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F. O. RICHEY (1878-1964)

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PATENT AND
TRADEMARK LAW

LLOYD L. EVANS
OF COUNSEL

December 28, 1967

Robert H. Rines, Esq.
Hofgren, Wegner, Allen, Stellman & McCord
20 North Wacker Drive
Chicago, Illinois 60606

Re: Log Periodic Patent Litigation

Dear Bob:

Between now and the New Years week end, I shall complete the job of duplicating all of the documentary exhibits of plaintiff (The Finney Company, in our case) identified in the course of the Finkel deposition, despite the fact that, individually, many of them contain nothing of special interest. My reason for identifying every piece of advertising and sales promotion literature of JFD that I could get my hands on and that pertained to its so-called "log-periodic antennas" is to support the argument that the commercial success of those antennas was not attributable solely (if at all) to the merits of the Isbell invention, but was the result, at least in large part, of a tremendous advertising and promotion compaign that sought to capitalize on the glamour of the circumstances under which the Isbell work was done.

During our telephone conversation this morning, Dick Phillips said that you were particularly interested in our Exhibits 10 through 30. I would think that you would be equally interested in Exhibits 4 through 9 and 31 through 38 (note that there were no Exhibits 20 through 29). All of the above-mentioned exhibits through 38 contain a patent notice reading substantially identically and as follows:

> "U.S. PATENT NUMBERS 2,958,081-2,985,879-3,011,168-
> ADDITIONAL PATENTS PENDING."

Accordingly, I am enclosing herewith a copy of each of those exhibits in a Xerox form from which additional copies can be prepared as needed.

A word of explanation may be helpful to an understanding of why those exhibits include a number of substantial duplicates. My purpose was to identify as a separate exhibit each individual piece of literature containing a false patent notice, on the assumption that a finding of false marking would produce a penalty computed by multiplying the $500 statutory fine by the number of separate items distributed with the false patent marking. Thus, for example, our PX-J19 is a booklet reproducing advertising mats available to JFD distributors. Because each of the advertising mats was a separately distributed item, each of them that contained the false patent notice was individually identified as a separate exhibit.

With the hope that nothing unexpected will interfere and that I can get transportation, I am planning to fly to Chicago during the late afternoon of New Years Day and will go to the Union League Club where I shall stay during the balance of your trial. I shall appreciate your leaving a message for me at the Union League Club as to where I can contact you after I arrive there.

Between now and my arrival I shall be concentrating on organizing information in my possession with which you might not yet be acquainted and which might be helpful to your case. In the meantime, best of luck.

Sincerely,

John

JFP:jh
Enclosures

cc: Richard S. Phillips, Esq.

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TRADEMARK LAW
LLOYD L. EVANS
OF COUNSEL

September 27, 1967 EW.

Robert H. Rines, Esq.
10 Post Office Square
Boston, Massachusetts

Re: <u>The Finney Company v. JFD et al.</u>

Dear Bob:

Enclosed herewith is a copy of the Finkel deposition which I took on September 8th. I ordered this copy as an extra one for your use on the asumption that it will prove of material value to you in the suit by JFD against Blonder-Tongue. Unfortunately, the reporter, who wore a hearing aid, had considerable difficulty, and corrections of some importance will be required on nearly half of the 98 pages. Jerry Berliner and I will attempt to agree on corrections, and I shall see that you receive a list of the corrections agreed upon in due course.

The gist of questions and answers relating to improper patent marking and improper representations regarding JFD's antennas is probably sufficiently clear from the deposition without your having the particular advertising exhibits available for reference. However, as I review the deposition a second time for the purpose of digesting its important contents, I shall note the particular exhibits referred to in the questions and answers and send copies of them to you.

Most of the advertising exhibits marked for identification as reported on page 3 of the deposition were not specifically referred to, and my collection is still not complete. By the time I am satisfied to quit collecting more, I shall have an additional 10 to 30 exhibits and, probably, the most complete collection in existence. If you should go to trial before we do, I am sure you will wish to review my entire collection, whether or not you wish to use copies of each individual exhibit of that character.

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NO. TEN POST OFFICE SQUARE, BOSTON

Despite Finkel's denial that JFD's advertising of its so-called "log periodic" antennas was extraordinarily great, the volume and character of that advertising, considered together, should be useful for convincing any Court that the commercial success was not necessarily attributable to the merit of any patented invention and, therefore, has little or no significance as evidence of patent validity.

Finkel's testimony regarding the hiring of Blonder-Tongue personnel runs from page 82 to page 85.

His testimony regarding patent mismarking runs from page 20 to page 31 and page 51 to page 59.

Most of the balance of Finkel's testimony through page 81 relates to misstatements in JFD's advertising.

Finkel's testimony from page 85 to page 88 covers what was largely an abortive effort to obtain admissions of antitrust law violation.

Pages 88-94 of Finkel's testimony primarily covers the establishment of JFD's infringement of three of our clients' patents on antennas having no relationship to the present litigation. Assuming validity of those patents, Finkel essentially admitted the infringement and was served with a pre-prepared notice thereof (PXJ119).

As a matter of minor interest, Finkel testified on page 8 that JFD had always known that it was "number two" in the antenna business in terms of total dollar sales volume. However, on page 45, after a question regarding JFD's advertising of itself as being "the world's largest antenna manufacturer," Finkel acknowledged that JFD probably was the largest in November 1962.

If we receive a decision from Judge Lynch on our Motion for Summary Judgment at our hearing scheduled for September 29th, as he has indicated, I shall let you know immediately, of course. Although the assignment at that hearing of a trial date for our case will probably be a subject of discussion, there is every indication that we will not go to trial before the early part of next year. Accordingly, if an earlier trial date is set in your case, we should probably be thinking about a fairly early conference to review ammunition we have collected that you might find useful.

Sincerely,

John

JFP:JH

Enclosure

cc: Richard S. Phillips, Esq.

P.S.: Since the above was typed I have received a revised copy of the original license agreement between the Foundation and JFD with the language of several previous deletions restored. This may be a more complete copy of that agreement than you have obtained, and a copy is enclosed.

J.F.P.

PATENT NO. →
(PLEASE WRITE IN WHITE SPACES, ONLY. VOID IF FOLDED, STAPLED OR [redacted] OTHER[redacted]ISE MUTILATED.)

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Rines & Rines

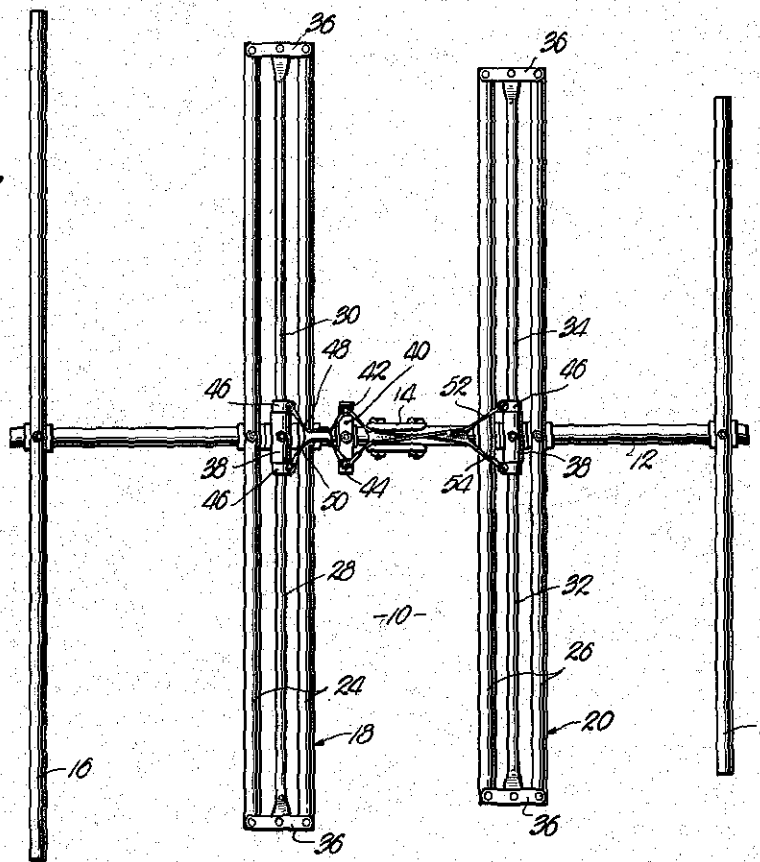
See ltr 9/28 to Rines from Pearne

March 8, 1955 G. N. CARMICHAEL 2,703,840

MULTIFREQUENCY ANTENNA ARRAY

Filed Feb. 9, 1951

Fig. 1.



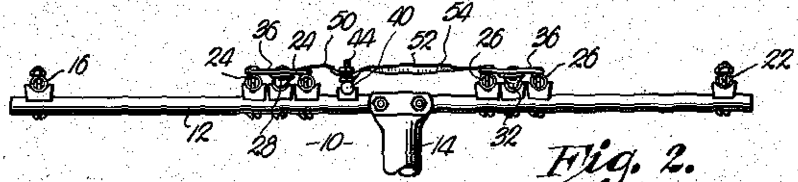


Fig. 2.

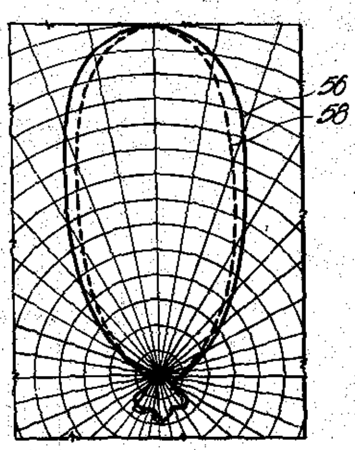


Fig. 3.

INVENTOR.
Gershom N. Carmichael
BY
ATTORNEY.

2,703,840

MULTIFREQUENCY ANTENNA ARRAY

Gershom N. Carmichael, Griggsville, Ill.

Application February 9, 1951, Serial No. 210,108

5 Claims. (Cl. 250—33.53)

This invention relates to antenna structure of the kind having both active and parasitic elements, the primary object being to provide optimum gain on any of a number of radio frequencies through advantageous use of all of the remaining elements in the array whenever any one element is active on its particular frequency.

The use of parasitic elements in antenna arrays as directors and reflectors to provide optimum gain and minimum interference in an active element on a particular frequency, is well known. Such parasitic elements, however, serve no other purpose so far as becoming active on other frequencies. Accordingly, each active element, in conventional structures, is provided with its own set of parasitic elements and even when the latter are rendered common to a number of active elements, an expensive, cumbersome and inefficient antenna system must be provided.

It is the most important object of this invention, therefore, to provide a number of active elements in a single array, so interconnected electrically as to render each alternately parasitic to the other, depending on which is active, not only from the standpoint of providing additive voltage directly, but from the standpoint of serving in a reflection and/or directive capacity.

Another important object of this invention is the provision of antenna structure wherein the elements, when operating parasitically, provide voltage gain for an active element by direct connection therewith and with the feed line through proper phasing relationships.

A further important object of this invention is to provide an antenna array having a number of elements each of a length corresponding to a respective frequency, critically spaced and interconnected with proper proportions and electrical distances with a common feed line, to effect the necessary phasing for accomplishing the above mentioned results relative to gain and output voltages.

It is an object of this invention to provide an antenna array which can be used for reception or transmission on either of two or more predetermined frequencies and which requires no manual adjustment at the antenna to accomplish a change from one frequency to the other.

Many other minor objects, including details of construction will be made clear or become apparent as the following specification progresses, reference being had to the accompanying drawings, wherein:

Figure 1 is a top plan view of a multi-frequency array made according to my present invention.

Fig. 2 is a side elevational view thereof.

Fig. 3 is a graphic representation of the voltage patterns for two selected frequencies.

Previously, it has been necessary to provide a separate antenna array for each frequency employed. Such a requirement has made operation on more than one frequency prohibitive to many users because of the cost and difficulty of installation of separate antennas. It is natural to consider the possibility of one conventional array having sufficiently broad frequency response to cover two adjacent frequencies, but the experiments in tuning the elements to obtain this result have not been successful. Since the functioning of the parasitic elements is dependent on dimensions and spacing of such elements to provide the proper phasing, it is not possible to have characteristic parasitic behavior over a range of frequencies which is any considerable percentage of the fundamental frequency.

Nearly all of the properties possessed by an antenna as a radiator or transmitter also apply when it is used as a receiving antenna. Current and voltage distribution, impedance and resistance, and directional characteristics are the same in a receiving antenna as they would be if it were used as a transmitting antenna. This reciprocal behavior makes possible the design of a receiving antenna of optimum performance based on the same considerations going into the design of a transmitting antenna. Accordingly, as will hereinafter become apparent, in describing the antenna structure hereof, it is to be understood that the array may be used within the broad concepts of the invention with equal advantages either for transmitting or receiving radio frequency signals. Additionally, while the novel features of the array have been developed primarily because of the dire need thereof in the field of television, it is not limited to such use and may have tremendous importance to the radio field, as will become clear to those skilled in the art.

For purposes of description and illustration, a four element array is shown. However, it is to be understood that this invention is not to be limited as to the number of elements employed, since anyone skilled in the art is capable of adding elements to amplify the signal received or transmitted.

In the following description of such an antenna, when used for reception, an active element shall be understood to be an element which is connected to the feed-line so that the voltage induced in it is delivered directly to the feed-line. A parasitic element shall be understood to be an element which re-radiates its induced voltage in such a way that voltage phases will produce a desired result in the active element, such as addition, in the case of a director, and cancellation or rejection, in the case of a reflector. The functioning of a parasitic element as a reflector or as a director is determined by its physical dimensions and spacing from the active element.

A parasitic array, in general, consists of an active element, together with one or more parasitic elements, designed to deliver a voltage by means of a feed-line to some certain point. The parasitic elements are designed to provide gain for signals from one direction and rejection of signals from some other direction, these elements being designed ordinarily to provide gain in one direction and rejection from the opposite direction. In general, in such a parasitic array, the forward gain and backward rejection can be maintained only over a very narrow band of frequencies. An array made in accordance with the principles hereof is, however, operative on two or more of such narrow band of frequencies.

Basically, the principle involved calls for a single element in an array to function in a dual way, both as an active element on one frequency and as a parasitic element on a different frequency. In the simplest case, such an array would consist of two elements, one of which acts as an active element on a frequency, f_1, while the other acts as a parasitic element on that frequency. On some other frequency, f_2, the first element would act as a parasitic element, while the second would be *the active element for the frequency,* f_2. This is possible since the functioning as a parasitic element necessitates a length different from that of an active element. In this case, each of the elements is also an active element and it is necessary to connect each to the feed-line. This means that the two elements have a direct connection to each other, and this connection must be made in such a way that the voltages, both from the direct connection and from the re-radiated signal, will have the proper phase relation.

The antenna array chosen for illustration in Figs. 1 and 2 of the drawing, is broadly designated by the numeral **10** and includes an elongated supporting bar **12** that is horizontally disposed when the array **10** is used in one common manner. The supporting bar **12** is secured intermediate its ends to a vertical mast or standard **14**.

The array **10** illustrated is provided with four elements **16, 18, 20** and **22**. The elements **18** and **20** being known in the trade as "folded dipoles." It is noted that the dipoles 18 and 20 are of differing lengths, that the element 16 is longer than the dipole 18 and that the element 22 is shorter than dipole 20. It is well known that such lengths are critical, and, in the instance shown, the length of dipole 18 has been chosen to receive or transmit radio signals having a frequency of 66–72 megacycles, while the length of dipole 20 has been chosen to receive or transmit on 76–82 megacycles. Likewise, the lengths of elements 16 and 22 should be chosen to render the same operative as a reflector and as a director respectively for the frequency ranges of the two primary elements 18 and 20. Such precise physical lengths vary directly with the frequencies employed and are well known to those skilled in this field.

Thus, in the illustrated antenna 10, dipole 18 is 80 inches long, dipole 20 is 69 inches long, reflector 16 has a length of 85 inches, and director 22 is preferably 66 inches long.

Each dipole 18—20 includes a pair of spaced-apart elongated, preferably tubular members 24 and 26 respectively, of metallic or other conducting material, together with a center member of the same length in spaced parallelism with the outermost members 24 and 26, as the case may be. In a folded dipole such center member consists of a left segment 28 and a right segment 30 for element 18, as well as a left segment 32 and a right segment 34 for the element 20. The three members of each dipole 18—20 are interconnected electrically at the outermost ends in any suitable manner such as by metallic plates 36. Proper operation demands, however, that the left and right segments be electrically separated at their proximal ends and thus there is provided in the present construction, tubular insulators 38 telescopically receiving the segments and serving as a means of joinder thereof to the bar 12.

Following the principles of this invention, the center segments of the dipoles 18 and 20, must be joined with each other electrically and with a feed-line (not shown) whether the latter serves to supply voltages to a receiver or to receive voltages from a transmitter. To this end, a terminal bar 40 of insulating material is secured to bar 12 between the elements 18 and 20 for mounting a pair of spaced terminal posts 42 and 44, one conductor of the feed-line being joined to each post 42–44 respectively.

Each segment 28—30—32—34 is provided with a conductible clamp 46 adjacent the corresponding tube 38 serving as a means for joining such segments with the posts 42 and 44 and thus with the feed-line. A conductor 48 joins segment 30 with post 42; a conductor 50 connects segment 28 and post 44; a conducting line 52 is attached to segment 34 and to post 44; and a fourth conductor 54 joins the segment 32 with the post 42. It is thus seen that, in the illustrated array 10, conductors 52 and 54 are transposed between element 20 and the feed-line connected to posts 42 and 44.

As above indicated, the purposes of such arrangement include rendering the elements 18 and 20 alternately active on their respective frequencies within a single bay. However, by following certain important considerations, the other element is not completely inactivated, but serves to provide an appreciable voltage gain for the active element, not only through parasitic functioning, but by direct inducement to the feed-line or, in the case of use with a transmitter, to the atmosphere. It is thus clear that in order to render the elements 18 and 20 mutually cooperative in this respect, a proper phasing relationship must be established therebetween.

With the lengths of dipoles 18 and 20 chosen for the above mentioned frequencies, it has been found preferable to space the same at a distance equal to one-tenth of the average of the wave lengths of dipoles 18 and 20. Accordingly, the distance between the center segments of dipoles 18 and 20 is approximately 22 inches.

The spacing and lengths of the elements 16 and 22 which are purely parasitic are designed to provide the best compromise between three primary objectives, i. e., high forward gain, broad frequency response, and high front-to-back ratio. To this end, the distance between reflector 16 and the center element of dipole 18 should be equal to approximately one-tenth of the wave length of the latter or substantially 25 inches. The same proportion has been found preferable in establishing the distance between the center segment of dipole 20 and director 22 or approximately 20 inches.

All of the above dimensions may be varied within virtually infinite ranges but with the distance between the dipoles chosen, proper phasing can be establishing only by effecting a proper ratio of electrical lengths between the dipoles through conductors 48, 50, 52 and 54. In the present instance, the electrical distance from the outermost end of segment 34 (adjacent its plate 36) to its clip 46 and thence through conductor 52 to post 44 is equal to the electrical distance from the outermost end of segment 30 to post 42 through conductor 48. Likewise, the electrical distance from the outer end of segment 32 through conductor 54, to post 42, is equal to the electrical distance from the outermost end of segment 28 to post 44 via conductor 50. Such 1 to 1 ratio varies directly with the chosen distance between the dipoles and even with the precise location of the terminal posts 42 and 44 relative to the dipoles. In the present antenna, such posts are co-planar with the dipoles and spaced approximately 7½ inches from the segments 28—30.

It is well appreciated in this field that no precise formula can be set forth for establishing the proper phasing relationship produced by the dimensions and ratios above set forth. Thus, changing of the distance between the dipoles may require one or more additional alterations such as varying the electrical distance ratio above set forth, or re-positioning the terminal posts 42—44 toward or away from the dipole 18 or in another plane.

Such factors as the diameters of the members forming a part of the dipoles, the widths thereof, the electrical resistance of the interconnecting conductors, and so forth, may also affect the desired phasing characteristics. To this end, it is also recognized that in some constructions, the transposition between conductors 52 and 54 must be eliminated to effect the results of the present invention.

Extensive tests have proved that the operation of antenna array 10 is substantially as follows:

Assuming first that dipole 18 is rendered active on its particular frequency, even at maximum efficiency, it will deliver little more than fifty percent of the induced voltage to the feed-line through posts 42 and 44. Since an active element has some of the necessary characteristics of a parasitic element, the remaining voltage is, in a large part, re-radiated. Such re-radiated voltages are directed to a considerable extent to the inactive dipole 20, and induced thereby through segments 32—34 and conductors 52—54 to the feed-line to provide gain in the output voltage of dipole 18. In addition, added voltages on the frequency of dipole 18 are received directly by the dipole 20 and fed to the feedline to provide additive effect.

Such operation on the part of inactive dipole 20 is made possible solely because of the fact that proper phasing is provided in the connection of the dipoles with each other and with the feed-line while maintaining the critical values above described. In absence of a proper choosing of the distance between the dipoles, the parasitic effect would be seriously affected. And, without proper phasing, the voltages received by dipole 20 either directly or by re-radiation from dipole 18 would not produce the desired gain in the feed-line.

It is seen therefore, that when dipole 18 is active, its operation is enhanced not only by element 16 operating as a reflector and element 22 as a director, but by the dipole 20 also operating as a director but inducing its received voltages directly to the feed-line.

