BT

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

THE UNIVERSITY OF ILLINOIS FOUNDATION,	:	
Plaintiff and Counterclaim Defendant,	:	
-against-	:	
BLONDER-TONGUE LABORATORIES, INC.,	:	
Defendant and Counterclaimant,	:	Civil Action No. 66 C 567
-against-	:	
JFD ELECTRONICS CORPORATION,	:	
Counterclaim Defendant.	:	

DEPOSITION of ROBERT F. HESLIN, taken at the offices of Messrs. Ostrolenk, Faber, Gerb & Soffen, 10 East 40th Street, New York, New York, on February 14, 1967, at 1:30 o'clock P.M., pursuant to Notice, before Isaac H. Shapiro, a Notary Public of the State of New York.

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A P P E A R A N C E S :

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New York, New York,
JEROME M. BERLINER, ESQ., of Counsel.

- - -

IT IS STIPULATED AND AGREED by and between counsel for the respective parties that the transcript of the record of the within deposition may be subscribed and sworn to by the witness before any Notary Public of the State of New York with the same force and effect as if subscribed and sworn to before a Clerk or Justice of this Court.

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ROBERT F. HESLIN, called as a witness, being first duly sworn by the Notary Public, testified as follows:

DIRECT EXAMINATION

BY MR. BERLINER:

Q Please state your name and address for the record.

A Robert F. Heslin, 281 Thornell Road, Pittsford, New York.

Q Where are you employed?

A General Dynamics Corporation, Rochester, New York.

Q What type of work do you do?

A I am a Senior Project Engineer on the F111 program.

Q What is the F111 program?

A The F111 program is a weapons system being built by General Dynamics for the United States Air Force and United States Navy.

Q Where did you work prior to your employment with General Dynamics?

A Fairchild Stratos Corporation in Wyandanch, New York.

Q What position did you hold at Fairchild?

A Starting with the last and working back?

Q Any order you care to.

A When I left I was a senior electronics engineer. Prior to that I was an electronics engineer. Prior to that I was an associate engineer and prior to that I was a senior laboratory technician.

Q What were your duties while employed at Fairchild?

A When I first started with the company I was assigned as a technician in the Microwave and Antenna Development Department, after which I became an associate engineer. I was in charge of the laboratory facilities ~~supervision~~.

In 1961 I was assigned to the ~~Unit~~ Yuma Test Station in Yuma, Arizona as a field service engineer, after which I came back to Wyandanch, New York. I was an electrical engineer and subsequently a senior electrical engineer.

Q During what period of time were you employed by Fairchild?

A From the summer of 1959 to the summer of 1963.

Q What is your educational background, at least past the high school level?

A I have an Associate's degree in Applied Science from the Long Island Agricultural & Technical Institution at Farmingdale, Long Island. I graduated in June of 1953.

Q In the period from June of 1953 until your

employment with Fairchild commenced, were you employed in any technical capacity?

A Yes. In the summer of 1953 to the summer of 1955 I worked as a technician in the microwave measurements laboratories for Sperry Gyroscope Company, Lake Success, Long Island.

From 1955 to 1958 I was self-employed. I owned a service station in East Meadow, Long Island.

In 1958 I went to work for the Airborne Instruments Laboratories in ~~Mellenville~~ MELVILLE, Long Island, for approximately six months.

After that I went to work for Fairchild Stratos Corporation.

Q I hand you a copy of a publication called QST, the June 1963 issue, and I ask you whether you are the Robert F. Heslin designated as the author of an article on Pages 50, 51 and 52.

A Yes, I am.

MR. BERLINER: Off the record.

(Discussion off the record.)

MR. BERLINER: Please mark, as Exhibit J-10, the cover page of QST of June, 1963, and Pages 50, 51 and 52.

(Cover page of QST of June, 1963, and

Pages 50, 51 and 52, were marked Exhibit J-10 for identification.)

Q When did you submit this article to QST?

A In November of 1961, November 13, 1961.

MR. BERLINER: Please mark this as Exhibit J-11 for identification. It is the original manuscript.

(Original manuscript above referred to was marked Exhibit J-11 for identification.)

JFDSA

Q I hand you Exhibit J-11 and ask you if you recognize it.

A yes.

Q What is it?

