959; #2, April, 1959; Contract # AF 33 (616)-6079. Could you tell me if that appears to be a proper identification of that item?

A Proper in what way?

Q As to the contract under which the report was written, for example.

A I am sure that Quarterly Engineering Reports were prepared under this contract. I could not establish, without reference to the reports, whether or not these dates are correct.

Q Is that report the one previously identified as Plaintiff's Exhibit 4?

A Yes.

Q I call your attention to the fact that on the title page of that report, it carries date 31-3-59; can you tell me the significance of that date, what that date would refer to, the writing of the report?

A Not necessarily.

Q To what did it refer?

A It's the approximate date of issue of the report as

stipulated in the contract.

Q So that 31-3-59 date would not necessarily be the day of the writing of the report?

A No.

Q Or the day the report was printed?

A No.

Q Or the day the report was published?

A No.

Q Is there anything in that report that you know of that includes the date April, 1959?

A I don't know; I would have to look through it to see.

Q Well then, what would be the significance of the date April, 1959 in the bibliography at the end of plaintiff's Exhibit 27?

A I am not sure.

Q If you had compiled the report as you indicated you might have, what would you consider that date to be?

A Ordinarily I would think that the date should be 31-3-59.

Q What would you consider the April, 1959 to signify?

A I don't know.

Q Is it not normal in bibliographies in technical publications to cite publications by their publication date?

A Yes.

Q And wouldn't one normally interpret that April, 1959 date to be a publication date?

A Yes.

Q Going back to the Carrel publication, Technical Report #53, Plaintiff's Exhibit 24, I would like to call your attention to the paragraph beginning in line 6 on page 163, which I will read: "There also exists the possibility of tailoring the directivity characteristic such that the patterns are frequency dependent in a special way. This would require that τ and β or both be a function of position. In this case β' should be held constant to achieve a frequency independent input impedance. The above idea was applied to one model in which Δ was fixed at 25°. The spacing between all elements was a constant, one-half inch. β varied along the antenna from 0.022 to 0.089. The measured directivity increased with frequency from 5 to 8.5 db, then decreased to 7.5 db."

Dr. Mayes, does not that paragraph purport to describe an antenna design and model and test results of what Mr. Carrel characterized as a frequency dependent antenna?

A Yes.

Q And what was the principal characteristic of that an-

these parameters would enter into performance.

Q Could you name parameters that you would expect to be important in that respect?

A Yes.

Q Would you do so?

A The characteristic impedance of the feeder lines, the Q or aspect ratio of the dipoles and the scaling parameter of each independent zone.

MR. PEARNE: I think I have no further questions.

MR. MANN: No cross examination.

MR. PEARNE: Dr. Mayes, it is common policy for the witness to waive reading and signing of the deposition. Counsel will have the opportunity to ask for any necessary corrections and Mr. Mann will in all probability go over the deposition with you anyway. Is it satisfactory with you to waive the signature?

DR. MAYES: This will be satisfactory.

(WITNESS EXCUSED.)

STATE OF ILLINOIS)
) ss
COUNTY OF COLES)

I, Marjorie W. Yelvington, Notary Public within and for the County of Coles, acting in the County of Champaign, and CSR, do hereby certify that Dr. Paul E. Mayes came before me in conference room 468, EMM, of the antenna laboratory, Electrical Engineering Department, University of

Illinois, beginning at 9:00 A. M., January 17, 1967, and at two succeeding times on succeeding days, who was by me sworn to testify to the truth of his knowledge touching the matter in controversy aforesaid; that I did take down in shorthand notes all of the questions propounded to said witness and his answers thereto; that I did later personally transcribe said notes; that the above and foregoing is a true, correct and complete transcript of said notes; that the said testimony is now herewith returned.

I further certify that I am not related in any way to any of the parties involved in this cause of action and have no interest in the outcome thereof.

I further certify that the plaintiff was represented at said deposition by Mr. John H. Pearne and Mr. William A. Gail of the law firm of McHenny, Farrington, Pearne & Gordon; that the defendant, JFD Electronics Corporation was represented by Mr. Sidney C. Faber of the law firm of Ostrolenk, Faber, Gerb & Soffen; and that the defendant, The University of Illinois Foundation, was represented by Mr. Basil P. Mann of the law firm of Merriam, Marshall, Shapiro & Klose.

I further certify that I did mail the original transcript of said deposition to the Clerk of the Court for

filing, postage prepaid, registered, return receipt requested.

Dated at Mattoon, Illinois, this 1st day of February, A. D. 1967.

[signature] CSR