Conversely, when the dipole 20 is active on its frequency, the dipole 18 operates parasitically as a reflector for cancelling undesired signals from other directions. However, in such instance, the dipole 18 receives voltages that are re-radiated by dipole 20 and also receives directly voltages corresponding to the frequency of dipole 20, both of which are impressed upon the feed-line to provide a very significant and extremely important additive effect.

It can now be understood why the precise physical characteristics of antenna 10, as illustrated in the drawing have no importance whatever to the principles involved herein. The new departure from conventional parasitic antennas contemplates two or more active elements, whether or not the same are formed as dipoles and whether or not the additive elements **16** or **22** are utilized. In its simplest form, a pair of active elements such as segments **30** and **34** mounted on a suitable support **12**, may be coupled together and to a feed-line irrespective of the position of the point of connection with the feed-line, in which case such active elements would most likely be arranged vertically.

Another possibility, still within the principles hereof, would contemplate the elimination entirely of members **16**, **22**, **24** and **26** from the array illustrated in Figs. 1 and 2.

Still further, a virtually unlimited number of active elements such as dipoles **18** and **20**, could be provided, each operating in an additive way when any one element is active.

Finally, the number of reflectors and directors may be varied as desired.

Antenna **10**, therefore, is characterized by its high gain, sharp lobe pattern, high front-to-back ratio and low vertical wave angle response. Figure 3 of the drawing shows graphically voltage lobes **56** and **58** for the frequencies of dipoles **18** and **20** respectively, it being noted that the front-to-back ratio is high and remains above 20 decibels from the carrier wave for the frequency of dipole **18** through the carrier frequency of dipole **20**.

Through use of the antenna structure hereof, the problem of attempting to produce a single bay having sufficiently broad frequency response to cover two or more adjacent frequencies is overcome. Irrespective of the fact that the functioning of parasitic elements is dependent upon dimensions and spacing to provide proper phasing, rendering cost and installation difficulties prohibitive, particularly in fringe areas, in order to cover a wide range of frequencies, following the principles of this invention affords excellent parasitic behavior in a single bay.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A multielement, multifrequency, unidirectional, broadside antenna array adapted for high gain operation selectively on any one of a number of separated, distinct frequency channels, throughout the respective band widths thereof, with each channel centered about a single predetermined frequency, by minimizing losses of reradiated energies, and notwithstanding any inherent impedance mismatching resulting from different self-impedances of the elements, said single predetermined frequencies being different and separated, said antenna array comprising a plurality of antenna elements, each of said elements being self-resonant to a different one of said single predetermined frequencies and the elements progressively decreasing in electrical length as one end of the array is approached, whereby the frequencies to which the same are tuned are progressively higher as said one end of the array is approached, each element having conductor means coupled thereto; structure mounting said elements against relative movement and in predetermined spaced relationship, whereby to electromagnetically couple each element with the remaining elements and thereby render each a parasitic element at the resonant frequencies of the remaining elements in order to utilize a substantial portion of said reradiated energies; and transmission line terminal means coupled with said conductor means to render each of said elements a driven element on its respective resonant frequency.

2. A multielement, multifrequency, unidirectional, broadside antenna array adapted for high gain operation selectively on any one of a number of separated, distinct frequency channels, throughout the respective band widths thereof, with each channel centered about a single predetermined frequency, by minimizing losses of reradiated energies, and notwithstanding any inherent impedance mismatching resulting from different self-impedances of the elements, said single predetermined frequencies being different and separated, said antenna array comprising a plurality of antenna elements, each of said elements being self-resonant to a different one of said single predetermined frequencies and the elements progressively decreasing in electrical length as one end of the array is approached, whereby the frequencies to which the same are tuned are progressively higher as said one end of the array is approached; structure mounting said elements against relative movement and in predetermined spaced relationship, whereby to electro-magnetically couple each element with the remaining elements and thereby render each a parasitic element at the resonant frequencies of the remaining elements in order to utilize a substantial portion of said reradiated energies; transmission line terminal means; and means for rendering each of said elements a driven element on its respective resonant frequency and comprising conductor means for each element respectively, coupling the elements with the transmission line terminal means and provided with predetermined electrical lengths for delivering voltages carried thereby in phase.

3. A multielement, multifrequency, unidirectional, broadside antenna array adapted for high gain operation selectively on any one of a number of separated, distinct frequency channels, throughout the respective band widths thereof, with each channel centered about a single predetermined frequency, by minimizing losses of reradiated energies, and notwithstanding any inherent impedance mismatching resulting from different self-impedances of the elements, said single predetermined frequencies being different and separated, said antenna array comprising a plurality of elongated antenna elements having parallel, longitudinal axes and median, transverse, aligned axes, said axes all being in a common horizontal plane, each of said elements being self-resonant to a different one of said single predetermined frequencies and the elements progressively decreasing in length as one end of the array is approached, whereby the frequencies to which the same are tuned are progressively higher as said one end of the array is approached, each element having a pair of colinear, quarter-wave segments, each segment having a conductor coupled thereto and disposed to render each element a center-fed, half-wave dipole; structure mounting said elements against relative movement and in predetermined spaced relationship, whereby to electro-magnetically couple each element with the remaining elements and thereby render each a parasitic element at the resonant frequencies of the remaining elements in order to utilize a substantial portion of said reradiated energies; and a pair of spaced, transmission line terminals spaced from said elements and connected directly with said conductors to render each of said elements a driven element on its respective resonant frequency.

4. A dual element, dual frequency, unidirectional, broadside antenna array adapted for high gain operation alternately on either of a pair of separated, distinct frequency channels, throughout the respective band widths thereof, with each channel centered about a single, predetermined frequency, by minimizing losses of reradiated energies, and notwithstanding any inherent impedance mismatching resulting from different self-impedances of the elements, said single predetermined frequencies being different and separated, said antenna array comprising a pair of elongated antenna elements having parallel, longitudinal axes and median, transverse, aligned axes, said axes all being in a common plane, each of said elements being self-resonant to a different one of said single predetermined frequencies, one element being longer than the other, whereby the frequency to which it is tuned is lower than the frequency to which said other element is tuned, each element having a pair of colinear, quarter-wave segments; structure mounting said elements against relative movement with the shorter element ahead of the longer element and in predetermined spaced relationship, whereby to electro-magnetically couple each element with the other and thereby render the shorter element a parasitic director for the longer element at the resonant frequency of the latter and render the longer element a parasitic reflector for the shorter element at the resonant frequency of the latter in order to utilize a substantial portion of said reradiated energies; a pair of spaced, transmission line terminal means spaced from said elements; and means for rendering each of said elements a driven, center-fed, half-wave dipole on its respective resonant frequency and comprising conductor means for each element respectively, coupling the elements with the transmission line terminal means and provided with predetermined electrical lengths for delivering voltages carried thereby in phase.

5. A dual element, dual frequency, unidirectional, broadside antenna array adapted for high gain operation alternately on either of a pair of separated, distinct frequency channels, throughout the respective band widths

thereof, with each channel centered about a single, predetermined frequency, by minimizing losses of reradiated energies, and notwithstanding any inherent impedance mismatching resulting from different self-impedances of the elements, said single predetermined frequencies being different and separated, said antenna array comprising a pair of elongated antenna elements having parallel, longitudinal axes and median, transverse, aligned axes, said axes all being in a common horizontal plane, each of said elements being self-resonant to a different one of said single predetermined frequencies, one element being longer than the other, whereby the frequency to which it is tuned is lower than the frequency to which said other element is tuned, each element having a pair of colinear, quarter-wave segments, each segment having a conductor coupled thereto and disposed to render each element a center-fed, half-wave dipole; structure mounting said elements against relative movement with the shorter element ahead of the longer element and in predetermined spaced relationship, whereby to electro-magnetically couple each element with the other and thereby render the shorter element a parasitic director for the longer element at the resonant frequency of the latter and render the longer element a parasitic reflector for the shorter element at the resonant frequency of the latter in order to utilize a substantial portion of said reradiated energies; and a pair of spaced, transmission line terminals spaced from said elements and connected directly with said conductors to render each of said elements a driven element on its respective resonant frequency, the conductors of the shorter element being longer than the conductors of the longer element, the electrical length of each segment of the longer element plus the electrical length of its conductor being substantially the same as the electrical length of each segment of the shorter element plus the electrical length of the conductor of the latter.

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May 25, 1967

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HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

Robert H. Rines, Esq.
Rines & Rines
10 Post Office Square
Boston, Massachusetts

COPY

Re: Log Periodic Patent Litigation

Dear Bob:

In attempting to organize the evidence I have accumulated in support of patent mismarking, unfair competition, etc. by JFD, I again reviewed the correspondence and other documents produced by the Foundation and by JFD over a year ago. Much of that material is of little or no value, and some is of value to our case but not to yours. However, a few items appeared to be of interest in connection with your case, and copies are enclosed. The enclosed copies are divided into two groups which I shall discuss briefly.

The stamped document numbers were put on the enclosed documents at the time they were produced. Those produced by the Foundation were stamped with a number beginning with the letter "A." Those produced by JFD were stamped with a number preceded by "JFD DOC. NO."

Among the first group of enclosed letters is one of September 6, 1962, which deals with the period of exclusivity provided in the license from the Foundation to JFD. Although the letter does not so state, I believe it is the fact that such period of exclusivity was selected to run for three and one-half years after allowance of a claim in the Isbell or Mayes et al. applications because both parties recognized that, until that time, no claims would have been allowed that would be applicable to any antenna contemplated by JFD for manufacture.

Nevertheless, as you are undoubtedly aware, JFD applied to its cartons and literature the numbers of patents that had issued at the time the license was granted and which clearly did not apply to the antennas JFD was making.

The second letter in this group, dated April 17, 1963, was apparently prompted by a response from Kay-Townes to a notice of infringement in which Kay-Townes questioned the applicability of patents enumerated in the JFD patent notices to any of the antennas JFD was making. This letter indicates that the Foundation, as late as April 17, 1963, was not aware of the patent notices being used by JFD since about September 1962. This letter raises the question of the propriety of such notices and asks that JFD advise as to the form of notices. Nevertheless, as acknowledged on page 3 of a sworn statement provided me by JFD (copy also enclosed), JFD made no change in its patent notices until about September 9, 1963 and presumably did not actually use the revised notices until somewhat after that date.

For some time after September 1963, the Foundation used the "one or more" type of patent notice, naming only the same three inapplicable patents "and additional patents pending." The last two letters of the first group enclosed herewith indicate that both the Foundation and JFD recognized the impropriety of that notice where none of the specified patents was applicable.

As late as November 1963, JFD put out an advertisement to be used by its customers and referring to advertisements in Look and Sunset magazines that contained a freak patent notice of the latter character that omitted the word "pending." A copy of this advertising form is enclosed for such value as it may have.

As is evident from the two preceding paragraphs herein, the list of patent notice forms on pages 2 and 3 of the JFD sworn statement is incomplete in failing to disclose the notice employed like Form B with only the three inapplicable patents being enumerated.

The second group of letters (Smith to Finkel of 10/28/64 and Mayes to Smith of 12/18/64) both discuss the significance of element spacing in a manner that is probably of greater interest to us than to you. The second of these letters, however, discusses the spacing of the parallel feeders of the "double boom" type of antenna, and this discussion may be of particular interest to you in your case.

It seems possible that our collection of information, admissions, etc. on various aspects of this litigation may include many details that would be helpful to your case but which we have not yet had an opportunity to discuss. I plan to be a spectator at the trial of your case if it should come up for trial in the near future as indicated, and will be available at that time for any discussion you might consider helpful. However, knowing the difficulty of working new ideas into a case while the case is being tried, I am wondering if you would consider it worthwhile for us to get together sometime prior to your trial for making available to you every bit of information and every idea which you might find helpful. After all of the work we have done in preparing our case, I would hope that we could contribute something, and it is a part of my job for my client to do this if possible.

Sincerely,

John

JFP:jh
Enclosures

cc: Richard S. Phillips, Esq.

LAW OFFICES

JFD DOC.NO. 50

MERRIAM, SMITH & MARSHALL

THIRTY WEST MONROE STREET

CHICAGO 3

TELEPHONE FINANCIAL 6-5750

CHARLES J. MERRIAM
SAMUEL B. SMITH
JEROME B. KLOSE
NORMAN H. SHAPIRO
WILLIAM A. MARSHALL
BASIL P. MANN
ALVIN D. SHULMAN

September 6, 1962

Mr. Edward Finkel
JFD Electronics Corporation
6101 Sixteenth Avenue
Brooklyn 4, New York

Re: License Agreement Between University of Illinois Foundation and JFD Electronics Relating to Antenna Inventions

Dear Ed:

The Board of Directors of the University of Illinois Foundation at its meeting held today (Thursday, September 6, 1962) approved a modification of the license agreement above identified. The grant clause will be modified to the extent that the period of exclusivity will extend for 3-1/2 years subsequent to the allowance of a claim in either application Serial No. 26,589 or Serial No. 59,671 which is not a claim involved in interference with Marconi, or it will cover a period of 2-1/2 years subsequent to the issuance of a U.S. patent based on either of the said applications, whichever period is the longer.

To illustrate, if a claim were allowed say October 1, 1962, the exclusive period would run for a period of 3-1/2 years from that date if a patent should issue sooner than one year subsequent to October 1, 1962. On the other hand, even if a claim were to be allowed in one of the applications on say October 1, 1962 but the first patent on either named application did not issue until say January 1, 1964, you could hold your exclusive license period until July 1, 1966, which would be a longer period than 3-1/2 years subsequent to October 1, 1962 basing the supposition on the date of claim allowance.

I presume in view of this Board approval the existing agreement can be modified by a separate side letter which Mr. Colvin will write to you in duplicate and which you can accept on behalf of the corporation. This plan would seem to me to be preferable to reexecuting the agreement, but we want to afford you an opportunity to make your choice.

MERRIAM, SMITH & MARSHALL

Mr. Edward Finkel
September 6, 1962
Page Two

A copy of this letter goes forward to Mr. Faber so that he will be alerted to the situation existing.

Sincerely,

Samuel B. Smith

Samuel B. Smith

SBS:jg

ccs: Mr. Sidney G. Faber
Mr. James C. Colvin

LAW OFFICES
MERRIAM, SMITH & MARSHALL
THIRTY WEST MONROE STREET
CHICAGO 3

CHARLES J. MERRIAM
SAMUEL B. SMITH
JEROME B. KLOSE
NORMAN M. SHAPIRO
WILLIAM A. MARSHALL
BASIL P. MANN
ALVIN D. SHULMAN
R. JONATHAN PETERS
EDWARD M. O'TOOLE

TELEPHONE
FINANCIAL 6-5750

April 17, 1963

Mr. Edward Finkel
JFD Electronics Corporation
15th Avenue at 62nd Street
Brooklyn 19, New York

Re: JFD Electronics Corp. License Under <u>University of Illinois Antenna Patents</u>

Dear Ed:

Professor Paul Mayes of the University of Illinois received a letter from the Kay-Townes Antenna Company (print enclosed) concerning JFD Electronics Corporation products.

I would appreciate having you advise me how you are marking any antenna products now being sold. Ordinarily we would not be adverse to having a patent notice on goods which shows that the marketed product involved one or more of a group of patents. However, while you are licensed under the patents named in the Kay-Townes Antenna Company letter (note patent listed as 3,001,168 probably should have been listed as 3,011,168) I am somewhat doubtful that you are marketing any product which would fall within the scope of the identified patents. All of the patents relate to antenna structures which have radiation patterns and impedance characteristics which are essentially independent of frequency over wide bandwidths, but the antenna structure described is not of the general type provided by the LPV antenna.

For instance, in Dyson patent 2,958,081 (and not attempting to construe the patent in any respect) the conducting elements are wound so as to lie on a conical surface. In the Isbell patent 3,011,168 the elements are V-shaped and lie in different planes. However, the structure does provide a plurality of alternating slots and teeth which more or less characterize the general nature of the component described. In the DuHamel patent 2,985,879 the structure described is very much like the Isbell patent except that the limitations of the use of different planes is not present.

I think that Professor Mayes has done a credible job in his answer to the Kay-Townes Antenna Company but it would be helpful to me if you would send me a copy of your patent marking label or escutcheon, as the case may be, so that we will have some knowledge of how the patents are being

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marked and what patents are being marked. It may well be that your marking includes patents owned by JFD Electronics Corporation in addition to those of the University of Illinois Foundation and if that is the case then, of course, we can give some thought to this problem.

In respect of the Kay-Townes Antenna Company, I would like to have you supply as much information as you can about the group. Is it a group that worked with or collobo-rated with Channel-Master? What type of antenna structures are sold by Kay-Townes Antenna Company? This group may be one that should be considered with respect to infringement matters provided, of course, we can promptly issue either or both the Mayes and Carrel case and the Isbell case. Your prompt comments will be appreciated and I hope that I may have them prior to the end of the week because all of Professor Mayes, Mr. Lo and I plan to see the Examiner on the Mayes and Carrel case on Monday, April 22.

Perhaps a few comments should be made to answer your April 15 letter, which is appreciated. The essential point is that the matter of the Isbell case is one that cannot be moved except at the wish of the Patent Office. You may recall in this regard that we are still involved in the inter-ference with the Marconi group. We have asked for reconside-ration of the decision in the interference relating to Count II which embodied the claim originating in the Kravis et al application. However, no decision on our petition for recon-sideration has been received and, consequently, I am going to have to proceed to file a statement in the Patent Office that we will rely upon the dates asserted in our original preliminary statement. If we cannot manage to have the Examiner withdraw his decision then, of course, we are going to have to prove our case and this will involve, in all probability, the taking of depositions which will involve some time. I will let you know as soon as I can on what has happened, but I don't like to discourage you too much at this point.

Sincerely,
Original Signed by
SAMUEL B. SMITH
Samuel B. Smith

SBS:jg
Enc.: Kay-Townes Letter

ccs: Professor Paul E. Mayes
Mr. James C. Colvin

AOC295

3(b)

right file ?

J.F.D. License from U. of Ill. Foundation

April 15, 1964

Mr. Ed Finkel
Vice President-Sales
JFD Electronics Corporation
1462 Sixty Second Street
Brooklyn 19, New York

Dear Ed:

Thanks for your April 13 letter, with the enclosures of the numerous trade ads and consumer ads, as well as your most recent promotional pamphlets. I would like to have two additional copies of each of the recent promotional pamphlets.

Most of the problems raised by your advertising material relate to policy matters concerning the University of Illinois Foundation and the University itself. Those are matters upon which I cannot pass. I have, accordingly, sent all of your material to Mr. Colvin for his review and consideration and I should be able to advise you within the fifteen-day period concerning our views as to the propriety of all of the advertising. At the same time it will then be possible to give you a final indication of whether or not the material can be published with the understanding that you have complied with Paragraph 10 of the License, insofar as reference to the University or Foundation is concerned and with Paragraph 2, insofar as reference to the patents may be concerned.

I would like to know, however, what structures you are manufacturing or selling which you believe at the present time come within the teachings of the Dyson, Du Hamel and Isbell patents referred to, for instance, on page 4 of ELECTRONIC & APPLIANCE SPECIALIST for March, 1963. May I please have your comments at an early date.

Sincerely,

SBS:mn

Samuel B. Smith

A00070

160 Duplicate A-00068

JFD

JFD ELECTRONICS CORP.

April 21, 1964

Merriam, Smith & Marshall
30 West Monroe Street
Chicago, Illinois

Attention: Mr. Sam Smith

Re: University of Illinois
and LPV

Dear Sam:

In reply to yours of April 15th, I enclose two additional copies of the pamphlets requested. There are other pieces in work which are at the printers right now. As soon as they are available I will send them on to you.

In reading your letter, I am a little concerned about your reference to Paragraph 2 of the agreement, referring to patents. If you recall, at the beginning we had not used the patent phrase properly and it was on your instructions that I changed the phrase to read, "Licensed under one or more of U. S. Patents 2,958,081; 2,935,879; 3,011,168; 3,108,280 and additional patents pending in U.S.A. and Canada. Produced by JFD Electronics Corporation under exclusive license from the University of Illinois Foundation."

You explained that it was not necessary that each and every patent be applicable to the specific product on which this phrase was printed, but so long as it referred to one of the patents, it was permissible.

A00229

JFD

JFD ELECTRONICS CORP.

Mr. Sam Smith (Cont.)

At the present time we are not selling any products that come under the Dyson, DuHamel and Isbell patents. However, in the very near future, we intend offering a log periodic Trapezoid indoor antenna which Paul feels comes under the Isbell patent.

I trust this is the information you desired.

Kindest regards.

Sincerely,

Ed Finkel

EF/ss
cc- P. Mayes
J. Colvin
S. Faber

COPY

A00230

October 28, 1964

Mr. Edward Finkel
Vice President-Sales
JFD Electronics Corporation
15th Avenue at 62nd Street
Brooklyn, New York 11219

Re: Knight MK-24

Dear Ed:

Your Mr. Tom Reeder has furnished information concerning the dimensions of length and spacing of the Knight MK-24 antenna. He has also supplied me with a drawing prepared by Mr. F. J. Dubson, carrying a date of September 26, 1964.

Judging from the arrangement of the V-elements, I find that we have in this particular antenna spacings which appear to be identical for all V-elements. The control of the length of the halves of the dipole elements arranged in V-formation is so erratic that there is really no multiplier which fits the situation. The scale factor for the dimensions which Mr. Reeder notes vary between .9 and .98, and this is about a 10 per cent variance.

Then, from the standpoint of the UHF end of the antenna I find that the spacings between adjacent dipoles at the highest frequency end correspond to the spacings at the lowest frequency end (restricting this definition to the UHF portion) and that the spacings for the intermediate frequencies covering six separate dipoles are 20 per cent less. This leads me to a situation which is confusing. It certainly looks as though there has been a very definite effort to avoid any possibility of coming within the terms of what we would call an "LPV Antenna."