A It is the original manuscript that was packaged for me by the Publications Department of Fairchild Stratos Corporation. It was mailed to me in Yuma, Arizona. I in turn submitted it to QST Magazine.

Q Is it true to say that the manuscript, Exhibit J-11, subsequently became the article, Exhibit J-10 for identification?

A Yes.

Q I notice that Exhibit J-11 for identification has a number of pencil markings on it. Do you know who placed those markings there?

A I would assume that they were placed there by

people at QST.

Q But you did not place them there?

A No.

Q Exhibit J-11 for identification bears a date on the first page of November 13, 1961. Does that date have any significance in connection with the preparation of J-11?

A That was the date that it was -- it would be shortly thereafter, within a few days, that it was mailed to QST.

Actually, I think the November 13th is probably the date that it was mailed to me from Long Island and it was within several days after that that I submitted it to QST.

Q Why was Exhibit J-11 prepared in Long Island when you were apparently in Arizona in November of 1961?

A The original drafts of that article were prepared while I was still in Wyandanch, Long Island. I was transferred to Arizona and Mr. Ralph Logan, who at that time was my section head in charge of the laboratory, followed it up with the Publications Department in putting the package into condition for a formal submittal to QST.

Q Is the Ralph Logan you mentioned one and the same person as Ralph Logan at the end of the QST article?

A Yes, it is.

Q Do you have the original drafts or copies of original drafts of J-11?

A I do (handing folder to counsel).

MR. BERLINER: The witness has handed me a folder that I would like marked as Exhibit J-12 and as reference is made to particular pages, these pages will be given individual identifications.

(Folder above referred to was marked Exhibit J-12 for identification.)

Q Referring to Exhibit J-12, please indicate those papers that were created preliminarily to the preparation of Exhibit J-11.

A Do you want me to mark them?

MR. BERLINER: I would like the reporter to mark them with consecutive numbers, starting with J-13.

THE WITNESS: This is the plot of standing wave ratio versus frequency.

MR. BERLINER: Mr. Reporter, will you mark that paper Exhibit J-13 and the rest of the papers indicated by the witness with consecutive numbers.

(Papers contained in Exhibit J-12, as indicated by the witness, were marked respectively Exhibits J-13 through J-50 for identification.)

Q Among the Exhibits J-13 through J-50 there are a

number of curves. Did you draw these curves?

A Yes, I did. The curves on this first sheet I drew. These other sheets are antenna patterns which are recorded automatically.

Q Certain of the Exhibits J-13 through J-50 are handwritten or contain hand sketches. Did you prepare each of those?

A Yes, I did.

Q Exhibits J-22, J-23 and J-24 each have handwritten corrections. Did you make some or all of these corrections?

A I put in the reference to Isbell's article.

The rest of the corrections were made by Mr. Ralph Logan.

Q Do you know when those corrections were made and the reference to Isbell's article added?

A They were added between October 18, 1961 and November 13, 1961; some time before this first draft and the final draft.

Q Exhibits J-20 and J-21 each contain stamp notations on the backs. Will you explain what those notations are?

A That is a document control number used by Fairchild Stratos Corporation Publications Department.

Q Did you prepare the article of J-10 under the direction of your employer, Fairchild?

A You mean was I directed to do this by him?

Q Were you directed?

A No, I wasn't directed.

Q Is the antenna which appears in the photographs, J-20 and J-21, the same antenna that appears in the article J-10?

A Yes, it is.

Q Is that antenna in existence?

A Yes, it is.

Q Where is that antenna?

A In this room.

MR. BERLINER: Please mark the antenna as Exhibit J-51 for identification.

(Antenna above referred to was marked Exhibit J-51 for identification.)

Q At the central region of J-51 there appears to be a mast mounting means that is not shown in the photographs J-20 and J-21. Did you add the mounting means to the antenna?

A No, I did not.

Q Do you know who did?

A It is my belief that Mr. Van Field added this.

Q Since the time of the construction of J-51, in whose custody has this antenna been?

A Within the custody of Mr. Van Field.

Q Do you know where Mr. Field lives?

A Mr. Field's address at the time that I presented it to him was in Center Moriches, Long Island. I do not know his present address.

Q Do you know where Mr. Field can be contacted now?

A I ~~had~~ HAVE a telephone number in my office. I don't have it with me. He is a school teacher, I believe, in Blue Point, Long Island, but I am not certain of that.

