Isbell's work as prior art against Mayes et al.

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. Go to next page

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 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.

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.

Folded dipoles vs. simple dipoles

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 ~~dipiers~~ dipoles.

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-

Research reports were freely available & there was no policy against it as long as copies were available

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

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 those reports contain distribution lists at the ends of those 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.

Referring to Antenna Laboratory Research Reports

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.

Go to next page

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

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 these monthly reports and for what purpose were they prepared and how were they handled?

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

Turner's suggestion of Vecing

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. Mayes, 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 Mayes, et al. Re-issue Patent and the original Mayes, et al. patent 3108280?

A Yes.

Inv. record

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. Mayes, 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

Go to next page

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.

Go to next pg.

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. But it still worked

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. What parameter? -- V-angle

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.

Go to next pg.

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 departures from the log periodic formulas 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-