A copy of this letter is being sent to Paul Mayes because I think we are now at a point where we should know a great deal about the antenna performance when operated under these peculiar spacings and dipole lengths, but to a novice, such as myself, it seemed to be

Mr. Edward Finkel
Page 2
October 28, 1964

somewhat randomly selected.

I would be very reluctant to try to apply the structure of the Knight MK-24 antenna to presently held patents because so doing might open up a tremendous amount of prior art against which, strictly speaking, should have no relationship whatever to the nature of the invention. Thus, I hope I can have further comments from Paul Mayes and your engineers. At the moment, I am greatly confused.

Sincerely,

SBS:mn

Samuel B. Smith

cc: Sidney G. Faber, Esq.
Professor Paul E. Mayes

A00018

JFD DOC.NO. 80

December 18, 1964

Mr. Samuel B. Smith
Merriam, Smith & Marshall
30 West Monroe Street
Chicago, Illinois 60603

Re: Knight MK VHF-UHF antennas

Dear Sam,

Ed Finkel has requested that I elaborate and document in this letter some of the comments which have been given to you by phone heretofore concerning the above antennas.

I believe the Knight MK series of VHF-UHF antennas infringes upon Carrel and Mayes, patent number 3,150,376. In particular, claims 15-18 of said patent read directly upon the structures of the MK-12, MK-18, and MK-24 antennas. From the drawings of these antennas previously supplied, it is apparent that the nonal scale factors deviate only slightly from a median value except for a few selected elements.

The elements are "substantially coplanar" certainly within an engineering interpretation of the term as it pertains to a reasonable attainment of performance. In fact, the V-shaped elements could be said to be "exactly" coplanar. The method of construction using two booms to serve as both feed line and support for the dipoles is clearly illustrated in Figure 2 of the patent and the language of "substantially coplanar" should be interpreted in agreement with that drawing. The influence of changing the separation between the booms is clearly documented in Technical Report No. 52 of the University of Illinois Antenna Lab. entitled, "Analysis and Design of the Log-Periodic Dipole Antenna" by R. L. Carrel, a coinventor on the above-mentioned patent. I refer particularly to Figure 42 on page 89 of that report.

The formula for characteristic impedance of a two-conductor transmission line in air is well-known to be

$$Z_o = 120 \cosh^{-1} \frac{D}{d}$$

where D is the center-to-center separation and d is the diameter of the circular cylindrical conductors. (See, for example, Reference Data for Radio Engineers, third edition, Federal Telephone and Radio Corporation, page 323). Figure 42 of Carrel's report shows the variation of the impedance at the input of the antenna as it depends upon the characteristic impedance of the transmission line. It is possible, therefore, to control the input impedance of the antenna to some degree by changing the feed line impedance and this can be done by changing the ratio D/d above. When using the twin-boom construction, where the feeder must support the dipole elements, there will be a minimum value of d necessary for structural rigidity. Therefore to obtain a high value of input impedance it is necessary to increase the separation D.

Since the input impedance of television receivers is nominally 300 ohms and 300 ohm transmission line is used to connect antenna to receiver, it is desirable that the antenna impedance also be 300 ohms in order to transfer a maximum amount of the signal received at the antenna to the television set. From Carrel's curves it is seen that achieving an impedance near 300 ohms requires a high value of feeder impedance and thus the separation of feeder conductors which is too small will be detrimental to performance.

The question then arises as to the separations which would be permissable and still maintain the desired operation of the two-conductor feeder as a transmission line and the perpendicular conducting elements as dipoles. It is in this area that the meaning of the term "substantially coplanar" must be clarified. A conventional dipole ordinarily has two conducting rod elements which lie along a common axis. The electrical performance of the dipole is affected very little, however, if the axis of one element is displaced from that of the other by a limited distance. Since the judgement must be based upon the electrical performance, the limiting distance is best determined in terms of wavelengths at the operating frequency. It should be apparent that a separation of much less than one wavelength will produce very little change in electrical performance.

Similar considerations apply to the permissable separation of the conductors of the twin-boom feeder. The basic limitation on feeder separation is related to minimizing radiation from currents along the feeder conductors. In a balanced mode the current in one conductor is equal to but out of phase with the current at the corresponding point in the other conductor. Hence, the radiation field due to the current in one conductor tends to cancel that due to the current in the other and this is particularly effective for separations between conductors which are small in terms of the wavelength.

Consider now a typical case of the Knight MK antenna where D = 1.53", a = 0.437" where a is the width of the square feeder conductor. It is first recognized that the deviations caused by using feeder conductors of square rather than circular cross-section result in no change in the principle of operation. It is still possible to calculate an approximate value for the characteristic impedance of the feeder using the equation given above with d = a. It is further apparent that a separation of 1.53" is small compared to the wavelength, particularly at the lower end of the UHF operating band where most UHF television broadcasting currently is found. At 500 Mc, for example, the wavelength is approximately 2 feet. It is clear then, that relative to wavelength measure, the dipole elements of the Knight MK antennas are "substantially coplanar".

With regard to the spacing variations, let me state that the element lengths are more critical as to dimension than the element spacings. It is possible with some degradation in performance to permit spacing variations which are not considered to be optimum. It was with this in mind that claim 15 was submitted with language which does not specifically state how the dipoles are to be spaced.

I trust that the above discussion will provide the information you need. If further clarification is necessary, please call me.

Sincerely yours,

Paul E. Mayes
Professor

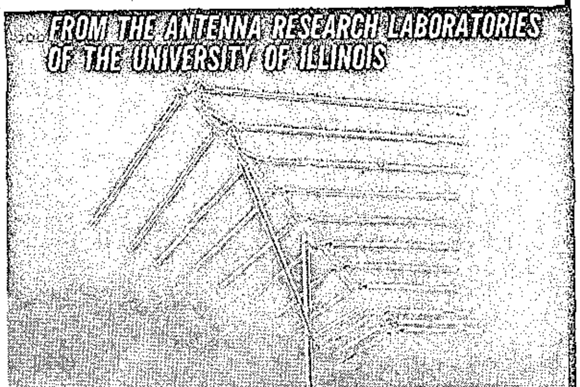
cc. Edward Finkel

A-14

ADVERTISED IN LOOK AND Sunset

LOG PERIODIC

JFD LPV TV/FM ANTENNA



. . . a remarkable new space antenna formula now adapted by JFD for sharper and clearer reception in glowing COLOR or vivid Black and White TV—plus FM Stereo!

$$\frac{L_{(n+1)}}{L_n} = \tau$$

The log-periodic antenna formula was developed by the Antenna Research Laboratories of the University of Illinois. Using this basic log-periodic formula, JFD Electronics has developed the log-periodic LPV TV/FM antenna that works wonders in reception. Snowy, faded pictures suddenly come aglow with radiant detail . . . "ghosts" and interference vanish . . . shows from distant stations come in crisp and steady. And if you like FM Stereo you can hear it at best with the same log-periodic LPV TV/FM antenna. LICENSED UNDER ONE OR MORE OF U.S. PATENTS 2,958,081; 2,985,879; 3,011,168 AND ADDITIONAL PATENTS

NO LAZY ELEMENTS—ENTIRE ANTENNA RESPONDS TO SELECTED CHANNEL

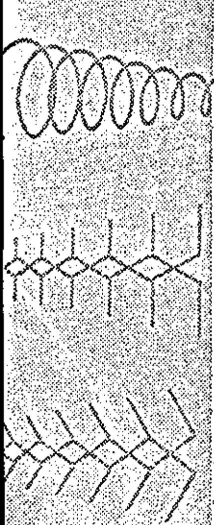
All antenna elements (not just some elements as in other antennas) respond to the channel you want—absorb maximum signal on every channel from 2 to 13, as well as on all FM Stereo frequencies. And the log-periodic LPV is made of lustrous gold alodized aluminum that stays like new!

RECOMMENDED BY

Form No. 630LP Rev. litho in U. S. A. 11-63

ERA OF COMPROMISE IS OVER!

of the University of Illinois* Proved in Space Satellite Telemetry



HOW THE LOG-PERIODIC LPV MAKES ALL OTHER ANTENNAS OBSOLETE

The JFD LPV antenna is a direct descendant out of the logarithmic conical spiral antenna used on the Transit satellite. This basic design is FREQUENCY INDEPENDENT—it works like a conical waveguide to yield almost constant gain, matched impedance and a unidirectional polar pattern across an extremely wide band of frequencies.

Dipole version of spiral antenna has elements whose length and spacing is determined by formula derived from conical spiral geometry, so that antenna acts like a spiral with parts of coils missing. A logarithmic scaling multiplier ties the dipoles together into active multi-element cells for each frequency. Crossed phasing harness inserts a 180 degree phase shift between dipoles that cancels signals from rear, reinforces signals from front.

JFD's LPV antenna for TV and FM goes one step further—increases gain and front-to-back ratio while maintaining frequency independence. Forward V-ing of elements shrinks rear radiation lobes, narrows forward beam for sharp directivity, helping to eliminate ghosts and adjacent channel interference. Forward V also permits low band dipoles to contribute to high band gain by operating on the third harmonic mode.

For example: Operation of the JFD LPV-11 on the low band: The larger dipole cells resonate to the low band TV frequencies at their fundamental wavelength. Within each cell, one dipole absorbs the greatest amount of signal for any particular channel, adjacent dipoles pull in 50% more and the next two dipoles add 30% more signal. Many active dipoles working on each channel with constant impedance guarantee high gain.

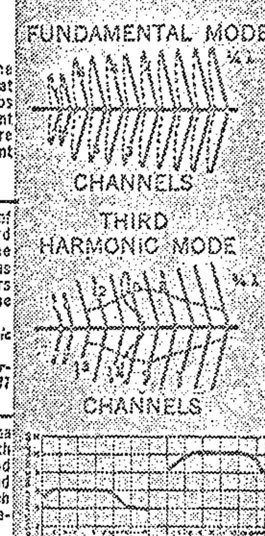
— — — indicates current distribution on fundamental mode.

On the high band: The third harmonic cell forms at the rear of antenna for channel 7 and as the frequency increases toward channel 13, the active region moves toward the apex of the antenna. It is this third harmonic operation which guarantees as much as 3¾ db. additional gain. Continuous and co-linear directors sharpen forward pattern and give peak performance across the entire VHF TV band.

— — — indicates the current distribution for the third harmonic mode which will be received on all elements.

• • • • • • indicates the active region for channel 10, i.e., the different efficiencies with which the elements of the LPV-11 act on channel 10.

The actual gain curves measured for the LPV-11 in the JFD Antenna Research Laboratories confirm this fact: Within the band for which it is designed (the principle will also be adapted for UHF and other uses), the log-periodic LPV's impedance, polar patterns and front-to-back ratio are virtually constant—with gain for each channel as high as that furnished by a comparable-sized single-channel Yagi.



Each antenna in the LPV series consists of an array of resonant V-dipoles and crossed phasing bars, constituting a group of "cells." The size of each cell differs from the one before it by a Logarithmic factor. For any particular frequency, the active portion of the antenna centers on the resonant dipole (equal to one-half wavelength at that frequency), with the adjacent elements also absorbing significant signal energy. The resonances of adjacent cells overlap, so that as the frequency increases or decreases, it is transferred smoothly from one cell to the next.

In effect, the signal is passed along as the frequency increases—the active area moving toward the apex or small end—until, as the fundamental harmonic reaches one end, the other end approaches resonance in the third harmonic. Conventional wide-band antennas are like rows of compartments, one for each channel desired, with sharp cutoffs. The log-periodic antenna is like a continually moving belt that accepts smoothly any frequency that hops aboard.

SEE THE JFD LOG-PERIODIC LPV AT YOUR JFD DISTRIBUTOR NOW—AND BE THE FIRST ONE IN YOUR AREA TO INTRODUCE AND PROFIT FROM THIS NEW ERA IN TV RECEPTION.

THE BRAND THAT PUTS YOU IN COMMAND OF THE MARKET

JFD

JFD ELECTRONICS CORPORATION
15th Avenue at 62nd Street, Brooklyn 19, N.Y.

JFD Electronics-Southern Inc., Oxford, North Carolina
JFD International, 15 Moore Street, New York, N.Y.
JFD Canada, Ltd., 51 McCormack Street, Toronto, Ontario, Canada
401-144 W. Hastings Street, Vancouver 3, B.C.

GP

THE GARFIELD PRESS INC. / PRINTERS AND LITHOGRAPHERS / 200 HUDSON STREET, NEW YORK, N.Y. 10013 / (212) WALKER 5-3984

J.F. D. Electronics Corporation
15th Avenue at 62nd Street
Brooklyn 19, New York

DATE Oct. 24th 1963

OUR ORDER NO. 6512

INVOICE NO. 1862

TERMS: NET 10TH E.O.M.

YOUR ORDER NO.	DESCRIPTION	AMOUNT	TOTAL
7160	10M L.P.V. Form 620LP Look/sunsey House Of Good Taste reprint flyer	279 00	
7171	10m L.P.V. Form 622 LP tv/fm antenna kits flyer	249 00	
	sales tax	21 84	
			567 84

ok 11/1/63

CITY
TYPOGRAPHIC SERVICE INC.

305 East 45th Street, New York 17, N.Y.
MUrray Hill 6-2760

SOLD TO
JFD ELECTRONICS, CORP.
1462 62ND ST.
B'KLYN 19, NY

INVOICE No. 10183
CLIENT JOB No.
CLIENT ORDER No.
DATE 12/28/64

TERMS: NET CASH

CATV		
Composition..............................		
Make-Up..............................	168	70
Repro Proofs..............................	6	00
	174	70
SALES TAX	6	99
Metal............... TOTAL	$181	69

To avoid a rental charge all metal must be returned within 90 days after date of this invoice.

WHY PAY FOREVER

As A CATV Subscriber? Own Your Own Powerful New

LOG PERIODIC TV ANTENNA SYSTEM

AND ENJOY CLEAR RECEPTION ON ALL CHANNELS 2 TO 83—COLOR AND BLACK/WHITE, PLUS FM,

FREE!

YOUR OWN ANTENNA PAID FOR IN LESS THAN A YEAR!!! CALL TODAY FOR DETAILS! NO OBLIGATION!

LICENSED UNDER ONE OR MORE OF U.S. PATENTS 2,958,081; 2,985,879; 3,011,168; 3,108,280; 3,150,376 AND ADDITIONAL PATENTS PENDING IN U.S.A. AND CANADA. PRODUCED BY JFD ELECTRONICS CORPORATION UNDER EXCLUSIVE LICENSE FROM THE UNIVERSITY OF ILLINOIS FOUNDATION.

(license notice)

CITY

TYPOGRAPHIC SERVICE INC.

305 East 45th Street, New York, N.Y. 10017
MUrray Hill 6-2760

SOLD TO
J F D ELECTRONICS, CORP.
1462 62ND ST.
B'KLYN 19, NY

INVOICE No. 719
CLIENT JOB No.
CLIENT ORDER No.
DATE 11/11/65

TERMS: NET CASH

COMMODITIES		
Composition........................		
Make-Up........................	14	60
News Proofs........................		
Repro Proofs........................	5	00
ADD'L COPY	12	50
	32	10
5% SALES TAX	1	60
Metal.................. TOTAL	$33	70

DEC 10 1965

CHECK NO.

1187

836 A-04

~~800-04~~

To avoid a rental charge all metal must be returned within 90 days after date of this invoice.

LICENSED UNDER ONE OR MORE OF U.S. PATENTS 2,958,081; 2,985,879; 3,011,168; 3,108,280; 3,150,376; 3,210,767, RE. 25,740 AND ADDITIONAL PATENTS PENDING IN U.S.A. AND CANADA. PRODUCED BY JFD ELECTRONICS CORPORATION UNDER EXCLUSIVE LICENSE FROM THE UNIVERSITY OF ILLINOIS FOUNDATION.

LICENSED UNDER ONE OR MORE OF U.S. PATENTS 2,958,081; 2,985,879; 3,011,168; 3,108,280; 3,150,376; 3,210,767, RE. 25,740 AND ADDITIONAL PATIENTS PENDING IN U.S.A. AND CANADA. PRODUCED BY JFD ELECTRONICS CORPORATION UNDER EXCLUSIVE LICENSE FROM THE UNIVERSITY OF ILLINOIS FOUNDATION.

3,108,280; 3·150,376; 3,210,767, RE. 25,740

all patents included

CITY—719 JFD Elect 1P 11-15 lite relyon
DD-52 MUrray Hill 6-2760

FIREBALL DELUX TENNA PAKS THE ANTEN

FIREBALL DELUX TENNA PAKS THE ANTENNA INSTA

LICENSED UNDER ONE OR MORE OF U.S. PATENTS 2,958,081; 2,985,879; 3,011,168; 3,108,280; 3,150,376, RE. 25,740 AND ADDITIONAL PATENTS PENDING IN U.S.A. AND CANADA. PRODUCED BY JFD ELECTRONICS CORPORATION UNDER EXCLUSIVE LICENSE FROM THE UNIVERSITY OF ILLINOIS FOUNDATION.

LICENSED UNDER ONE OR MORE OF U.S. PATENTS 2,958,081; 2,985,879; 3,011,168; 3,108,280; 3,150,376, RE. 25,740 AND ADDITIONAL PATENTS PENDING IN U.S.A. AND CANADA. PRODUCED BY JFD ELECTRONICS CORPORATION UNDER EXCLUSIVE LICENSE FROM THE UNIVERSITY OF ILLINOIS FOUNDATION.

LICENSED UNDER ONE OR MORE OF U.S. PATENTS 2,958,081; 2,985,879; 3,011,168; 3,108,280; 3,150,376, RE. 25,740 AND ADDITIONAL PATENTS PENDING IN U.S.A. AND CANADA. PRODUCED BY JFD ELECTRONICS CORPORATION UNDER EXCLUSIVE LICENSE FROM THE UNIVERSITY OF ILLINOIS FOUNDATION.

Model 6719
best for locations
up to 75 miles

Model 6720
Best for locations up
to 125 miles

City 12443-1P JFD 3-4 6 lite relyon (WG)
C-33 MUrray Hill 6-2760

CITY

TYPOGRAPHIC SERVICE INC.
305 East 45th Street, New York, N. Y. 10017
MUrray Hill 6-2760

SOLD TO

JFD ELECTRONICS, CORP.
1462 62ND ST.
B'KLYN 19, NY

INVOICE No. 12443
CLIENT JOB No.
CLIENT ORDER No.
DATE 3/4/65

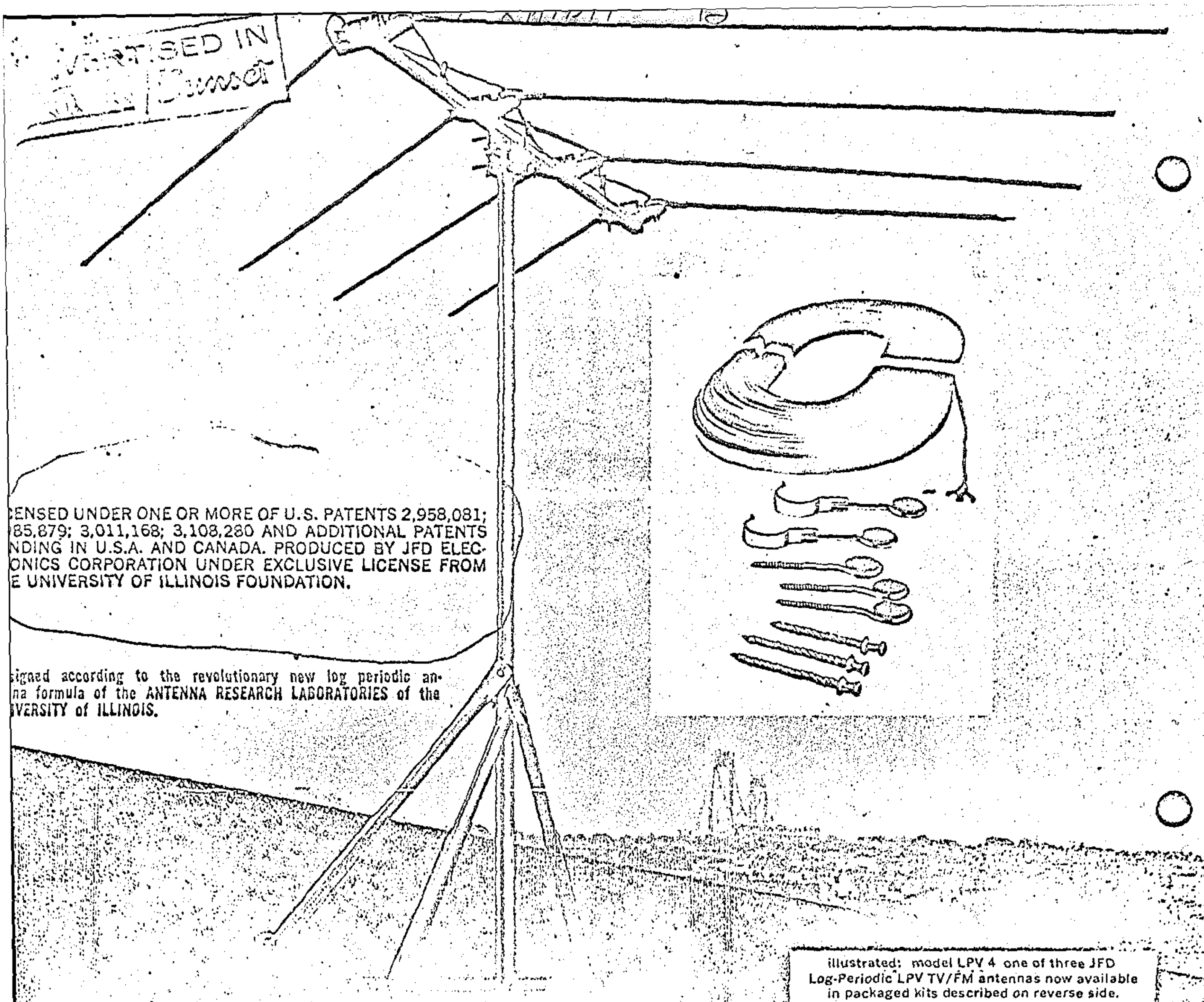
TERMS: NET CASH

FIREBALL		
Composition..................................		
Make-Up..................................	34 / 2	20
News Proofs..................................		
Repro Proofs..................................	2	50
	36	70
SALES TAX	1	47
Metal................. TOTAL	$38	17

JFD ELECTRONICS CORP.
PAID
APR 10 1965

149 800-01 CHECK 153

To avoid a rental charge all metal must be returned within 90 days after date of this invoice.