Q Is that Bellport?

A Bellport, that's right.

Q How did you determine the ~~space in~~ SPACING between the booms of J-51?

A The original idea came from an article by Isbell in May, 1960, proceedings ~~to~~ of the IRE on antennas and propogation.

The actual calculation of the spacing and element lengths were performed by myself.

Q Does the Isbell article you refer to indicate how to calculate boom spacing?

A No, it does not.

Q How are you able to calculate boom spacing?

A From reading the article it was brought to my attention that Mr. Isbell was using parallel balanced conductors and parallel balanced conductors, the impedance of which is spelled out in the various literature in the field, namely the I.T.T. handbook.

Q Do you have a more complete title for the I.T.T. handbook?

A No, I don't. It is a publication that is put out every few years by I.T.T. over at ~~Rutland~~ NUTLEY, New Jersey. It is a standard engineering handbook.

Q The article, J-10, contains a statement that the antenna can also be fed with open wire line. Did you ever feed the antenna, J-51, with an open wire line?

A No, I did not.

Q Is there any particular reason why you didn't?

A When I determined the size of booms that I was going to use and I calculated what the boom spacing would be for a characteristic impedance of 300 ohms, I found that the spacing was in the order of several inches; this in addition to the fact that the type of measuring equipment that I had available at the time required 50 ohms unbalanced transmission line.

Q Do you have copies of any correspondence with QST in connection with the article, J-10?

A Yes, I do.

Q May I have it?

A Yes (handing folder to counsel).

MR. BERLINER: Please mark the pages within this folder with individual identification numbers.

(Pages in folder above referred to were marked respectively Exhibits J-52, J-53, J-54A, J-54B and J-55 for identification.)

Q What is Exhibit J-54A and Exhibit J-54B?

A J-54A and B is a two-page letter in answer to an inquiry dated February 13, 1963 to me from Laird Campbell.

Q Is the inquiry J-55?

A It is the inquiry, J-55.

Q When did you write J-54A, J-54B?

A February 20, 1963.

Q Approximately when did you come into possession of Exhibit J-52 and J-53?

A Approximately February 4, 1967.

MR. BERLINER: Please mark this Exhibit J-56.

(Document was marked Exhibit J-56 for identification.)

Q Does your signature appear on Exhibit J-56?

A Yes, it does.

Q Did you write the letter of J-56?

A Yes, I did.

Q Was the letter of J-56 written on 1 April, 1963?

A Yes, it was.

Q Referring to the photographs, J-20 and J-21, do you know why the antenna in those photographs appears to extend vertically?

A This is because the antenna was mounted on a small stand, mounted vertically for the ease of photography.

Q Was the antenna operated in that position when you were taking measurements?

A No, it wasn't.

Q What position was it operating in?

A It operated horizontally with respect to the earth.

Q Prior to submission of J-11 to QST, did you discuss the contents of J-11 with anyone?

A Yes, I did. The contents were discussed with Mr. Ralph Logan and Mr. Van Field, both of the Fairchild Stretos Corporation at the time.

Q Were there any other persons with whom you discussed the contents of J-11?

A Yes, they were discussed with various technicians and associates within the laboratory on an informal basis.

Q Do you recall the names of any of these persons?

A Mr. Charles Pecorara, Mr. Eugene Katz, Mr. Jesse Trachtenberg, Mr. Henry Jones. That is all I can remember at the moment. All these people were with Fairchild Stratos Corporation at the time.

Q When you operated the antenna, Exhibit J-51, did you obtain expected results?

A Yes, I did.

MR. BERLINER: Your witness.

CROSS EXAMINATION

BY MR. RINES:

Q In connection with your discussion with the people you listed in the laboratory, was this an in-house discussion of proprietary information of the Fairchild Stratos Company?

A No, it was not developed in connection with the Fairchild Stratos Corporation. This was developed in my own time, using Fairchild's facilities and equipment with the permission of Fairchild supervision.

Q Was the Fairchild Company interested, perhaps, in marketing this product?

A They showed no interest in this particular antenna at the time.

Q Can you tell us briefly why it is they were willing to allow you to use the company's facilities and so

forth for this development?