NOW—THE ANTENNA AMERICA KNOWS BEST IN THE KIT THAT SELLS BEST!

JFD LOG-PERIODIC TV/FM ANTENNA KITS!

$\frac{L_{(n+1)}}{L_n} = \tau$ —FEATURING HARMONICALLY RESONANT V-ELEMENTS OPERATING ON THE LOG-PERIODIC CELLULAR PRINCIPLE IN THE FUNDAMENTAL AND THIRD HARMONIC MODES

Take the tremendous popularity of the nation's most demanded antenna, add premium-quality installation accessories and you've got the antenna combination that zooms sales—the JFD Log-Periodic LPV TV/FM Antenna Kit.

You have your choice of any one of three Log-Periodic LPV antennas — the dramatic new antenna concept developed by the Antenna Research Laboratories of the University of Illinois and adapted for TV/FM reception by JFD. Regardless of location . . . local, suburban, or near fringe, there is a Log-Periodic LPV kit that will give your customer spectacular reception results in COLOR, black and white, and FM stereo.

With color set sales growing, two and three-set homes a fact, the best antenna makes sense for your reputation, your customer's reception. And that antenna is the JFD Log Periodic LPV.

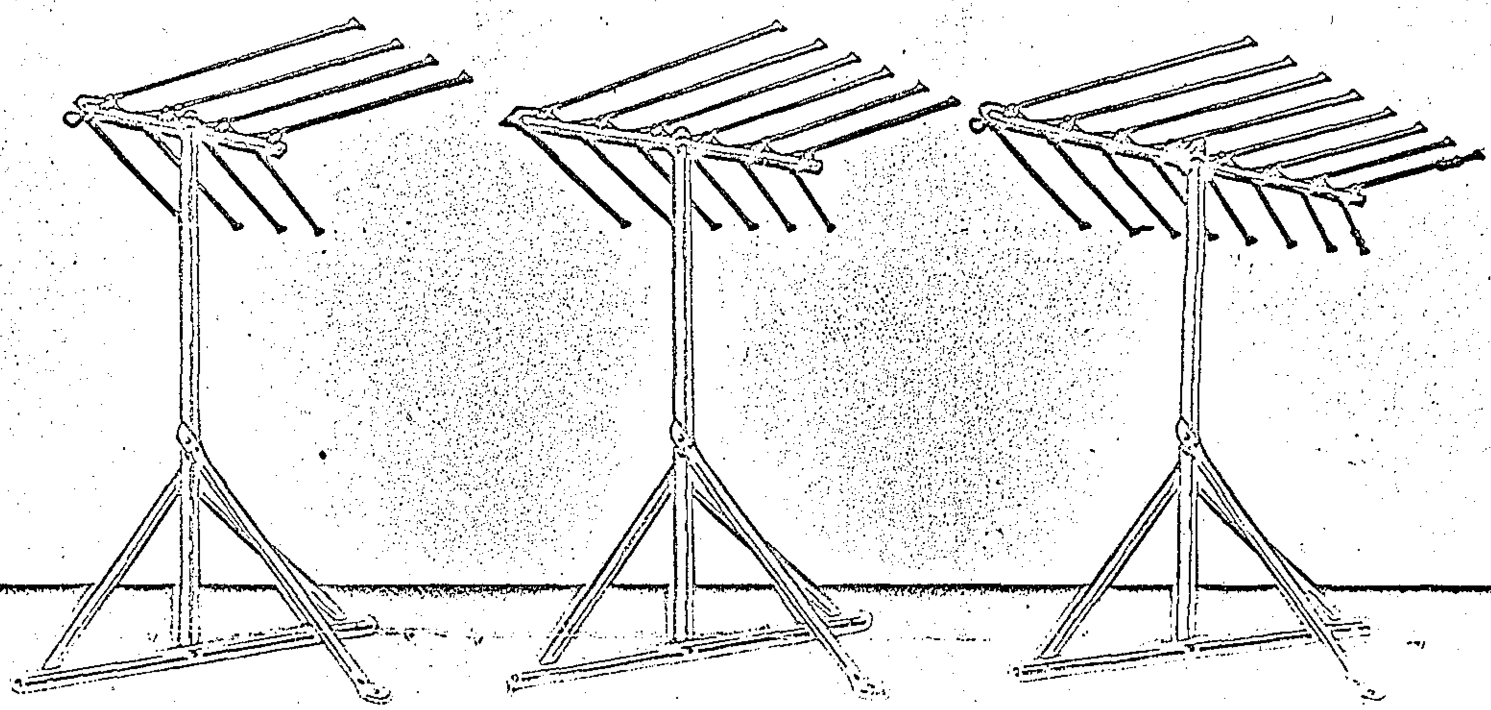
And new Log-Periodic LPV kits not only perform better but look better, too. Their compact inline design and "flying-jet" appearance identify the home owner as a knowledgeable individual who wants the best. The lustrous AAA® Gold Bond Alodized construction of the Log-Periodic LPV also helps tell the world that it's different!

JFD LPV $\frac{L_{(n+1)}}{L_n} = \tau$

AT THE MOMENT OF TRUTH, THE PICTURE IS THE PROOF — THE JFD LOG PERIODIC WORKS BEST!

JFD LPV TV/FM ANTENNA KITS!

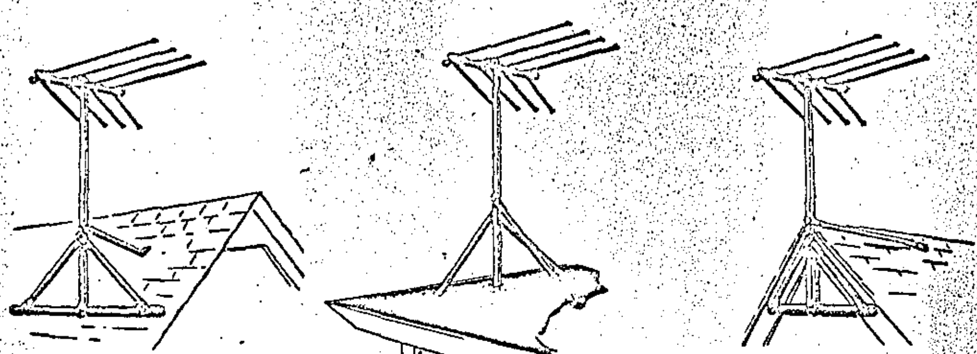
- Deliver More Yet Cost No More!
- Engineered for Maximum Picture Power — **Color and** Black and White
- Styled to Improve Home Appearance
- Provides Superb FM Stereo
- Complete Ready-to-Install Kit
- Ideal for Attics, Mobile Homes, Cottages



model LPV-4PM Kit. 4 Active Cells for LOCAL USE UP TO 50 MILES FROM TRANSMITTER. $21.95 list

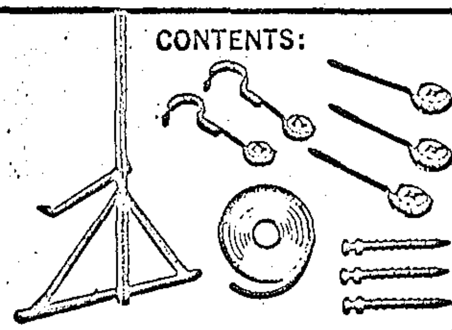
model LPV-6PM Kit. 6 Active Cells for USE UP TO 75 MILES FROM TRANSMITTER. $29.95 list

model LPV-8PM Kit. 8 Active Cells for USE UP TO 100 MILES FROM TRANSMITTER. $37.95 list



Versatile is the word for the JFD Tri-Mount and Mast. Goes up in minutes on flat, slanted or vertical surface . . . on eave, end, or peak of roof. Needs no guy wires. Made of lustrous gold alodized aluminum.

CONTENTS:



- One LPV4, LPV6 or LPV8 Log-Periodic LPV Gold Alodized TV/FM antenna
- 50 ft. 300 ohm polyethylene twin lead
- Three 3½" wood screw eye stand-offs (T3)
- Two mast stand-off (SPT125)
- Three self-sealing nails
- Gold Alodized Aluminum Tri-Mount that Installs Anywhere

Form No. 622LP Litho in U. S. A. 9-63

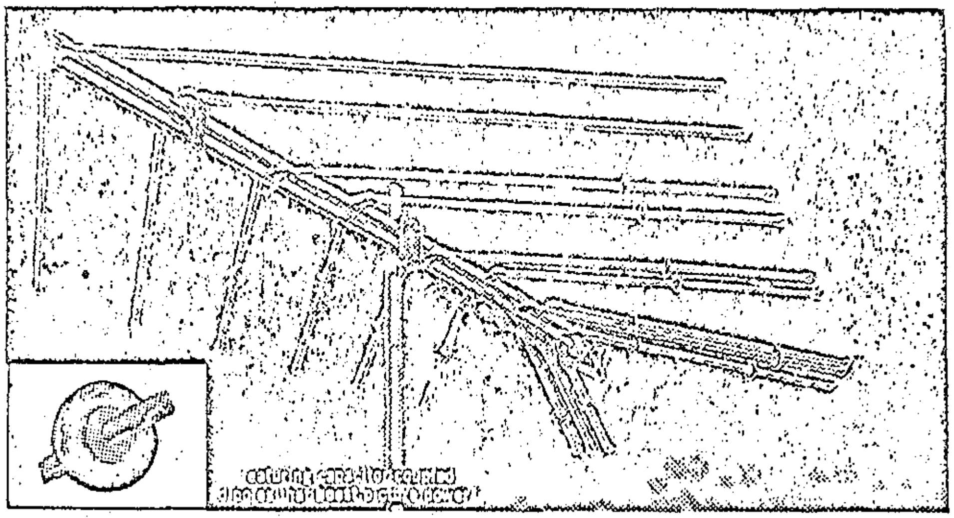
JFD

JFD ELECTRONICS CORPORATION

15th Avenue at 62nd Street, Brooklyn, N. Y. 11219

JFD Electronics-Southern Inc., Oxford, North Carolina
JFD International, 64-14 Woodside Ave., Woodside 77, N. Y.
JFD Canada, Ltd., 51 McCormack Street, Toronto, Ontario, Canada

Get the New UHF channel 0000



Plus all other channels from 2 to 83!

JFD LPV

WITH NEW SPACE AGE

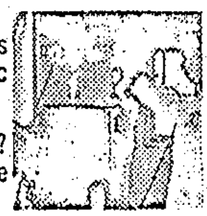
CAP-ELECTRONIC DIPOLE

Log Periodic

TV/FM ANTENNA

It's here! . . . the first combination VHF/UHF/FM antenna that receives all channels from 2 to 83 . . . all FM and FM Stereo stations—yet uses only one down-lead.

JFD eliminates need for cumbersome and expensive antenna hodgepodges. The secret is in the patented JFD capacitor-coupled periodic design that pulls in powerful reception on every TV and FM station, including the new UHF channels. No other antenna features this electronic advance.



Developed from research performed at the University of Illinois Antenna Research Laboratories, the JFD All-Channel Log Periodic works especially well on color — even FM Stereo.

Why settle for less than the best reception your set can deliver? Let us install the JFD Cap-Electronic Log Periodic today and solve your reception problems now and in the future.

HOW THE JFD CAP-ELECTRONIC LOG PERIODIC LPV WORKS BETTER

No lazy elements! All antenna elements (not just some elements as in other antennas) respond to the channel you want—absorb maximum signal from channels 2 to 83, as well as on FM/Stereo. Why? Because the JFD LPV is designed according to the amazing new log periodic formula used by space scientists for satellite tracking and communication.

Selected by

SEE THE JFD CAP-ELECTRONIC LOG PERIODIC LPV AT THE WORLD'S FAIR

Featured at the spectacular House of Good Taste Exhibit and installed on more World's Fair pavilions than any other TV antenna.

Licensed under one or more of U. S. Patents 2,958,081; 2,985,879; 3,011,168; 3,108,280; 3,150,376 and additional patents pending in U. S. A. and Canada. Produced by JFD Electronics Corporation under exclusive license from the University of Illinois Foundation.

PHONE TODAY! SEE THE DIFFERENCE!

Mat No. 341   3 Cols. x 154 = 462 lines

ORegon 4-4600

GRAMERCY LANE PHOTOENGRAVING CORP.

131 EAST 23RD STREET, NEW YORK 10, N. Y.

Invoice № 5650

W.T. # 3473

C.P.O. #

J. F. D. Electronics Corp.

Date 11 19 64

1 coarse screen silh. combination 814			
1 Extra line negative 61			
1 positive negative 48			
1 tint negative 40			
2 Extra ht. negatives @40 80			
1043 @.075	78.23		
Setting up	28.00		
Extra finishing	18.00		
#25 Mats @.64	16.00		
		140.23	

833-01 LPV WE

1180

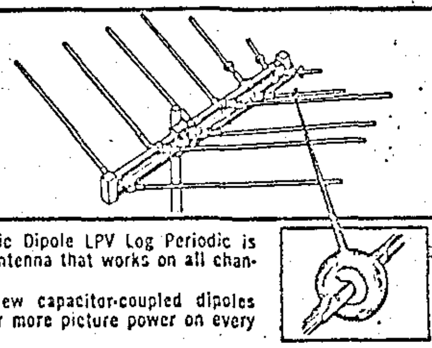
GRAMERCY LANE PHOTOENGRAVING CORP.

DON'T BE ½ SET... BE ALL SET!

New or converted TV sets are all set to receive channels 2 to 83. Be sure your antenna is not ½ set but all set to receive them—in brilliant COLOR and black & white.

JFD LPV LOG PERIODIC TV ANTENNA

LICENSED UNDER ONE OR MORE OF U.S. PATENTS 2,958,081, 2,985,879; 3,011,168, 3,108,280 3,150,376, RE 25 740 AND ADDITIONAL PATENTS PENDING IN U.S.A. AND CANADA. PRODUCED BY JFD ELECTRONICS CORPORATION UNDER EXCLUSIVE LICENSE FROM THE UNIVERSITY OF ILLINOIS FOUNDATION.



shown: model LPV-VU6

as low as $27.50 — plus installation

The new JFD Cap-Electronic Dipole LPV Log Periodic is the first and only single antenna that works on all channels 2 to 83, (and FM).

features super-sensitive new capacitor-coupled dipoles that work electronically for more picture power on every channel.

It is based on the same design as that of satellite-tracking antennas to give you brilliant reception in COLOR, black/white TV—even FM Stereo. So if you *are converting your set* or buying a new all-channel 2-83 UHF/VHF TV, a new JFD LPV Log Periodic with Cap-Electronic dipoles is a "must." Developed from research performed at the University of Illinois Antenna Research Laboratories.

M360 2 Cols. X 64 lines = 128 lines

ORegon 4-4600

GRAMERCY LANE PHOTOENGRAVING CORP.

131 EAST 23RD STREET, NEW YORK 10, N. Y.

J. F. D. Electronics Corp.
1462 62nd St.
Brooklyn, N.Y.
Att. Miss Bertstein

Invoice № 7912
W.T. # 5632
C.P.O. #
Date 3 23 65

1 line cut	107 @.075	8.03	
50 Mats @.30		15.00	
		23.03	
	Postage charge	1.66	24.69

833-B-01

JFD ELECTRONICS CORP.
PAID
APR 1 0 196
CHECK

SHIP SAFE

Carolina CONTAINER COMPANY

Manufacturers of Corrugated Containers

HIGH POINT
NORTH CAROLINA PHONE 883-7146
27261

OUR ORDER NO. CUST. NO. 62307 INV. DATE October 22, 1964

Inv. No. L 00768

SOLD TO

J.F.D. Electronics Corp.
1462 62nd Street
Brooklyn 4, N. Y.

A

ALL CLAIMS MUST BE MADE UPON RECEIPT OF GOODS.

INTEREST CHARGED ON PAST DUE ACCOUNTS.

TERMS: LESS 1% FOR CASH WITHIN TEN DAYS OR NET 30 DAYS.

SHIPPED VIA

NO. BDLS.	NO. IN BDL.	TOTAL	SIZE	BOX NO.	TEST	PRICE	AMOUNT
		1	Printing Die for Small Die on LPV VU Boxs red			$ 350.00	$ 350.00

1470

ok to pay

500-01 ✓

JFD ELECTRONICS CORP.
PAID
NOV 10 1964

SQ. FT. CHECK NO.

CAROLINA CONTAINER COMPANY

MANUFACTURERS OF
Corrugated Paper Products
HIGH POINT, N. C. 27261

PHONE 883-7146

OUR ORDER NO. AB 8401 CUST. NO. 54885 (F) INV. DATE Dec 18, 1963

Inv. No. K 00894

SOLD TO
J.F.D. Electronics Corp.
1462 62nd. St.
New York, N.Y.

JFD ELECTRONICS CORP.
P A I D
JAN 10 1964

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TERMS: LESS 1% FOR CASH WITHIN TEN DAYS OR NET 30 DAYS.

SHIPPED VIA # 56 Oxford, N.C.

NO. BDLS.	NO. IN BDL.	TOTAL	SIZE	BOX NO.	TEST	PRICE	AMOUNT
112 1	10 2	1122	S & S Sheet 31 x 71 x 1½	LPV-U21	200	$555.90	$623.72
22 1	100 44	2244	Pads 30½ x 3	"	200		

CHECK NO.

570
550

1160

500-01

DATE RECEIVED 500-01
MERCHANDISE
12/29/63
41,477
SQ. FT.

A
OUTDOOR ANTENNA
(01)

PLACED & LOCATION	REMARKS:
Via Their Truck	

15TH AVE. 16TH AVE.

Rec'd By

No.NC 07607

COPY

CAROLINA CONTAINER COMPANY

MANUFACTURERS OF
Corrugated Paper Products
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OUR ORDER NO. AB 5879 CUST. NO. 54885 (F) INV. DATE Dec 18, 1963

Inv. No. K 00892

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1462 62nd St.
New York, N.Y.

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PAID
JAN 10 1964

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SHIPPED VIA # 76 Oxford, N.C. F.O.B. - Oxford

CHECK NO.

NO. BDLS.	NO. IN BDL.	TOTAL	SIZE	BOX NO.	TEST	PRICE	AMOUNT
213 1	10 6	2136	S & S Sheet 43 x 33 x 1½	LPV-U15	200	$398.45	$851.09
21 1	200 72	4272	Pads 42½ x 3	"	200		
			53,902 SQ. FT.				

DATE RECEIVED MERCHANDISE 12/29/63

500-01

OUTDOOR ANTENNA (01)

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TOTAL N OF PIECE
TOTAL W.
CONDITIO
GIVEN TO
PLACED &

Via - Their truck

Rec'd By 15TH AVE. 16TH AVE.

DARCO INCORPORATED

No. NC 07606

CAROLINA CONTAINER COMPANY

MANUFACTURERS OF
Corrugated Paper Products
HIGH POINT, N. C. 27261

OUR ORDER NO. AB 7978 ~~CUST.~~ NO. 54885(F) INV. DATE Dec 18, 1963

PHONE 883-7146

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J.F.D Electronics Corp.
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New York, N.Y.

A

Inv. No. E 00893

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INTEREST CHARGED ON PAST DUE ACCOUNTS.

TERMS: LESS 1% FOR CASH WITHIN TEN DAYS OR NET 30 DAYS.

SHIPPED VIA # 56 Oxford, N.C.

NO. BDLS.	NO. IN BDL.	TOTAL	SIZE	BOX NO.	TEST	PRICE	AMOUNT
84 63 1	10 20 13	2113	S & S Sheet 29½ x 32 x 1½	LPV-U9	200	$295.15	$623.65
21 1	200 26	4226	Pads 29½ x 3	"	200		
75 1	20 9	1509	S & S Sheet 29½ x 32 1½	LPV-U5	200	295.15	445.38
15 1	200 18	3018	Pads 29½ x 3		200		
			62,802 SQ. FT.				$1069.03

JFD ELECTRONICS CORP
PAID

DATE RECEIVED JAN 13 1964
MERCHANDISE
CHECK NO.
12/29/63 500-01

OUTDOOR ANTENNA (01)

CONDITION:

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PLACED & LOCATION

INSPECTED BY:

REMARKS:

By

No. NC 07608

CAROLINA CONTAINER COMPANY

MANUFACTURERS OF
Corrugated Paper Products
HIGH POINT, N. C. 27261

PHONE 883-7146

OUR ORDER NO. 2489 CUST. NO. 57195 (F) INV. DATE March 4, 1964

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A
J.F.D. Electronics Corp.
1462-62nd St.
Brooklyn, N.Y.