A Well, I had previously been assigned to the task of designing and developing a similar type of antenna for a classified military program with the company, which I did successfully, and being interested in amateur radio I looked upon it as possibly an extension that would be of general interest to radio amateurs throughout the world.

Q Did you try to elicit interest from the Fairchild Company in possibly building this antenna?

A No, I did not.

Q Did they have a license for this design of yours or shop rights, do you know?

A Not to my knowledge.

Q You indicated that you added to your draft, J-22, a reference to the D. E. Isbell article of May, 1960, IRE transaction. Do you consider that in designing the antenna described in the article, J-10, you have followed the teachings of Mr. Isbell?

A Yes, from an electrical standpoint only. The electrical design was based on Mr. Isbell's article. The mechanical packaging was my own conception.

Q What do you mean by "mechanical packaging"?

A The means of mounting the elements to the boom.

Q The brackets that hold dipoles on to the boom?

RH A Yes, and the wooden block spaces to separate the two booms of the antenna.

Q You were aware then of Mr. Isbell's teaching that it was desirable to try to get the dipole elements of each pair of dipoles as close to coplanai as possible?

A It is my recollection from the article that Mr. Isbell stated that the space between the booms was not found to be critical.

Q Could they be separated in accordance with Mr. Isbell's teaching as much as a half wave length?

A I do not recall this in the article, this particular statement.

Q Do you recall that in the article they are described as very close together?

Before you look at the article, I would like your recollection.

A I do not recall any specific requirement as to what the spacing should be between the booms.

The spacing that I provided was strictly on my own intuition, my own feeling on the matter.

Q I note in your various drafts, and I am reading now from J-28, you say that "The spacing was not found to be critical but it is suggested that the spacing shown be adhered to as close as possible." Is that the spacing

between the booms?

A Well, this sentence here seems to conflict really within itself. I found, as I recall in making my measurements, that the spacing over the order of an inch or two, the separation between the booms, did not grossly affect the performance of the antenna; but in writing the article and knowing the type of individuals that would be constructing this in home workshops, as I recall, I tried to put this in so that the individuals constructing it would not go overboard in their boom spacing.

Q What do you mean by "overboard"?

A Well, when I made the measurements of the antenna, I moved the boom separation in the order of an inch or two in either direction and found it not to be critical. I did not go several inches apart. Therefore, I felt if I tied it down to a fairly close tolerance, then the individuals constructing an antenna would not tend to make the spaces excessive. By "excessive" I mean in the order of several inches.

Q In order to translate for the benefit of the Court, an inch into a fraction of a wave length, will you tell us over what frequency range the antenna described in your article, J-10, was operating?

A It was designed to operate from 140 megacycles

to 450 megacycles.

Q Now, starting at the lower end, will you tell us what fraction of a wave length the one and a quarter inch spacing referred to in Figure 4 of your article, J-10, would be?

A May I take time out to make some calculations?

Q Please.

A At the low end, that is 140?

Q Yes.

A You want to know what fraction of a wave length at 140 megacycles is one and a quarter inches. One and a half per cent of a wave length at 140 megacycles.

Q That would be .015 of a wave length?

A Yes.

Q That is a very small part of a wave length, is it not?

A Yes, it is.

Q And if I understand your discussion about going overboard correctly, what you wanted to insure was that people who built this antenna, amateurs, for example, were sure to keep that spacing of that order of .015 of a wave length and not make it several times or many times that which would be an appreciable portion of a wave length. Is that a fair statement?

A I think that by talking in terms of a wave length, that in my original conception of this antenna, I did not take into consideration what portion of the wave length one and a quarter inches represented.

Q You stated that you had made calculations from impedance charts or impedance formulas given in a handbook?

A Yes, I did.

Q Doesn't that impedance formula relate spacing to wave length?

A The formula that I used does not. The equation that I used was $Zo=276 \log 10\frac{D}{d}$.

This equation is correct, to the best of my knowledge, as I recall it.

Q Might I ask you, on a clean sheet of paper, to write that equation?

(Witness writes equation as requested.)

MR. RINES: Mark that Exhibit J-57, please, Mr. Reporter.

(Equation above referred to was marked Exhibit J-57 for identification.)

Q Would you, for the benefit of the Court, identify what the letters in that equation represent?

A (Witness marks exhibit as requested.)

Q Now, you have indicated that the small letter "d"

represents the cross section or diameter of one boom for our present purposes and the "D," the capital "D" is the actual distance between the pair of booms?

A That is correct.

Q What is the actual space of capital "D" in connection with the antenna described in your article, J-10, for the Exhibit J-51?

A Well, it would indicate to me between centers here that I have called that one and a quarter inches.

Assuming that these booms are one inch outside diameter, the spacing would indicate one-quarter inch.

Q So actually, the spacing, capital "D" between the booms is one-quarter inch in the antenna of your article, J-10, and the Exhibit J-56?

A That is correct.

Q If an inch and three-quarters represented .015 of a wave length, one-quarter of an inch is one-fifth of that, or .003 of a wave length. Is that fair?

A Yes.

Q Now, do you know how the formula of Exhibit J-57 was derived; under what assumptions that holds true and under what assumptions it does not hold true in terms of the near end radiation fields of energy that may be propogated along the line?

A Well, this equation applies to basically two parallel conductors.

Since it was my intent to use coaxial line in feeding this with the possibilities of alternately feeding it with 300 ohm twin lead, I used this equation just to arrive at a basic approximation of what the element spacing might be, knowing that that equation does not apply strictly in this particular case.

Q Then certainly if the spacing becomes a substantial portion of the wave length, of the energy being propogated, as distinguished from being very small compared to the wave length, you know that this formula for impedance does not hold.

A If you are applying this equation to a log periodic structure such as that, I can't answer your question because I don't know.

Q Did you, in your determination of lack of criticality, as you report in your article on the spacing between the one-quarter inch space booms, find any necessary relationship between the value of that spacing, the average spacing between successive pairs of dipoles along the log periodic array and the wave length of the energy with which the antenna is to operate?

A No, I did not.

Q Now, we notice in the article, J-10, that your sentence from Page 1 of the draft, Exhibit J-11, which merely said, "Provisions are also included to feed it with open wire line" -- we notice an additional phrase, and I will read the total thing on Page 50 of Exhibit J-10:

"The antenna can also be fed with open wire line but with a high SWR which would make it essential to use an antenna coupler at the in-put end of the line."

Where did that essential use of the antenna coupler come from, if you know?

A Since the antenna has a basic characteristic of most antennas of reciprocity -- by that I mean it can be used both as a receiving and a transmission antenna -- the high-standing wave ratio present at the feed point would be detrimental to a transmitter unless one were to employ an antenna coupling device to match out this standing wave ratio.

Q First of all, is this your language in the article about the essential requirement of an antenna coupler at the in-put end?

A Yes, it is.

Q Why did you add it?

Mr. Heslin, I have no desire to trap you. Perhaps you might look at all the drafts you have shown us

and see if when and if you ever added such language.

A Well, let me say this: Obviously it is not in any of my original drafts. I recall discussions about this feeder and it could very well be that this was added by Mr. Campbell at QST.

Q By "QST" you mean the magazine in which J-10 appeared?

A Yes.

Q Who is Mr. Campbell?

A Mr. Campbell is a member of the technical staff of the American Radio Relay League, publishers of QST.

Q Do you characterize him as an antenna expert?

A I do not know Mr. Campbell personally and going back over the years and the various articles that he has been involved with, I would say that he is not particularly an antenna specialist. I would say he is a jack-of-all-trades.

Q Would you say he is as competent as you in the field of antenna, or more competent?

A I can't answer that.

Q Do you agree with his statement that an essential element would be an antenna coupler at the in-put end of the line if one were to feed the antenna with an open wire line?

A If this particular antenna in its present form were to be used as a transmitting antenna and fed with open wire line, let me say of 300 ohms characteristic impedance, then the answer is yes.

Q By reciprocity, what is the difference if the antenna is used as a section?

A Once again, are you talking about feeding with open wire line?

Q Yes. Is this also a true statement?

A That is true, yes.

Q Would you be surprised to know that this problem of feeding the type of antenna under discussion with a 300 ohm parallel line has been successfully effected without the use of such antenna coupler?

A Well, I realize that this is true, that there are antennas in existence that are doing this. I have never looked into the method of the feed. I have not been aware of it. I have not been in the antenna field for several years. I would be interested in knowing the details behind it.