Inv. No. K 04584

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INTEREST CHARGED ON PAST DUE ACCOUNTS.

TERMS: LESS 1% FOR CASH WITHIN TEN DAYS OR NET 30 DAYS.

FOB Oxford

SHIPPED VIA #65 Oxford, N.C.

NO. BDLS.	NO. IN BDL.	TOTAL	SIZE	BOX NO.	TEST	PRICE	AMOUNT
139	15						
1	13	2098	5 Panel Folder 12 3/4 x 3½ x 45 3/4	LPV3 ZU-10	200	$272.70	$572.12
			29,460 SQ. FT.				

560-01

188

JFD ELECTRONICS CORP.
PAID
MAR 26 1964

CHECK NO.

A
OUTDOOR ANTENNA
(01)

CONDITION:

GIVEN TO Gene Hrabu

REMARKS

PLACED & LOCATION

No NC

15TH AVE. 16TH AVE.

Rec'd By

CAROLINA CONTAINER COMPANY

MANUFACTURERS OF
Corrugated Paper Products
HIGH POINT, N. C. 27261

PHONE 883-7146

OUR ORDER NO. 2490 CUST. NO. 57195(F) INV. DATE March 6, 1964

SOLD TO
JFD Electronics Corp.
1462 62nd. St.
Brooklyn, N. Y.

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Inv. No. K 04748

ALL CLAIMS MUST BE MADE UPON RECEIPT OF GOODS.

INTEREST CHARGED ON PAST DUE ACCOUNTS.

TERMS: LESS 1% FOR CASH WITHIN TEN DAYS OR NET 30 DAYS.

SHIPPED VIA # 70 Oxford, N.C.

NO. BDLS.	NO. IN BDL.	TOTAL	SIZE	BOX NO.	TEST	PRICE	AMOUNT
68	15	1020	5 panel folder 14½ x 3½ x 45 3/4	LPV-ZU-20	200	$304.85	$310.95
			15,665 SQ. FT.				

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MAR 24 1964

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PLACED & LOCATION	REMARKS:

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By

No. NC 09980

CAROLINA CONTAINER COMPANY

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PHONE 883-7146

OUR ORDER NO. ABCD 3296 CUST. NO. 61526(F) INV. DATE Sept 24, 1964

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JFD Electronics Corp.
1462 62nd St.
Brooklyn, N.C.

Inv. No. K 14297

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TERMS: LESS 1% FOR CASH WITHIN TEN DAYS OR NET 30 DAYS.

SHIPPED VIA # 72 Oxford, N.C.

FOB Oxford

NO. BDLS.	NO. IN BDL.	TOTAL	SIZE	BOX NO.	TEST	PRICE	AMOUNT
24 1	10 3	243	5 panel folder 13½ x 6 3/8 x 127½	LPV-VU-1	8250	$1229.40	$298.74
9 1	25 18	243	Scored pad 14 x 39 7/8	"	200		
9 1	25 18	243	" " 12 5/8 x 49½	"	200		
12 1	20 3	243	" " 20 5/8 x 127½	"	200		
			17,740 SQ. FT.				

OUTDOOR ANTENNA (01)

A

JFD ELECTRONICS

P

OCT 10 1964

CHECK NO.

500-01

136

OFFICE COPY

CAROLINA CONTAINER COMPANY

MANUFACTURERS OF
Corrugated Paper Products
HIGH POINT, N. C. 27261

PHONE 883-7146

OUR ORDER NO. 3299A-B-C-D CUST. NO. 61526 (F) INV. DATE September 28, 1964

Inv. No. K 14492

SOLD TO

J.F.D. Electronics Corp.
1462-62nd St.
Brooklyn, N.Y.

(A)

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INTEREST CHARGED ON PAST DUE ACCOUNTS.

TERMS: LESS 1% FOR CASH WITHIN TEN DAYS OR NET 30 DAYS.

FOB Oxford

SHIPPED VIA #60 Oxford, N.C.

NO. BDLS.	NO. IN BDL.	TOTAL	SIZE	BOX NO.	TEST	PRICE	AMOUNT
24 1	10 3	243	5 Panel Folder 13½ x 6½ x 112½	LPV-VU-15	250	$1156.35	$280.99
9 1	25 18	243	Scored Pad 14 x 54 3/4	"	200		
9 1	25 18	243	Scored Pad 14 x 42	"	200		
12 1	20 3	243	Scored Pad 21 x 112½	"	200		
			16,418 SQ. FT.				

JFD ELECTRONICS CORP.
PAID
NOV 10 1964
CHECK NO.

5000
1335

REMARKS:

Rec'd By
DARCO INCORPORATED

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No.NC 16705

ROLINA CONTAINER COMPANY
MANUFACTURERS OF
Corrugated Paper Products
HIGH POINT, N. C. 27261

PHONE 883-7146

AB 3297-8 CUST. NO. 61525(F) INV. DATE Sept 23,1964

Inv. No. K 14202

JFD Electronics Corp.
1462 62nd St.
Brooklyn, N. Y.

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TERMS: LESS 1% FOR CASH WITHIN TEN DAYS OR NET 30 DAYS.

VIA # 73 Oxford, N.C.

NO. BDLS.	NO. IN BDL.	TOTAL	SIZE	BOX NO.	TEST	PRICE	AMOUNT
30	10	300	5 panel folder 7½ x 6½ x 126	LPV-VU-12	200	$664.70	$199.41
12	25	300	Scored pads 14 x 33½	"	200		
22 1	10 2	222	5 panel folder 7½ x 6½ x 118	LPV-VU-9	200	646.75	143.58
8 1	25 22	222	Scored Pad 14 x 39½	"	200		
							$342.99

JFD ELECTRONICS CORP.
PAID
OCT 10 1964
CHECK NO. 19,519

SQ. FT.

A
OUTDOOR ANTENNA
(01)

500-01

LOCATION

REMARKS:

16TH AVE.

No. NC 16574

Carolina CONTAINER COMPANY

Manufacturers of Corrugated Containers

HIGH POINT
NORTH CAROLINA PHONE 883-7146
27261

OUR ORDER NO. AB 200 CUST. NO. 64622-P3 Phone (F) INV. DATE Jan 25, 1965

Inv. No. L 05581

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JFD Electronics Corp.
1462 62nd St.
Brooklyn, N. Y.

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INTEREST CHARGED ON PAST DUE ACCOUNTS.

TERMS: LESS 1% FOR CASH WITHIN TEN DAYS OR NET 30 DAYS.

SHIPPED VIA # 62 Oxford, N.C.

NO. BDLS.	NO. IN BDL.	TOTAL	SIZE	BOX NO.	TEST	PRICE	AMOUNT
264 1	10 5	2645	5 panel folder 7½ x 6½ x 77 5/8	LPV-VU-6	200	$322.60	$853.28
26 1	100 45	2645	Pads 14 x 10	"	200		
			62,729 SQ. FT.			CHECK NO.	

DATE RECEIVED MERCHANDISE 1/27/65

500-01

JFD ELECTRONICS CORP.
PAID
FEB 10 1965

CONDITION:

INSPECTED BY:

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15TH AVE. 16TH AVE.

No. NC22276

Rec'd By

HARCO INCORPORATED

OWENS-ILLINOIS GLASS COMPANY, INC.
TALLY 3388

FOREST PRODUCTS DIVISION

POST OFFICE BOX 1469 (I) SALISBURY, NORTH CAROLINA

.32

Invoice Number	Our Customer Number
440-6421	170680

JFD ELECTRONICS CORP.

SOLD TO
J F D ELECTRONICS CORP.
1462 62ND STREET
BROOKLYN, N.Y.

A

Ship To (Same as "Sold To" unless typed here)
PAID
SAME-OXFORD, N.C.
SEP 10 1964

TERMS: 1% 10 DAYS NET 30 · No Discount Allowed On Freight, Dies, or Misc. Items

MAIL CHECKS TO—Post Office Box 1469, Salisbury, N.C.

Invoice Date	Your Order No.	Our Order No.	Date of Order	Ship Via	F.O.B.	P-Prepaid C-Collect	Salesman No.
7-20-64	60120 60034	71443 71322		MAYBELLE	OXFORD	P	

*C/P	QUANTITY ORDERED	BOX NO. OR SIZE	STYLE	TEST	NO. BUNDLES	AMT. PER BUNDLE	QUANTITY SHIPPED	QUANTITY BILLED	PRICE PER M	AMOUNT
	71322									
C	#1 1500	FB 500	5 PANEL FOLDER	200C	105 1	15 9	1584	1584	261.80	$414.69
C	#2 500	B-400	5 PANEL FOLDER	200C	52 1	10 12	532	532	365.30	194.34
	71443									
C	#1 200	LPL-FM-6	5 PANEL FOLDER	200C	22	10	220	220	474.00	104.28
C	#2 400	LPL-FM-8	5 PANEL FOLDER	200C	44 1	10 8	448	448	449.20	201.24
										$914.55

DATE RECEIVED MERCHANDISE 7/21/64

500-01

OUTDOOR ANTENNA (01)

A

BILL OF LADING NO.	WEIGHT	FREIGHT RATE	TOTAL FREIGHT (TAX INC.)	Cash Discount Allowed if Paid Within 10 Days of Invoice Date.
	Ship.			$ 9.15
	Min.			

We hereby certify that these goods were produced in compliance with all applicable requirements of Section 6, 7, and 12 of the Fair Labor Standards Act as amended, and of the regulations and orders of the United States Department of Labor issued under Section 14 thereof.

NO CLAIM ALLOWED UNLESS REPORTED ON RECEIPT OF GOODS

*C/P C-Designates Complete Shipment
P-Designates Partial Shipment

ORIGINAL INVOICE

TALLY 4146 4167

OWENS-ILLINOIS GLASS COMPANY, INC.

FOREST PRODUCTS DIVISION

POST OFFICE BOX 1469 SALISBURY, NORTH CAROLINA

32

Invoice Number	Our Customer Number
440-7197	170680

JFD ELECTRONICS CORP.
PAID
SEP 10 1964

SOLD TO

J F D ELECTRONICS CORP.
1462 62ND STREET
BROOKLYN, N.Y.

Ship To (Same as "Sold To" unless typed here)

SAME-OXFORD, N.C.

CHECK NO.

TERMS: 1% 10 DAYS NET 30 — No Discount Allowed On Freight, Dies, or Misc. Items

MAIL CHECKS TO—Post Office Box 1469, Salisbury, N.C.

Invoice Date	Your Order No.	Our Order No.	Date of Order	Ship Via	F.O.B.	P-Prepaid C-Collect	Salesman No.
8-12-64	60465 60459	80626 80416		MAYBELLE	OXFORD	P	

*C/P	QUANTITY ORDERED	BOX NO. OR SIZE	STYLE	TEST	NO. BUNDLES	AMT. PER BUNDLE	QUANTITY SHIPPED	QUANTITY BILLED	PRICE PER M	AMOUNT
	80416									
C	500	LPL-FM-4 500-01 A	5 PANEL FOLDER	200C	41 1	12 13	505	505	376.90	$190.33
	80626									
C	10000	11813-1202 500-02 G	RSC	200C	402 31 1 1	25 25 18 23	10866 816 10050 10866	10866	116.00	1260.46 $1450.79

A — OUTDOOR ANTENNA (01)

G — INDOOR ANTENNA (02)

2108 500-01 + 500-02

CAR	WEIGHT	FREIGHT RATE	TOTAL FREIGHT(TAX INC)	Cash Discount Allowed if Paid Within 10 Days of Invoice Date.
Ship. / Min.				$ 14.51

We hereby certify that these goods were produced in compliance with all applicable requirements of Section 6, 7, and 12 of the Fair Labor Standards Act as amended, and of the regulations and orders of the United States Department of Labor issued under Section 14 thereof.

NO CLAIM ALLOWED UNLESS REPORTED ON RECEIPT OF GOODS

*C/P C-Designates Complete Shipment
P-Designates Partial Shipment

ORIGINAL INVOICE

ORIGINAL

PARK CONTAINER CORP.

Designers and Manufacturers

85 5TH AVE. PATERSON, N. J.

N. Y. LO 3-4900
N. J. MU 2-2626

PB 2289

SOLD TO
J F D Electronics
6101 16th Avenue
Brooklyn, New York

SHIPPED TO:
J F D Electronics
Oxford, North Caralina

(A)

TERMS: 1% 10 DAYS — NET 30

INVOICE DATE	VIA	OUR ORDER NO.	YOUR ORDER NO.	SALESMAN
11-9-62	Covert	6998 6803	25875	HA

BDLS.	AMT. PER BDLE.	QUANTITY	NO.	DESCRIPTION	SIZE	STYLE	TEST	UNIT PRICE	AMOUNT
147 1	15 9	2214	# FB500	Our Job 40118		5PF	200	370.00	819.18
71 1	15 12	1077	# LPV-8	Our Job 24426		5 PF	200	515.50	555.19
71 1	15 10	1075	# LPV-6	Our Job 20521		5PF	200	447.00	480.53
70 1	15 18	1068	# LPV 4	Our Job 16148		5 PF	200	369.00	394.09
2	15	30	# AW 250	Our Job 626		5 PF	200	480.50	14.42
21	15	315	# JET 161	Our Job 5444		5 PF	200	354.50	111.67
									2375.08

ORDER CONTROL
PRICE CHECK
PURCHASE JOURNAL
EXTENSIONS
DEPARTMENT 500-01
PACKING & RECEIPT SLIP

J. F. D. ELECTRONICS CORP.
PAID
DEC 10 1962
CHECK

A OUTDOOR ANTENNA (01)

NO CLAIMS ALLOWED UNLESS REPORTED UPON RECEIPT OF GOODS — ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE

ORIGINAL

PARK CONTAINER CORP.

Designers and Manufacturers

85 5TH AVE. PATERSON, N. J. N. Y. LO 3-4900
N. J. MU 2-2626

PB 2714

SOLD TO: J F D Electronics Corp. / 6th Avenue / Brooklyn, New York

ORDER CONTROL / PURCHASE JOURNAL / EXTENSION / DEPARTMENT — Bal - 500-01

SHIPPED TO: J F D Electronics Corp. / Pinetree Road / Oxford, N.C.

500-01 $1,797.34
500-02 $ 630.52

TERMS 1% 10 DAYS — NET 30

INVOICE DATE	VIA	OUR ORDER NO.	YOUR ORDER NO.	SALESMAN
12-11-62	Covert Trk	7151 7298-7152-7318-	50555- 50506-50074-50270-	

BDLS.	AMT. PER BDLE.	QUANTITY	NO. DESCRIPTION	SIZE	STYLE	TEST	UNIT PRICE	AMOUNT
82 / 1	10 / 11	831	# LPV 11 Our Job 24338	A	5PF	200	585.00	486.14
50	30	~~2x50x~~ 1500	# 2150 M Our Job 6815	G	F/OL	200	89.25	133.84
108 / 1	10 / 3	1083	# SX 711 Our Job 24301	A	5PF	200	451.50	488.97
107 / 1	10 / 7	1077	# 5 Our Job 16782	A	5PF	200	377.00	406.03
97 / 1	10 / 7	977	# RX 311-511 Our Job 17653	A	5PF	200	426.00	416.20
109 / 1	20 / 8	2188	# 2½ Blister Our Job 26803	G	RSC	200	227.00	496.68
								~~2427.90~~ 2427.86

A — OUTDOOR ANTENNA (01)

G — INDOOR ANTENNA (02)

NO CLAIMS ALLOWED UNLESS REPOR[TED]

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

WINNERS GOLD PACKAGING AWARD

DARBO INC. • WATSEKA, ILL.

ORIGINAL

PARK CONTAINER CORP.

Designers and Manufacturers

85 5TH AVE. PATERSON, N. J.

N. Y. LO 3-4900
N. J. MU 2-2626

PB 1898

SOLD TO
J.F.D. Electronics
6101 16th Avenue
Brooklyn, New York

SHIPPED TO:
(A)

TERMS: 1% 10 DAYS — NET 30

INVOICE DATE	VIA	OUR ORDER NO.	YOUR ORDER NO.	SALESMAN
10/16/62				

BDLS.	AMT. PER BDLE.	QUANTITY	NO.	DESCRIPTION	SIZE	STYLE	TEST	UNIT PRICE	AMOUNT
		1		Complete set of 2 Color Printing Dies # LPV					475.00

ORDER CONTROL
PRICE CHECK
PURCHASE JOURNAL
EXTENSION
DEPARTMENT
PACKING & RECEIPT SLIP

LPV4 LPV6 LPV8 1b 500-0

J. F. D. ELECTRONICS CORP.
PAID
FEB 14 1963
CHECK No.

NO CLAIMS ALLOWED UNLESS REPORTED UPON RECEIPT OF GOODS

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

ORIGINAL

PARK CONTAINER CORP.

Designers and Manufacturers

85 5TH AVE. PATERSON, N. J.

N. Y. LO 3-4900
N. J. MU 2-2626

PB 3190

SOLD TO:
J F D Electronics Corp.
6101 16th Avenue
Brooklyn, New York

SHIPPED TO:
J F D Electronics Southern
Pinetree Road
Oxford, N.C.

MAR 9 1963

A G L

500-01 $2,236.04
500-02 $144.59
500-06 $507.28

TERMS: 1% 10 DAYS — NET 30

INVOICE DATE	VIA	OUR ORDER NO.	YOUR ORDER NO.	SALESMAN
1-31-63	Hovert Ert.	7608-7601-7672 7655-7573-7583-		HA

BDLS.	AMT. PER BDLE.	QUANTITY	NO. / DESCRIPTION	SIZE	STYLE	TEST	UNIT PRICE	AMOUNT
100	10	1000	# LPV 14 verbal EX M/W Our Job 35420 A		5PF	200	779.00	779.00
110	10	1100	# B 400 (51010) 500-01 Southern Marble Our Job 25541 A		5PF	200	461.50	507.65
145 1	15 10	2185	# Zip Kit #2 (51129) 500-01 Southern M/W Our Job 31125 A		5PF	200	300.50	656.59
89 1	60 28	5368	# A-10 (51072Y 500-06 Southern Our Job 11273 L		Sleeve	200	94.50	507.28
17 1	15 16	271	# HF 72 (51010) 500-01 Southern Our Job 5418 A		5PF	200	503.00	136.31
64 1	25 20	1620	# 11813-1402 (50983) 500-02 Southern Our Job 7360 G		F/OL	200	89.25	144.59
66 1	25 6	1656	# (51179) 500-01 Southern Our Job 7303 A		RSC	200	94.50	156.49
								2887.91

ORDER CONTROL
PRICE CHECK
PURCHASE
EXTENSION
DEPARTMENT
CHECKING & RECEIPT SLIP

REPORTED UPON RECEIPT OF ... PRICES SU...

G INDOOR ANTENNA (02)

MASTING (06)

A OUTDOOR ANTENNA (01)

ORIGINAL

PARK CONTAINER CORP.

Designers and Manufacturers

85 5TH AVE. PATERSON, N. J.

N. Y. LO 3-4900
N. J. MU 2-2626

PB 2845

SOLD TO: J F D Electronics Corp.
6101 16th Avenue
Brooklyn, New York

SHIPPED TO: Same

TERMS: 1% 10 DAYS — NET 30

INVOICE DATE	VIA	OUR ORDER NO.	YOUR ORDER NO.	SALESMAN
12-26-62				

BDLS.	AMT. PER BDLE.	QUANTITY	NO.	DESCRIPTION	SIZE	STYLE	TEST	UNIT PRICE	AMOUNT
				1 Set of 2Color #LPV 11 Printing Dies					475.00

ORDER CONTROL	
PRICE CHECK	
PURCHASE JOURNAL	
EXTENSION	
DEPARTMENT	
PACKING & RECEIPT SLIP	

A OUTDOOR ANTENNA (01)

NO CLAIMS ALLOWED UNLESS REPORTED UPON RECEIPT OF GOODS

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

Carolina CONTAINER COMPANY

Manufacturers of Corrugated Containers

HIGH POINT
NORTH CAROLINA PHONE 8
27261

OUR ORDER NO. CUST. NO. 62308 INV. DATE Oct. 22, 1964

SOLD TO

J. F. D. Electronics Corp.
1462 62nd St.
Brooklyn 4, N. Y.

Inv. No. L 0076

ALL CLAIMS MUST BE MADE UPON RECEIPT OF GOODS.

INTEREST CHARGED ON PAST DUE ACCOUNTS.

TERMS: LESS 1% FOR CASH WITHIN TEN DAYS OR NET 30 DAYS.

SHIPPED VIA

NO. BDLS.	NO. IN BDL.	TOTAL	SIZE	BOX NO.	TEST	PRICE	AMOUNT
		1	Printing Die for Small Black Die onEPV Vu Boxes			$ 350.00	$ 350.00

JFD ELECTRONICS CORP.
PAID
NOV 18 1964
CHECK NO.

500-01

SQ. FT.

ORIGINAL

PARK CONTAINER CORP.

Designers and Manufacturers

85 5TH AVE. PATERSON, N. J.

N. Y. LO 3-4900
N. J. MU 2-2626

PB 3106

SOLD TO

J F D Electronics Corp.
6101 16th Avenue
Brooklyn, New York

SHIPPED TO:

(A)

TERMS: 1% 10 DAYS — NET 30

INVOICE DATE	VIA	OUR ORDER NO.	YOUR ORDER NO.	SALESMAN
1-2963				

BDLS.	AMT. PER BDLE.	QUANTITY	NO.	DESCRIPTION	SIZE	STYLE	TEST	UNIT PRICE	AMOUNT
		1		SET OF PRINTING DIES					
				2 COLOR LPV 14					475.00

ORDER CONTROL
PRICE CHECK
PURCHASE JOURNAL
EXPENSE
DEPARTMENT
PACKING & RECEIPT SLIP

300-01

OUTDOOR
ANTENNA
(01)

REPORTED UPON RECEIPT OF GOODS

PRICES SUBJECT TO CHANGE WITH...