Q Would it be fair then to say that it certainly was not obvious to you or to Mr. Campbell, apparently, that such an antenna could be fed with a parallel wire line without an antenna coupler at the time you wrote the

article?

A This antenna?

Q Yes, sir.

A Yes, some means for matching purposes.

Q And if it could be done without an antenna coupler, this would be a surprise to you at that time?

A At that time, yes.

Q I note at the bottom of Figure 5 of your article, J-10, you say, under the picture, that you have exaggerated the view of the extension of the inner or center coaxial line conductor.

A Yes.

Q You then go on to say that the center conductor should be made as short as possible.

A That is correct.

Q Wouldn't the length of that inner conductor or center conductor depend upon how closely you spaced the booms from each other?

A That is correct.

Q It is the fact, so the record is clear, that you never did operate the antenna, J-51, described in your article, J-10, with a parallel wire in-put feed.

A That is correct.

Q Would you tell us how you happened to appear

here today?

A Approximately two weeks ago I went into work and there was a message on my desk to call Mr. Berliner in New York. I was busy at the time and didn't get to make the call and later on that afternoon Mr. Berliner called again at which time I spoke to him about this.

He asked me if I was the author of this article. He asked me if I had any of the original data to which I said I had some, I would have to get it together.

He asked me who I worked with at QST and I told him Mr. Campbell.

I believe I volunteered the information that I thought the antenna was still in existence. I don't think Mr. Berliner asked me, and I told Mr. Berliner who I thought had it.

Q Did Mr. Berliner ask you to appear to give the facts you have given today?

A Yes, he did.

Q Did he tell you on behalf of what client?

A Yes.

Q Did he tell you it was JFD?

A Yes, he told me he represented the JFD Corporation.

Q Did he give you the Blonder patent in suit?

A He gave me a copy of the original Blonder patent itself.

Q Did you have a chance to study that before you testified?

A Not in detail. I made reference to Section 5 only that was in contention. I glanced very rapidly at Section 5. I did not study the entire patent in structure and detail.

MR. RINES: I have no further questions.

REDIRECT EXAMINATION

BY MR. BERLINER:

Q Mr. Heslin, when was the last time you had occasion to use the equation, J-57?

A Fairly recently there were a number of associates that I worked with that were interested in home construction of a similar antenna for television use and asked me if I would design one for them, and I went rapidly through some of these facts and I did go into this equation, but the intent was that we would not feed these antennas with open wire line; that we would feed them coaxially and use Balun transformers for impedance matching purposes.

I might add that this took place before I was involved in this. This came out of the blue to me. It

was not brought back to life by this situation.

Q Referring again to the passage in J-10, "The antenna can also be fed with open wire line but with a high SWR which would make it essential to use an antenna coupler at the in-put end of the line," do you know whether an antenna coupler would be necessary with the antenna, J-51, if the boom spacing approximated that required for a 300 ohm impedance?

A No, it would not be required.

MR. BERLINER: I am finished.

MR. RINES: I have no further questions.

- - -

(Signed) Robert F. Heslin

Subscribed and sworn to before me this 6th day of March 1967.

(Signed) David L Nachman
Notary Public, State of Ny
title

RAISED SEAL

CERTIFICATE

State of New York)
)ss
County of New York)

I, Isaac H. Shapiro, a Notary Public duly commissioned and qualified in and of the County of Kings, State of New York, do hereby certify that pursuant to stipulation there came before me the following person, to wit, ROBERT F. HESLIN, who was by me duly sworn to testify to the truth and nothing but the truth of his knowledge touching and concerning the matters in controversy in this cause; that he was thereupon carefully examined upon the interrogatories submitted and his examination reduced to writing under my supervision; that the deposition is a true transcript of the record of the testimony given by the witness and that there were marked upon this deposition Exhibits J-10 through and including J-57.

I further certify that I am neither attorney nor counsel for, nor related to or employed by any of the parties to the actions on which this deposition has been taken, and further that I am not a relative or employee of any attorney or counsel employed by the parties hereto, nor financially interested in the

action.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my Notarial Seal this 23rd day of February, 1967.

Notary Public
State of New York
No. 24-3613000
Commission expires
March 30, 1967

I N D E X

Witness	Direct	Cross	Redirect
ROBERT F. HESLIN	3	15	28

E X H I B I T S

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