Jack —
for your info —
Dick

McNENNY, FARRINGTON, PEARNE & GORDON
920 MIDLAND BUILDING
CLEVELAND, OHIO 44115

April 25, 1967

Robert H. Rines, Esq.
Rines & Rines
10 Post Office Square
Boston, Massachusetts

C O P Y

Re: The Finney Company v. JFD Electronics Corporation et al., Civil Action Nos. 65 C 220 and 65 C 671 (Consol.)

Dear Bob:

Thank you for your longhand note from Miami acknowledging receipt of an advance copy of our Motion for Summary Judgment and supporting memorandum. Since sending you that material, we have slightly revised the motion itself and considerably revised the supporting memorandum. Both were filed in Court yesterday, together with the various exhibits referred to therein.

After discussing the above with Dick Phillips by telephone this morning, I am sending you herewith the following:

1. Revised Motion for Summary Judgment

2. Revised memorandum in support of the motion

3. Motion Exhibits PX-H, PX-I, PX-1A, PX-3, PX-12, and PX-27.

I previously sent you copies of PX-C, PX-D, PX-F, PX-G, PX-15, PX-34, and PX-35. I am not sending you copies of the patents in suit that are attacked by the motion or the three prior art patents referred to in the motion (PX-A, PX-B, PX-31, PX-32, and PX-33). I am also not duplicating or sending to you copies of the printed University of Illinois reports or file histories of the patents in suit that are attacked by the motion (PX-4, PX-5, PX-17, PX-29, PX-30, and PX-36), or a copy of the IRE Transactions article constituting a file wrapper reference against Isbell (PX-28), on the assumption that you have copies of those documents. I also am not sending you a copy of the Lawler deposition (PX-E) or of the testimony of Johnson and Lawler in the Winegard suit (PX-DD and PX-EE) which Dick Phillips will reproduce by borrowing the copies from Winegard's Chicago counsel, Keith Kulie.

The Stipulation, PX-C, on substantive matters and the additional Stipulation on formal matters included in the Appendix at the end of our memorandum in support of our motion were both executed by counsel for all three parties to our suit.

I hope that by now I have supplied you with everything in my possession that may be useful to you in your suit. If not, please let me know.

If possible, I would like to arrange to sit as an observer at the trial of your suit, so that I may benefit as much as possible if and when our own suit should come to trial. To the extent that any questions arise in the course of your trial on which I might be of any further help, or on which I might have any useful evidentiary material, I would want you to feel free to call on me. So I can make my plans accordingly, I would greatly appreciate being advised by you or Dick as soon as a definite or prospective trial date has been set. In the meantime, if you believe I might have anything helpful in connection with your preparation for trial, please let me know and we can arrange to get together again for that purpose.

Sincerely,

John

JFP:jh
Enclosures
cc: Richard S. Phillips, Esq.

Litig.

April 25, 1967

Mr. John F. Pearne
McNenny, Farrington, Pearne & Gordon
920 Midland Building
Cleveland, Ohio 44115

RE: UIF v. BT v. JFD

Dear John:

* I enclose a copy of the trial brief prepared by Bob Rines.

Very truly yours,

Richard S. Phillips

RSP:iag

* Enclosure

McNENNY, FARRINGTON, PEARNE & GORDON
920 MIDLAND BUILDING
CLEVELAND, OHIO 44115

April 17, 1967

Robert H. Rines, Esq.
Rines & Rines
10 Post Office Square
Boston, Massachusetts

COPY

Dear Bob:

Re: The Finney Company v. JFD Electronics Corporation et al., Civil Action Nos. 65 C 220 and 65 C 671 (Consol.)

Enclosed herewith is a slightly revised version of our Motion for Summary Judgment compared to the advance copy sent to you earlier. Also enclosed herewith (not entirely in final form) is a copy of our memorandum in support of our Motion for Summary Judgment, together with a copy of the more important exhibits referred to which I assumed you might not have in your files. I have not yet prepared any part of the table of contents that will include a list of the exhibits, among other things.

I wish to call your attention particularly to the stipulation, PX-C. This stipulation has been approved by Pete Mann and is presently being circulated for execution by all of the parties. In view of the attitude taken heretofore by Faber regarding the patent aspects of the suit, I expect no problem in securing execution of that stipulation by him, as well as by Mann.

The reason for my use of capital letters to identify some exhibits and numerals to identify others is the likelihood that the exhibits identified by capital letters may never be used as exhibits at the trial or will be introduced as exhibits by the opposition, whereas those identified by numerals would seem most likely to be introduced by us as exhibits at the trial (if there is one), and those through PX-27 have already been identified by their exhibit numbers in our depositions.

If you can look over the enclosed material quickly and give me your comments by telephone, I may be able to profit from those comments in finally revising the memorandum and still get the motion and memorandum filed by the end of this week. In any event, and whether or not you decide to move for a separate trial of the issue of "unclean hands" I would hope that the enclosed material might be of some assistance to you in the handling of your own case.

I shall, of course, be intensely interested in whatever develops regarding a trial date for your case and what issues will be tried.

Sincerely,

John

JFP:jh
Enclosures

cc: Richard S. Phillips, Esq.
Walther E. Wyss, Esq.

April 13, 1967

VIA AIR MAIL

Mr. Robert H. Rines
Rines and Rines
No. Ten Post Office Square
Boston, Massachusetts 02109

RE: UIF v. BT v. JFD

Dear Bob:

I talked with John Pearne this morning and understand he is going to talk with you with regard to several matters.

His motion for summary judgment will be delayed a few days, but he is sending you a copy of a draft.

He is considering the possibility of a motion to separate the fraud question for trial and wondered if that might be of interest to you as a procedural tactic. I suggested that the question of fraud might be raised with regard to the Isbell patent also in view of Quarterly Report No. 2. I doubt if we could establish fraud on the Patent Office, but there might be an argument with regard to the continuation of this litigation after the facts become known.

The stipulation he is securing with regard to Quarterly Reports 1 and 2, Technical Report 39, and the Collins Radio publication sounds like a good idea and should simplify the testimony.

We checked with Judge Hoffman's clerk this morning and find that his trial calendar is moving as he had planned. The clerk suggested that he would not be able to give any definite information regarding your call until three or four days before the date it is set. Presumably you will go to trial on or shortly after May 1.

Very truly yours,

RSP:iag

Richard S. Phillips

4/14/67

Pearne – Going to miss 4/15 by a few days.

V-dipole – mailed P.O. –

32U 5806
89LEd. 1381

Prec. Inst. ✓ /

Hazel Atlas

Walker Process –

P.I. – Igoe – Separate tracking fraud

~~Wait #6~~

1/4 #1 public 4/59

#2 4/30 printed & in

possession of Morgan's Palmer –

& Shering –

#3 9/21/59 – mailed

one year prior to

Collins Radio 5/14/58

April 13, 1967

Mr. Myron C. Cass
Silverman & Cass
105 West Adams Street
Chicago, Illinois 60603

RE: UIF v. BT v. JFD

Dear Mike:

You were going to give me your thoughts on a stipulation regarding soft copies, publications and the like. I would appreciate having this so that we can have the stipulation signed before time for trial arrives.

Very truly yours,

Richard S. Phillips

RSP:iag

April 4, 1967

Mr. Robert H. Rines
Rines and Rines
No. Ten Post Office Square
Boston, Massachusetts 02109

Dear Bob:

You have a copy of John Pearne's letter of March 29. I talked with John after he had discussed this with Pete Mann. The Foundation does not wish to seek postponement of your trial and does not intend to bring the Winegard suit or the Finney motion, when filed, to Judge Hoffman's attention.

John tells me you have no objection to seeking postponement of the trial. I don't know what Judge Hoffman may do with this one, but we can bring it to his attention, probably by way of a motion to postpone the trial. I don't think this should be done, however, until Finney's motion has been filed.

Please let me know your thoughts on this.

Jack and I are looking forward to receiving a draft of your trial brief.

Very truly yours,

Richard S. Phillips

RSP:iag

McNENNY, FARRINGTON, PEARNE & GORDON
920 MIDLAND BUILDING
CLEVELAND, OHIO 44115

March 29, 1967

Basil P. Mann, Esq.
Merriam, Marshall, Shapiro & Klose
30 West Monroe Street
Chicago, Illinois 60603

COPY

Re: The Finney Company v. JFD Electronics Corporation and The University of Illinois Foundation - Civil Action Nos. 65 C 220 and 65 C 671 (Consolidated)

Dear Pete:

For your advance information, I am enclosing herewith a copy of a motion for summary judgment in the above-captioned suit. Plaintiff proposes to file this motion, together with a memorandum in support of the motion and supporting documents on or before a target date of April 15, 1967.

My purpose in sending you an advance copy of that motion is twofold. First, it occurred to me that you and counsel for Blonder-Tongue, parties to Civil Action No. 66 C 567 set for trial before Judge Hoffman on May 1, 1967, might wish to seek postponement of that trial pending decision of The Finney Company motion, particularly in view of the fact that a decision is also being awaited in your suit against Winegard in the Southern District of Iowa on the Isbell patent and the fact that a decision on The Finney Company motion against the Isbell and Mayes et al. patents should, effectively, either dispose of your suit against Blonder-Tongue (to the extent the motion may be granted) or simplify the issues in that suit (to the extent that the motion may be denied). Obviously, this involves an issue between you, counsel for Blonder-Tongue, and Judge Hoffman, but it seemed appropriate, under the circumstances, that you and counsel for Blonder-Tongue be informed of The Finney Company motion as far as possible in advance of the trial date set in your suit against Blonder-Tongue.

My second purpose for giving you advance notice of The Finney Company motion is to seek your cooperation in establishing, for the purposes of the motion and defendants' response, the authenticity of various documents and, perhaps, some of the pertinent facts, where such documents and facts clearly involve no genuine issue between the parties. To the extent that we can cooperate in this regard, the work of both parties in preparing their briefs, establishing the authenticity of documents they will rely upon, and preparing affidavits to establish undisputed facts should be reduced considerably to our mutual advantage and to the advantage of the Court.

Accordingly, I shall greatly appreciate hearing from you as quickly as possible regarding the desirability of cooperating in the manner suggested in the preceding paragraph.

Sincerely,

John

JFP:jh
Enclosure

cc: Richard S. Phillips

bcc: Walther E. Wyss, Esq.
Robert H. Rines, Esq.
Mr. L. H. Finneburgh, Jr.

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 No. 65 C 671

PLAINTIFF'S MOTION FOR SUMMARY JUDGMENT

Now comes the plaintiff, by its attorneys, and moves under the provisions of Rule 56, F.R.C.P., for a summary judgment that two of the three patents in suit are invalid in their entireties, and that one of the two is unenforceable for unclean hands in the procurement thereof, said patents in suit being:

I. U. S. patent No. 3,210,767 (PX-A)*
Inventor: Dwight E. Isbell
Application filed: May 3, 1960
Patent granted: October 5, 1965

II. U. S. patent No. Re. 25,740 (PX-B)**
Inventors: Paul E. Mayes and Robert L. Carrel
Original application filed: September 30, 1960
Original patent No. 3,108,280 granted: October 22, 1963
Reissue application filed: March 5, 1964
Reissue patent granted: March 9, 1965

I. ISBELL PATENT NO. 3,210,767

The ground for invalidity of the claims of the Isbell patent is that the subject matter of said claims was described in a printed publication (PX-4)*** published April 30, 1959 (more than one year prior to the May 3, 1960, date of application for the patent) in contravention of §102 of Title 35, United States Code [35 U.S.C. 102(b)].

---

* Hereafter called "Isbell patent."

** Hereafter called "Mayes et al. reissue patent," the original patent replaced thereby being hereafter called "Mayes et al. original patent."

*** Antenna Laboratory Quarterly Engineering Report No. 2, "RESEARCH STUDIES ON PROBLEMS RELATED TO ECM ANTENNAS," Electrical Engineering Research Laboratory, Engineering Experiment Station, University of Illinois, Urbana, Illinois. This report has heretofore been identified as plaintiff's Exhibit 4 (PX-4) and will hereafter be so referred to.

II. MAYES ET AL. REISSUE PATENT NO. RE. 25,740

A.

The ground for invalidity of the claims of the Mayes et al. reissue patent is that the alleged inventors did not themselves invent the subject matter of said claims, but derived the same from another,* so that the patent was granted in contravention of §102(f) and §103 of Title 35, United States Code [35 U.S.C. 102(f) and 103].

B.

The Mayes et al. reissue patent is unenforceable because it and the Mayes et al. original patent on which the reissue was based were both procured by the Foundation defendant by presenting the Patent Office with deceptive and misleading evidence to the effect that the earlier work of Dwight E. Isbell was not a part of the prior art, whereas it was in fact a part of the prior art and had been described in printed publications** more than one year prior to the date of the application for the Mayes et al. original patent. As a result, the Patent Office dropped the earlier work of Isbell from consideration as prior art against Mayes et al., which it otherwise would not have done, and was

---

* Edwin M. Turner of Wright Patterson Air Force Base, Dayton, Ohio.

** The publication PX-4 and Antenna Laboratory Technical Report No. 39, "LOG PERIODIC DIPOLE ARRAYS," Electrical Engineering Research Laboratory, Engineering Experiment Station, University of Illinois, Urbana, Illinois. The latter report has heretofore been identified as Plaintiff's Exhibit 17 (PX-17) and will hereafter be so referred to.

thereby influenced to grant the Mayes et al. original and reissue patents. Because defendant knew the pertinent facts, or should have known them, they have come into court with unclean hands with respect to the Mayes et al. reissue patent and are not entitled to enforce that patent. Hazel-Atlas Glass Co. v. Hartford-Empire Co., 322 U. S. 238 (1944).

SUPPORTING EVIDENCE AND MEMORANDUM

Affidavits supporting the foregoing motion as to each of the grounds thereof are attached hereto as a part hereof, together with copies of depositions, answers to interrogatories, and admissions that are on file or are filed herewith, and copies of prior patents and publications that are also relied upon in support of this motion.

A separate memorandum in support of this motion further explains each of the grounds therefor and is being filed by plaintiff concurrently therewith.

Respectfully submitted,

MASON, KOLEHMAINEN, RATHBURN & WYSS

By ______________________________
One of the Attorneys for Plaintiff
20 North Wacker Drive
Chicago, Illinois 60606
FInancial 6-1677

OF COUNSEL:
John F. Pearne
William A. Gail
McNenny, Farrington, Pearne & Gordon
920 Midland Building
Cleveland, Ohio 44115
623-1040

March 20, 1967

Mr. John F. Pearne
McNenny, Farrington, Pearne & Gordon
920 Midland Building,
Cleveland, Ohio 44115

Dear John:

* I enclose copies of JFD drawings 50451, 52720 and 52730. These are exhibits B-38, 39 and 40, respectively.

Very truly yours,

Richard S. Phillips

RSP:iag

* Enclosures

March 16, 1967

Mr. John T. Pearne
McNenny, Farrington, Pearne & Gordon
920 Midland Building
Cleveland, Ohio 44115

Dear John:

* I enclose copies of exhibits 27 through 33, 36, 37, 41, and 45 through 48 from the Mayes depositions taken on behalf of Blonder-Tongue. Exhibits 38 through 40 are blueprints which we are having copied and will send you later.

Very truly yours,

Richard S. Phillips

RSP:iag

* Enclosures

cc: Mr. Robert H. Rines

March 16, 1967

Mr. John F. Pearne
McNenny, Farrington, Pearne & Gordon
920 Midland Building
Cleveland, Ohio 44115

Dear John:

* Bob Rines asked that I send you copies of the transcripts of the depositions taken of Paul Mayes. They are enclosed. I am reviewing our exhibits from these depositions and will send you copies of those which I don't think you have. If there is anything further with regard to the depositions which would be of interest to you, let me know.

Bob asked that I check with you regarding your opinion as to the most pertinent prior art against the Isbell and Mayes et al patents. We have to prepare a list of exhibits by March 25. I would appreciate having your suggestions before then.

Bob is also considering the possibility of using DuHamel, Isbell or Carrel as witnesses at the trial. Have you contacted any of them? If so, have you learned anything which you believe to be of interest?

Very truly yours,

Richard S. Phillips

RSP:iag

* Enclosures

cc: Mr. Robert H. Rines

McNENNY, FARRINGTON, PEARNE & GORDON
920 MIDLAND BUILDING
CLEVELAND, OHIO 44115

June 27, 1967

Richard S. Phillips, Esq.
Hofgren, Wegner, Allen, Stellman & McCord
20 North Wacker Drive
Chicago, Illinois 60606

C O P Y

Re: The University of Illinois Foundation v. Winegard Company

Dear Dick:

I assume you have probably learned through the Chicago grapevine of Judge Stevenson's decision of June 23rd in the above suit in Iowa, holding the Isbell patent invalid for obviousness in view of the prior art, while deciding none of the other issues of validity or infringement. If you have not already seen the decision, I am sure Keith Kulie would be delighted to supply you and Bob Rines with copies.

Sincerely,

John

JFP:jh

cc: Robert H. Rines, Esq.

LAW OFFICES

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE

CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

June 27, 1967

Mr. Robert H. Rines
Rines and Rines
No. Ten Post Office Square
Boston, Massachusetts 02109

RE: UIF v. BT v. JFD

Dear Bob:

* I enclose a copy of the decision in the Winegard suit. I have read it very hurriedly. It is my initial feeling that the judge did a good job of analyzing the prior art and of applying it to the claims.

Unfortunately, he did not even discuss the question of Quarterly Report No. 2 and its effect as a statutory bar.

Very truly yours,

Dick

Richard S. Phillips

RSP:iag

* Enclosure

cc: Mr. I. S. Blonder (*)

IN THE UNITED STATES DISTRICT COURT

FOR THE SOUTHERN DISTRICT OF IOWA

DAVENPORT DIVISION

FILED

JUN 23 1967

F. E. VAN ALSTINE
CLERK, U. S. DISTRICT COURT
SOUTHERN DISTRICT OF IOWA

UNIVERSITY OF ILLINOIS FOUNDATION,	)	
	)	Civil No. 3-695-D
Plaintiff,	)	
vs.		MEMORANDUM OPINION
	)	
WINEGARD COMPANY,		
	)	
Defendant.		

This action was brought by the plaintiff University of Illinois Foundation, the owner by assignment of U. S. Patent 3,210,767, issued to Dwight E. Isbell on October 5, 1965 (hereinafter referred to as the Isbell Patent and attached hereto as Appendix A), against the defendant Winegard Company wherein the plaintiff seeks a finding that said patent has been and is being infringed by the defendant. In its answer the defendant alleges, inter alia, invalidity of the patent on the grounds that the invention was disclosed more than one year prior to the date of the application for the patent and that, at the time made, the invention was obvious to one skilled in the art. Jurisdiction is established by virtue of 35 U.S.C. § 381 and 28 U.S.C. § 1338.

Inasmuch as the defendant alleges invalidity of the patent as a defense, the Court must determine initially whether or not the Isbell patent is valid. General Mills, Inc. v. Pillsbury Co., _______ F.2d ______ (8th Cir., June 8, 1967); American Infra-Red Radiant Co. v. Lambert Indus., Inc., 360 F.2d 977, 983-84 (8th Cir.,1966). Of course, a patent, from the fact of its issuance is presumed to be valid. 35 U.S.C. § 282;

Radio Corporation of America v. Radio Engineering Laboratories, Inc., 293 U.S. 1, 7-8 (1934); L & A Products, Inc. v. Britt Tech. Corp., 365 F.2d 83, 86 (8th Cir., 1966); American Infra-Red Radiant Co. v. Lambert Indus.,Inc., supra at 988-89. However, this presumption of validity is weakened when, as in this case, there are prior art references or alleged disclosures of the patent before the Court that were not considered by the patent office during the prosecution of the application for the patent. Imperial Stone Cutters, Inc. v. Schwartz, 370 F.2d 425, 429 (8th Cir., 1966); American Infra-Red Radiant Co. v. Lambert Indus.,Inc., supra at 989; Greening Nursery Co. v. J & R Tool & Mfg. Co., 252 F. Supp. 117, 139 (S.D. Iowa 1966), aff'd ______ F.2d ______ (8th Cir., May 9, 1967).

There are three separate conditions precedent to patent validity. They are: Novelty, utility, and nonobviousness. 35 U.S.C. §§ 101-03; Graham v. John Deere Co., 383 U.S. 1, 12 (1966); United States v. Adams, 383 U.S. 39, 48 (1966); L & A Products, Inc. v. Britt Tech. Corp., supra at 85. In this case the defendant relies on lack of novelty (Title 35 U.S.C. Section 102) and obviousness (Section 103) as barring patentability. It is the opinion of the Court that the issue of obviousness is dispositive of this case. Therefore, that issue will be first considered.

While the ultimate question of patent validity is one of law, the determination of the question of obviousness lends itself to several basic factual inquiries. Graham v. John Deere Co., supra at 17; L & A Products, Inc. v. Britt Tech. Corp., supra at 86. In addition to setting out the scope of the patent in suit, the scope and content of the prior art must be defined so that a determination can be made as to whether the differences between the patent in suit and the pertinent prior art would have been obvious to one ordinarily skilled in the art. If such differences as may exist would have been obvious to a person ordinarily skilled in the art, the obviousness test of 35 U.S.C. § 103 has not been met and the patent will be invalid. Graham v. John Deere Co., supra, at 37; General Mills, Inc. v. Pillsbury Co., supra.

The Patent in Suit

The Isbell Patent is entitled "Frequency Independent Unidirectional Antennas" and relates to antennas designed for the transmission and reception of electromagnetic radio frequency signals. These signals are used for the broadcasting of many types of communications including radio and television signals. The Isbell antenna consists of a plurality of elements called "dipoles"[1] which are arranged in relation to each other and

---

1. Generally, in this context, a simple straight dipole antenna element consists of two elongated metallic conductors (wires, rods or tubes) arranged approximately colinearly in such a manner that there is a small gap or terminal between their inner ends, at which point a transmission line is attached. The familiar "rabbit-ear" indoor television antenna is a simple dipole having its arms at an angle rather than in a straight line. When immersed in an electromagnetic field the dipole element will intercept electromagnetic radio waves and produce a voltage across the terminal. This voltage is carried to the receiver by means of the transmission line. The dipole antenna element, like any other electrical conductor, will intercept radio energy from the atmosphere to a limited extent, regardless of the frequency of the energy being transmitted. There is, however, a special condition, known as "resonance", in which the dipole is strongly receptive, which occurs when the dipole is of a particular length in relationship to the wavelength of the radiated energy. This condition occurs primarily when the overall length of the dipole is one-half of the wavelength of the radio wave. Thus, it is apparent that a dipole can be "tuned" for optimum reception of a particular radiowave frequency by adjusting the overall length of the dipole. The relative ability of one antenna to produce a signal (i.e., a radio frequency voltage) at a given location distant from the transmitting station in comparison with another antenna similarly located is a measure of the antenna's "gain," a technical term used in the industry in reference to an antenna's signal-producing capabilities.

connected to each other in a particular manner. Generally, as stated in the patent specification, "the antennas of the invention are coplanar dipole arrays consisting of a number of dipoles arranged in side-by-side relationship in a plane, the length and the spacing between successive dipoles varying according to a definite mathematical formula, each of the dipoles being fed by a common feeder (transmission line) * * * ."[2] According to the patent specification,

> The lengths of the dipoles and the spacing between dipoles are related by a constant scale factor τ defined by the following equations:
>
> $$\tau = \frac{L(n+1)}{Ln} = \frac{\Delta S(n+1)}{\Delta Sn}$$
>
> where τ is a constant having a value less than 1, Ln is the length of any intermediate dipole in the array, L(n+1) is the length of the adjacent smaller dipole, ΔSn is the spacing between the dipole having the length Ln and the adjacent larger dipole, and ΔS(n+1) is the spacing between the dipole having the length Ln and the adjacent smaller dipole.[3]

The feeder or transmission line consists of two conductors, one of which is connected to the inner end of one-half of each dipole, the other being connected to the inner end of the other half of the dipole, and transposed between connections of successive dipoles in such a manner that each conductor is connected alternately to the left and right halves of successive dipoles. (See Appendix A, Fig. 1.)

Antennas designed in accordance with the patent specifications are claimed to have unidirectional radiation patterns and high quality performace which are, over a wide band of frequencies, essentially independent of the frequency of the electromagnetic radio waves being transmitted or received. An

2. Isbell Patent, Col. 1, lines 14-19. See App. A.

3. Isbell Patent, Col. 1, lines 50-62. See App. A.

antenna with such characteristics is, of course, desirable when the reception of many different frequencies is required as one such antenna may be used in place of many antennas which are each capable of receiving a limited number of frequencies. Since VHF television signals are broadcast over a range of frequencies of 54 megacyles/second to 216 megacycles/second,[4] an antenna capable of receiving high quality signals with uniform performance characteristics in that range of frequencies would be of commercial utility. This is particularly true in respect to the reception of color television signals where the minimum standards of performance are higher than those required for satisfactory black and white television reception.

There are fifteen claims in the Isbell patent. See Appendix A. All of the claims except numbers 6, 7 and 8 are claimed to be infringed by one or more of twenty-two models of defendant's antennas which are designed for the reception of television signals.[5] Specifically, all twenty-two models

---

4. Channels 2-6 broadcast over radiowave frequencies 54-88 megacycles/second, each channel being assigned a band 6 megacycles wide in which to broadcast. Thus, channel 2 broadcasts over the range 54-59 megacycles/second; channel 3, 60-65 megacycles/second; etc. Channels 7-13 broadcast over frequencies 176-216 megacylces/second, with 89-175 megacycles/second being assigned to non-television broadcasting. While some of the antennas accused of infringing are designed for the reception of VHF and UHF (470-890 megacycles/second) signals, it is only the VHF sections of these antennas that are alleged to be infringements of the Isbell patent.

5. The Winegard antennas that are alleged to be infringements of the Isbell patent are the models with the following numbers:

Chromaflex	B-445	R.C.A.	10-B-200
"	B-550	"	10-B-300
"	B-555	"	10-B-400
"	B-660	"	10-B-1010
"	B-770	"	10-B-1020
"	B-105	"	10-B-1030
"	B-335	"	10-B-1040
Chromatel	CT-40	"	10-B-1050
"	CT-80	"	10-B-1120
"	CT-90	"	10-B-1130
"	Ct-100	"	10-B-1140

are alleged to be literal infringements of claims 14 and 15 and also within the inventive concept of claims 1-5 and 9-13. In addition, one of the antennas, the chromatel CT-100, is alleged to be a literal infringement of claims 1, 2, 9, 10, 11, and 12. It should be noted here that while the portions of the antennas which are charged as infringing are designed solely for the reception of VFH television signals, the Isbell antenna is not so limited. It is designed both as a receiving antenna and a transmitting antenna for use in an unlimited range of frequencies. For example, the specification indicates that the antenna has very high performance characteristics over as high a range as 1100 to 1800 mc/sec.[6]

Prior Art

Four prior patents are cited in the patent as having been considered by the patent examiners. One of these patents, five other U. S. patents not referred to by the examiners, an article published on March 31, 1958 and three antennas in use prior to 1959 are among the references relied upon by the defendant as revealing the prior art at the time of the invention. An examination of some of these references will be helpful in defining the state of the prior art on May 3, 1960, the date of the filing of the application for the patent.

The Katzin patent (U.S. Patent No. 2,192,532, the first page of which is attached hereto as Appendix B) cited by the patent office reveals an antenna consisting of an array of dipole elements of different lengths arranged in a side-by-side relationship in a plane. While some of the illustrated embodiments of the Katzin invention show antennas having several elements of one length arranged parallel to several elements of

6. Isbell Patent, Col. 2, lines 47-52. See App. A.

another length, one illustrated embodiment (Figure 3c, Appendix B) shows an array described in claim seven of the patent as being "a plurality of aerial elements, all of differing length, continuously tapering in length from one end of said antenna to the other * * * ."[7] The patent also suggests, in claim 11 thereof, that the spacing between the shorter elements may be less than that between the longer elements.[8] The teaching of the Katzin patent is that if elements, or groups of elements, of differing lengths are combined into one array, each of the elements, or groups of elements, "will respond most efficiently to its corresponding band of frequencies, so that the combination of two or more such groups * * * will give the result of a high response for a wider frequency band."[9]

One of the antennas cited as prior art by the defendant is the Channel Master "K. O." antenna model 1023, produced and marketed by the Channel Master Corporation of Ellenville, N. Y. between September 1954 and December 1958. A schematic diagram of this antenna, Exhibit DX-G-16, is attached hereto as Appendix C. This antenna is an array of <u>folded</u> dipoles,[10] each

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7. U.S. Patent No. 2,192,532, p. 2, Col. 2, lines 54-58.
8. U.S. Patent No. 2,192,532, p. 3, Col. 2, lines 5-14; See also Fig. 3d, App. B.
9. U.S. Patent No. 2,192,532, p. 2, Col. 1, lines 16-21.
10. Folded dipoles are simple dipoles, see n. 1, <u>supra</u>, which have been altered by adding another conductor in such a manner that it is approximately parallel to the simple dipole and attached to the outer ends of each half of the simple dipole. The resulting structure is an elongated loop having a terminal point midway along one of its longer sides. (See App. C) Folded dipoles have somewhat different characteristics than straight or simple dipoles, the primary differences being that folded dipoles have better performance over a greater bandwidth of frequencies and that folded dipoles have a greater resistance to the flow of electric current than do simple dipoles. This resistance to the flow of current is known as "impedence." In order to achieve the maximum transmission of the signal to the receiver, the impedence of the antenna, the transmission line and the receiver should be as nearly equal

of a different length, arranged in a coplanar side-by-side relationship decreasing in length from one end of the array to the other. The spacing between the dipole elements is irregular, the elements not being equally spaced and the spacing not varying progressively from one end of the array to the other. The feeder or transmission line running between the elements consists of two conductors, one of which is connected to one end of the folded dipole at the terminal point, the other connected to the other end of the dipole at the terminal point, and transposed between dipoles such that each conductor is alternately connected to the left and right ends of successive dipoles. Transposed feeder lines are also shown in the Koomans Patent (U.S. Patent No. 1,964,189, the first page of which is attached hereto as Appendix D) and the Winegard Patent (U.S. Patent No. 2,700,105, the first page of which is attached hereto as Appendix E), both of which are cited as prior art by the defendant. The White Patent (U.S. Patent No. 2,105,569, the first page of which is attached hereto as Appendix F) also uses transposed feeder lines in conjunction with dipole elements decreasing in length from one end of the array to the other. However, the White array is "center-fed," that is, connected to the down lead transmission line which leads to the receiver, at the center of the array, rather than at the end of the array. The antennas described in the Katzin, Koomans, and Winegard patents noted above and the "K. O." antenna, as well as the Isbell antenna, are all fed at the end of the antenna having the smaller

10. (Con'd) as possible. Television transmission line and receivers have an impedence set by FCC regulation at about 300 ohms. A simple dipole has an impedence of about 75 ohms while a folded dipole has an impedence of about 300 ohms.

elements.

The article cited by the defendant Winegard as prior art is "Logarithmically Periodic Antenna Designs" published by R. H. DuHamel and F. R. Ore on March 31, 1958. This article explains the elements of the theory of logarithmically periodic (log periodic) antennas and the development of several such antennas. Generally stated, log periodic antennas are designed according to the theory that an antenna "design cell"[11] having high performance characteristics for reception of a limited band or period of radio frequency signals, if altered in all dimensions by a constant scale factor will have high performance characteristics for reception of a band of signals having wavelengths which vary from the wavelengths of the first band of frequencies by the same constant scale factor. Thus, according to the theory, if an antenna design cell has certain characteristics for reception of particular frequency wavelengths, an antenna geometrically similar but reduced in all dimensions by a scale factor of .5 will have similar characteristics for reception of frequencies of wavelengths half those of the first. The theory continues that if a particular design cell is reduced successively by a constant scale factor which is less than 1, and repeated periodically in one antenna "array", the array will have the characteristics of the design cell over a broader band of frequencies which is limited only by the largest and smallest of the geometrically similar design cells which are

---

11. The term "design cell" is used herein to refer to a structural unit of an antenna which is capable of receiving and transmitting electromagnetic radio energy. A simple or folded dipole and an adjacent section of transmission line are examples of such antenna design cells. A particular antenna array may be composed of one or more similar or dissimilar design cells.

repeated in the array. Because the performance of the antennas so designed is theoretically the same over any band of frequencies for which the antenna is designed the antennas are termed Frequency Independent Antennas. The application of this theory to antenna design appears to be limited only by the conditions that the design cell used must have uniform performance over a single period and that the overall array, the periodic repetition of the cell, not cause an "end effect"[12] that would destroy the frequency independence of the array.

The formula set out by DuHamel and Ore as defining the relationship between the repeated, or periodic, design cells is: $\tau = \frac{R_{n+1}}{R_n}$, which defines a constant proportional relationship between like elements of the design. In this case the formula relates to the radii of circular structures. Of course, in the case of geometrically similar designs all dimensions of one design are proportionally equal to all dimensions of the other similar designs. That is, they must all vary proportionally. The theory of the log periodic antenna was adopted by Isbell in his work and the formula, $\tau = \frac{L_{(n+1)}}{L_n} = \frac{\Delta S_{(n+1)}}{\Delta S_n}$ where τ is a constant having a value of less than 1, can be

12. Very generally stated, "end effect" is a term used to describe a bouncing back and forth, from one end of an antenna array to the other, of any energy that is not fully transmitted or absorbed by the elements of the antenna as the energy travels initially along the antenna. This bouncing, or reflection, back and forth may cause shadows or ghosts in the reception of a television picture. Thus, in order to avoid this end effect an antenna should be designed to have sufficient elements to radiate or absorb all of the energy as it passes from one end of the antenna to the other so that there will be no such reflection of the energy back down the antenna.

seen to be a simple adaptation of the DuHamel-Ore formula[13] and its mathematical equivalent.

The Invalidity of the Patent

Keeping in mind the prior art previously discussed, it can be seen that an antenna with the general parameters of the Isbell Patent will result from a combination of the dipole array of Katzin with the transposed feeder line of the Channel Master "K. O. " or the Koomans or Winegard Patents. Such an antenna would consist of a coplanar side-by-side array of straight dipole elements of differing lengths which decrease in length and spacing from one end of the array to the other (as disclosed by claims 7 and 11 of the Katzin patent), fed at the small end of the array by a two conductor transmission line that is transposed between successive elements (as disclosed by the Koomans and Winegard Patents and the Channel Master "K. O." antenna). Further, if

13. While DuHamel and Ore defined circular structures by relating the radii of different parts of one cell to the radii of another, Isbell has defined linear structures by relating the lengths and spacings of one design cell to another. That these are alternative means of expressing the same mathematical relationsip is evident from an examination of Figure 1 of the Isbell patent and the discussion, found in Col. 1, line 63 to Col. 2, line 2 of the patent, relative to the distance from the base line O, in Figure 1, to the dipole having the length Ln. If the distance from the base line O to dipole having the length Ln were the radius of a circle having its axis at line O and its circumference tangent to the same dipole, the distance represented by Xn ("the distance from the base line O to the dipole having the length Ln", see Col. 1, lines 71-72 of Appendix A) would be equal to Rn, where Rn is the radius of the said circle having its axis at O and its circumference tangent to the dipole of length Ln; then, it is easily seen that the formulas $\tau = \frac{R_{n+1}}{R_n}$ (Isbell) and $\tau = \frac{X_{(n+1)}}{X_n}$ (DuHamel & Ore) are different but equal mathematical expressions of the same proportional relationship.

the length and spacing of the dipole elements in such an antenna are adjusted by the log periodic theory of antenna design which dictates that the periodic or repeating cells (here a dipole element and adjoining section of transmission line) shall be geometrically similar and related to each other in size by a constant scale factor, the result is the Isbell antenna disclosure. It is thus apparent that the Isbell antenna is a combination of elements, all known in the prior art and also that these known elements were combined in the Isbell antenna in a manner dictated by a theory also known in the prior art. Therefore, the critical question is whether such a combination would have been obvious to one reasonably skilled in the art of antenna design. United States v. Adams, supra at 50-52; Kell-Dot Indus., Inc. v. Graves, 361 F.2d 25, 30 (8th Cir., 1966); Infra-Red Radiant Co. v. Lambert Indus., Inc., supra at 988. Those skilled in the art at the time of the Isbell application knew (1) the log periodic method of designing frequency independent antennas, (2) that antenna arrays consisting of straight dipoles with progressively varied lengths and spacings exhibit greater broad band characteristics than those consisting of dipoles of equal length and spacing and, (3) that a dipole array type antenna having elements spaced less than 1/2 wavelength apart could be made unidirectional in radiation pattern by transposing the feeder line between elements and feeding the array at the end of the smallest element.

It is the opinion of the Court that it would have been obvious to one ordinarily skilled in the art and wishing to design a frequency independent unidirectional antenna to combine these three old elements, all suggested by the prior art references previously discussed.[14] The test of obviousness is the proper test to be applied in determining whether a new combination of known elements is patentable. <u>American Infra-Red Radiant Co. v. Lambert Indus., Inc.</u>, <u>supra</u> at 988. When one skilled in the art with the prior art references before him could have, without the exercise of inventive faculty, combined old elements known in the art to produce the plaintiff's "invention," the "invention" does not rise to the level of patentability notwithstanding the fact that it may be an improvement over the

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14. It should also be noted that the File Wrapper of the Isbell patent indicates that on November 9, 1960, all original 9 claims (final claims 1-8 and another never approved) were initially rejected by examiner G. N. Westby as being met by Katzin (Patent No. 2,192,532, App. C) in view of other patents teaching the crossing of the feeder line and the use of straight tubular conductors. On May 10, 1961, Isbell submitted an amendment to the Patent Office wherein he argued that "there is certainly no teaching or suggestion in the Katzin patent of an arrangement in which <u>both</u> the length of successive dipoles <u>and</u> the spacing between said dipoles vary in a manner <u>such that the ratio of the length of adjacent dipoles is a constant which is also equal to the ratio of the spacings between adjacent dipoles</u>. Unless both of these conditions are met the antenna does not have the remarkably wide band paths, the high gain and the directivity exhibited by the antennas of the invention." (Emphasis in the original). Subsequently, original claims 1-8 were allowed by examiners H. K. Saalbach and Eli Lieberman as were 7 additional claims added as a result of an interference proceeding and further amendments by the applicant. It appears, thus, that the above argument in regard to the constant proportional relationship of the lengths and spacings of the elements and the importance of such relationship convinced the Patent Office that the Isbell disclosure was patentable. However, there is nothing in the file wrapper to indicate that the patent examiners were aware of published work of DuHamel and Ore, their formula, or the log periodic theory of antenna design all of which was a part of the prior art at the time of the application.

prior art. Kell-Dot Indus., Inc. v. Graves, supra at 29. The Court, upon full consideration of the record herein, finds that the disclosure of Isbell's Patent No. 3,210,767 is lacking in the prerequisite non-obviousness and is, therefore, invalid.

Inasmuch as an invalid patent cannot be infringed, Imperial Stone Cutters, Inc. v. Schwartz, supra at 429; Kell-Dot Indus., Inc. v. Graves, supra at 28, the question of infringement is rendered moot and is, therefore, not decided by this Court.

The foregoing shall constitute the findings of fact and conclusions of law pursuant to Fed. R. Civ. P. 52(a).

IT IS ORDERED that judgment will be entered for the defendant with costs, exclusive of attorney's fees, taxed to the plaintiff.

Dated this 23rd day of June, 1967.

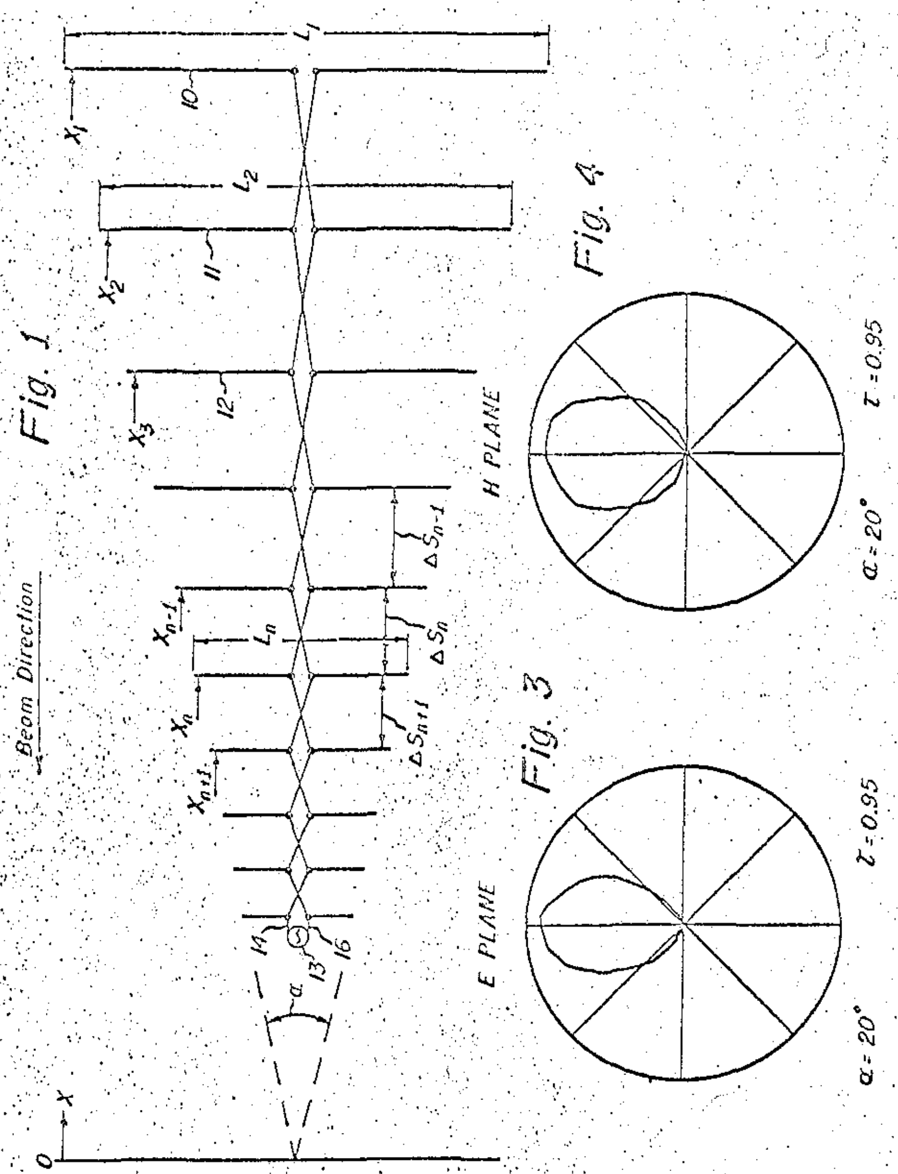
CHIEF JUDGE

APPENDIX A

Oct. 5, 1965 D. E. ISBELL 3,210,767

FREQUENCY INDEPENDENT UNIDIRECTIONAL ANTENNAS

Filed May 3, 1960 2 Sheets-Sheet 1



INVENTOR.
Dwight E. Isbell

BY

Merriam, Smith & Marshall
ATTORNEYS

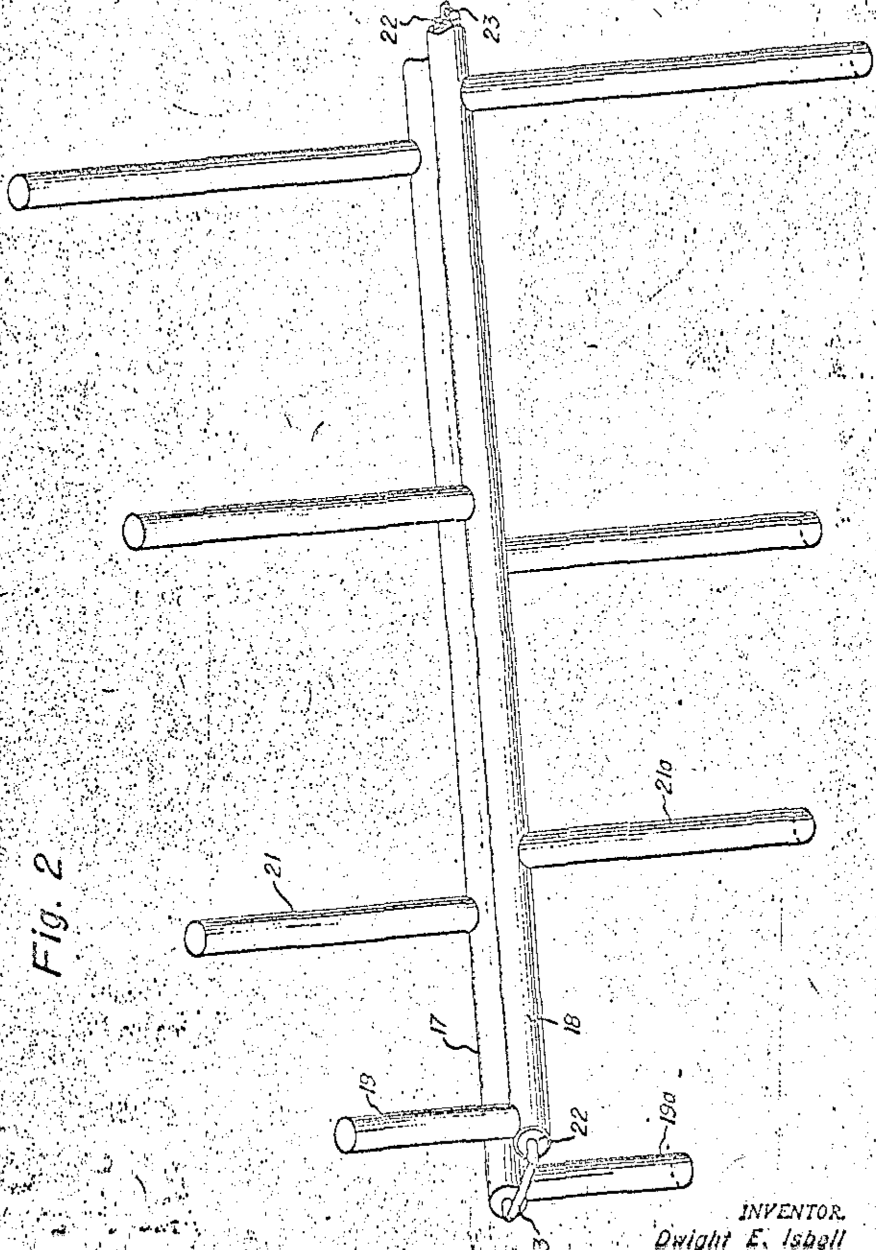


Fig. 2

INVENTOR.
Dwight E. Isbell
BY
Merriam, Smith & Marshall
ATTORNEYS

United States Patent Office

3,210,767

Patented Oct. 5, 1965

1

3,210,767

FREQUENCY INDEPENDENT UNIDIRECTIONAL ANTENNAS

Dwight E. Isbell, Seattle, Wash., assignor to The University of Illinois Foundation, a non-profit corporation of Illinois

Filed May 3, 1960, Ser. No. 26,589
15 Claims. (Cl. 343—792.5)

This invention relates to antennas, and more particularly, it relates to antennas having unidirectional radiation patterns that are essentially independent of frequency over wide bandwidths.

The antennas of the invention are coplanar dipole arrays consisting of a number of dipoles arranged in side-by-side relationship in a plane, the length and the spacing between successive dipoles varying according to a definite mathematical formula, each of the dipoles being fed by a common feeder which introduces a phase reversal of 180° between connections to successive dipoles. The antennas of the invention provide unidirectional radiation patterns of constant beamwidth and nearly constant input impedances over any desired bandwidth.

The invention will be better understood from the following detailed description thereof taken in conjunction with the accompanying drawing, in which:

FIGURE 1 is a schematic plan view of an antenna made in accordance with the principles of the invention;

FIGURE 2 is an isometric view of a practical antenna embodying the invention; and

FIGURES 3 and 4 are radiation patterns of a typical antenna, in the E plane and H plane, respectively.

Referring to FIGURE 1, it will be seen that the antenna of the invention was composed of a plurality of dipoles 10, 11, 12, etc., which are coplanar and in parallel, side-by-side relationship. It will be noted that the lengths of the successive dipoles and the spacing between these dipoles is such that the ends of the dipoles fall on a pair of straight lines which intersect and form an angle α. In the preferred embodiment the antenna is symmetrical about a line passing through the midpoints of the dipoles, as shown.

The antenna is fed at its narrow end from a conventional source of energy, depicted in FIGURE 1 by alternator 13, by means of a balanced feeder line consisting of conductors 14 and 16. It will be seen that the feeder lines 14 and 16 are alternated between connections to consecutive dipoles, thereby producing a phase reversal between such connections.

The lengths of the dipoles and the spacing between dipoles are related by a constant scale factor τ defined by the following equations:

$$\tau = \frac{L_{(n+1)}}{L_n} = \frac{\Delta S_{(n+1)}}{\Delta S_n}$$

where τ is a constant having a value less than 1, L_n is the length of any intermediate dipole in the array, $L_{(n+1)}$ is the length of the adjacent smaller dipole, ΔS_n is the spacing between the dipole having the length L_n and the adjacent larger dipole, and $\Delta S_{(n+1)}$ is the spacing between the dipole having the length L_n and the adjacent smaller dipole.

It will be seen from the geometry of the antennas, as given above, that the distance from the base line 0 at the vertex of the angle α to the dipoles forming the array are defined by the equation:

$$\tau = \frac{X_{(n+1)}}{X_n}$$

where X_n is the distance from the base line 0 to the dipole having the length L_n, $X_{(n+1)}$ is the corresponding distance from the base line to the adjacent smaller dipole, and τ has the significance previously given.

2

The radiation pattern of the antennas of the invention, having the geometrical relationship among the several parts as defined above, is unidirectional in the negative X direction, i.e., extending to the left from the narrow end of the antenna of FIGURE 1.

The construction of an actual antenna made in accordance with the invention is shown in FIGURE 2. In this antenna the balanced line consists of two closely-spaced and parallel electrically conducting small diameter tubes 17 and 18 to which are attached the dipoles, each of which consists of two individual dipole elements, e.g., 19 and 19a, 21 and 21a, etc. It will be noted that each of the two elements making up one dipole is connected to a different one of said conductors 17 and 18, in a direction perpendicular to the plane determined by said conductors 17 and 18. Moreover, considering either one of the conductors 17 and 18, consecutive dipole elements along the length thereof extend in opposite directions. It will be seen that this construction has the effect of alternating the phase of the connection between successive dipoles, as depicted schematically in FIGURE 1. Although the dipoles of FIGURE 2 are not precisely coplanar, differing therefrom by the distance between the parallel conductors, in practice this distance is very small so that the dipole elements are substantially coplanar and the advantages of the invention are maintained. The antenna of FIGURE 2 may be conveniently fed by means of a coaxial cable 22 positioned within conductor 18, the central conductor 23 thereof extending to and making electrical connection with conductor 17 as shown.

As an example of the invention, an antenna of the type shown in FIGURE 2 was constructed using 0.125 inch diameter tubing for the balanced line and 0.050 inch diameter wire for the elements. The elements were attached to the feeder line with soft solder, and the array was fed with miniature coaxial cable inserted through one of the balanced line conductors. The antenna was defined by the parameters τ=0.95 and α=20°. The antenna had a total of 15 dipoles, with the longest dipole element being 2½" long, while the shortest element was one-half of this length, or 1¼". The array was 7½" long.

Typical radiation patterns for the above-described antenna in the E plane and the H plane are shown in FIGURES 3 and 4, respectively. These patterns were found to remain essentially constant over the band of about 1100 to 1800 mc./sec. The minimum front-to-back ratio over this band was 17 db and the directivity over the range from about 1130 to 1750 mc./sec. was better than 9 db over isotropic.

The performance of the above-described antenna clearly indicates that the antennas of the invention provide excellent rotatable beams for use particularly in the HF to UHF spectrum. In comparison to the well-known parasitic types of antennas which bear some resemblance to those of the invention, such as the Yagi array, the antennas of the invention provide a much wider bandwidth with essentially comparable directivity. Advantageously, however, the antennas of the invention need no adjusting for their performance over a wide bandwidth, compared to the parasitic types which must be adjusted by cut-and-try procedures for each frequency. Further experimental work with other antennas similar to that described above has indicated that the preferred values for the parameters which define the antennas of the invention include a range of values for angle α between about 20° and 100°, with τ having a value between about 0.8 and about 0.95. When these parameters have values within the preferred ranges the antennas were found to have essentially frequency independent performance over any desired bandwidth. The upper and lower limits of the bandwidths may be adjusted as desired by fixing the lengths of the longest dipole and the shortest dipole, respectively. It has been determined experimentally that the longest dipole element should be approximately 0.47 wavelength long at the lower limit and the shortest element should be about 0.38 wavelength long at the upper limit. Moreover, in order to provide a suitable front-to-back ratio at the low frequency limit, there should be at least 3 dipoles in the array and preferably about 10 to 30 dipoles.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, as modifications will be obvious to those skilled in the art.

What is claimed is:

1. A broadband unidirectional antenna comprising an array of substantially coplanar and parallel dipoles of progressively increasing length and spacing in side-by-side relationship, the ratio of the lengths of any two adjacent dipoles being given by the formula

$$\frac{L_{(n+1)}}{L_n}=\tau$$

where L_n is the length of any intermediate dipole in the array, $L_{(n+1)}$ is the length of the adjacent smaller dipole and τ is a constant having a value less than 1, the spacing between said dipoles being given by the formula

$$\frac{\Delta S_{(n+1)}}{\Delta S_n}=\tau$$

where ΔS_n is the spacing between the dipole having the length L_n and the adjacent larger dipole, $\Delta S_{(n+1)}$ is the spacing between the dipole having the length L_n and the adjacent smaller dipole, and τ has the significance previously assigned, said dipoles being fed in series by a common feeder which alternates in phase between successive dipoles.

2. The array of claim 1 which is symmetrical about a line passing through the midpoint of each dipole in the array.

3. A broadband unidirectional antenna comprising an array of a plurality of substantially coplanar and parallel dipoles of progressively increasing length in side-by-side relationship, the ends of said dipoles falling on a V-shaped line forming an angle α at its vertex, the ratio of the lengths of any pair of adjacent dipoles being given by the formula

$$\frac{L_{(n+1)}}{L_n}=\tau$$

where L_n is the length of the longer dipole of the pair, $L_{(n+1)}$ is the length of the shorter dipole, and τ is a constant having a value less than 1, the dipoles in said array being fed in series by a common feeder which alternates 180° in phase between successive dipoles.

4. The antenna of claim 3 in which the angle α has a value between about 20° and 100° and the constant τ has a value between about 0.8 and 0.95.

5. The antenna of claim 3 in which said feeder is a balanced line which twists 180° between the connections to successive dipoles.

6. A broadband unidirectional antenna comprising a balanced feeder line consisting of two closely spaced, straight and parallel conductors, a plurality of dipoles each consisting of two dipole elements, one of which elements is connected to one of said conductors, the other element being connected directly opposite the first to the other of said conductors, the elements of any dipole extending in opposite directions perpendicular to the plane determined by said conductors, consecutive dipole elements on each of said conductors extending in opposite directions, the ratio of the lengths of the elements in any two adjacent dipoles being given by the formula

$$\frac{l_{(n+1)}}{l_n}=\tau$$

where l_n is the length of an element of any dipole in the antenna, $l_{(n+1)}$ is the length of an element in the adjacent smaller dipole and τ is a constant having a value less than l, the spacing between said dipoles being given by the formula

$$\frac{\Delta S_{(n+1)}}{\Delta S_n}=\tau$$

where ΔS_n is the spacing between the dipole having the element length l_n and the adjacent larger dipole, $\Delta S_{(n+1)}$ is the spacing between the dipole having the element length l_n and the adjacent smaller dipole, and τ has the significance previously assigned.

7. The antenna of claim 6 wherein τ has a value of about 0.8 to 0.95.

8. The antenna of claim 6 wherein said feeder line conductors are tubular.

9. An aerial system including at least one set of parallel dipoles spaced along and substantially perpendicular to the longitudinal axis of a two-conductor balanced feeder to which the halves of the dipoles are connected at their inner ends, said dipoles being of different electrical lengths increasing substantially logarithmically from the connected end of the feeder to the other end and the dipole feeder connections being crossed over one another between adjacent dipoles, the spacings between which also increase substantially logarithmically from said connected end to the other end.

10. An antenna system for wide-band use comprising a plurality of substantially parallel conducting dipole elements arranged in substantially collinear pairs, the opposite dipole elements of each pair constituting dipole halves, a two-conductor balanced feeder having one conductor connected to each of said elements at substantially the inner end thereof, each of said dipole halves in a pair being connected to a different feeder conductor, adjacent dipole elements being reversely connected to different conductors of the feeder, said dipole elements being selectively spaced along and substantially perpendicular to said feeder, the elements of each pair being of substantially equal length, adjacent dipole elements of different pairs differing in length with respect to each other by a substantially constant scale factor, the selective spacings between adjacent dipoles generally decreasing from one end of the feeder to the other with the greatest spacing being between the longest dipoles, and means to connect the feeder to an external circuit at substantially the location of the smallest of the dipole elements.

11. An antenna system for wide-band use comprising a plurality of substantially parallel conducting dipole elements arranged in substantially collinear pairs, the opposite dipole elements of each pair constituting dipole halves, a two-conductor balanced feeder having one conductor connected to each of said elements at substantially the inner end thereof, each of said dipole halves in a pair being connected to a different feeder conductor, adjacent dipole elements being reversely connected to different conductors of the feeder, said dipole elements being selectively spaced along and substantially perpendicular to said feeder, the elements of each pair being of substantially equal length, adjacent dipole elements of different pairs differing in length with respect to each other by a substantially constant scale factor, the selective spacings between the dipoles along the feeder differing from each other also by a substantially constant scale factor, the greatest spacing being between the longest dipoles, and means to connect the feeder to an external circuit at substantially the location of the smallest of the dipoles.

12. The aerial system of claim 11 in which said scale

factors have values within the range from about 0.8 to about 0.95.

13. An antenna system for wide-band use comprising an array of at least three linear substantially parallel conducting dipoles, each dipole being composed of two opposite substantially collinear conducting elements, a two-conductor balanced feeder having one conductor connected to each of said elements at substantially the inner end thereof, adjacent parallel dipole elements being reversely connected to a different conductor of the feeder, the two elements of each dipole being of substantially equal length and successive elements being of lengths which differ from one dipole to the next by a substantially constant scale factor within the range from about 0.8 to about 0.95, the dipoles being spaced from each other in a generally decreasing manner in the direction of decreasing element length, and means to connect the feeder conductors to an external circuit at substantially the location of the smallest dipole elements.

14. An antenna system for wide-band use comprising a minimum of three pairs of linear substantially parallel conducting elements arranged substantially coplanarly, each pair being substantially collinear and comprising the halves of a dipole, a two-conductor feeder connected to the inner ends of said collinear pairs of elements, adjacent parallel elements being connected to different conductors of the feeder so that the halves of the dipoles connect to different conductors of the feeder and adjacent dipoles are reversely connected, the halves of each dipole being substantially the same length, adjacent dipole elements being selectively spaced from each other along the feeder, the length of the successive dipole elements along the feeder decreasing in accordance with a substantially constant scale factor, each dipole and the feeder between it and the adjacent dipole constituting a cell, the dimension of the several cells measured from the point of connection of one dipole and the feeder to the outer end of the next smaller adjacent dipole also decreasing from one cell to the next in the direction of decreasing dipole length according to a substantially constant scale factor so that the combination of cells provides a substantially uniform wide-band response, and means to connect an external circuit to the feeder elements at substantially the location of the shortest of the dipoles.

15. An antenna system for wide-band use comprising a minimum of three pairs of substantially parallel and coplanar linear conducting elements arranged in substantially collinear pairs, each pair of elements comprising the halves of a dipole, a two-conductor feeder, one conductor of which is connected to each of said elements substantially at the inner end thereof, adjacent parallel elements being connected to different conductors of the feeder so that the halves of the dipoles connect to different conductors of the feeder and adjacent dipoles are reversely connected, the halves of each dipole being substantially the same length, adjacent dipole elements being selectively spaced from each other along the feeder, the lengths of the elements decreasing from one end of the feeder to the other substantially in accordance with a substantially constant scale factor within the range from about 0.8 to 0.95, each dipole and the feeder between it and the adjacent dipole constituting a cell, the cell dimension from the inner end of one dipole to the outer end of the next smaller adjacent dipole also generally decreasing from one cell to the next in the direction from the longer to the shorter dipoles so that the combination of cells provides a substantially uniform wide-band response, and means to connect an external circuit to the feeder elements at substantially the location of the shortest of the dipoles.

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2,507,225	5/50	Scheldorf	343—814 X

FOREIGN PATENTS

1,023,498	1/58	Germany.
408,473	4/34	Great Britain.

HERMAN KARL SAALBACH, *Primary Examiner.*

GEORGE N. WESTBY, ELI LIEBERMAN, *Examiners.*

APPENDIX B

March 5, 1940. M. KATZIN 2,192,532

DIRECTIVE ANTENNA

Filed Feb. 3, 1936

Fig. 1

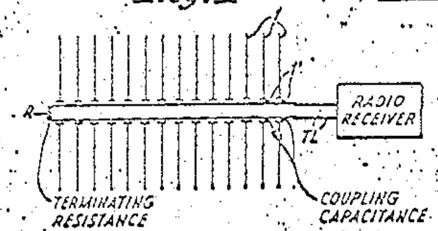


Fig. 2

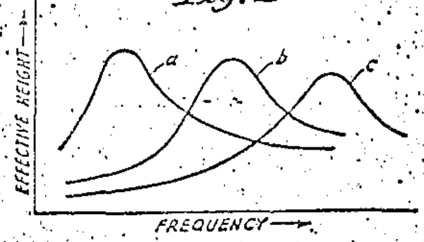


Fig. 3a

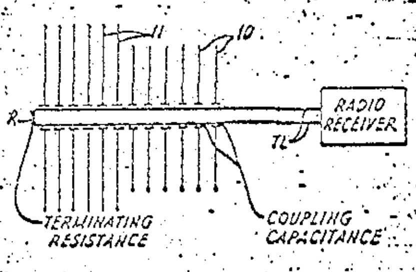


Fig. 3b

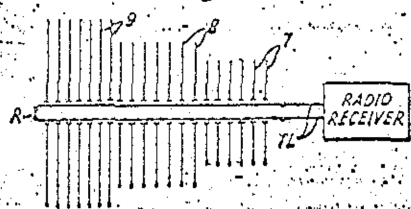


Fig. 3c

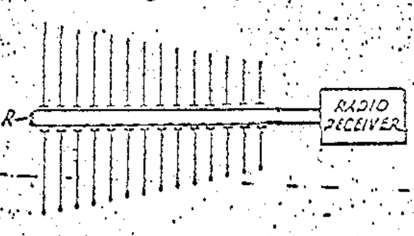


Fig. 4

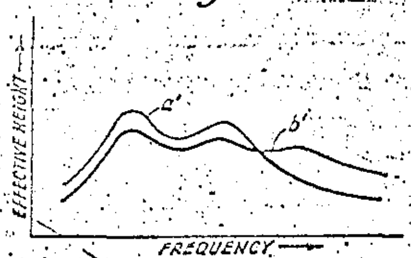
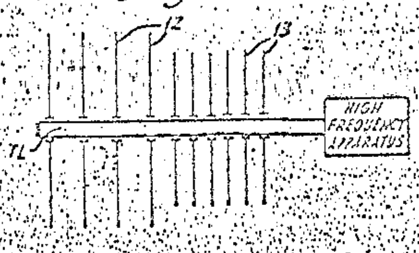


Fig. 3d



INVENTOR
MARTIN KATZIN

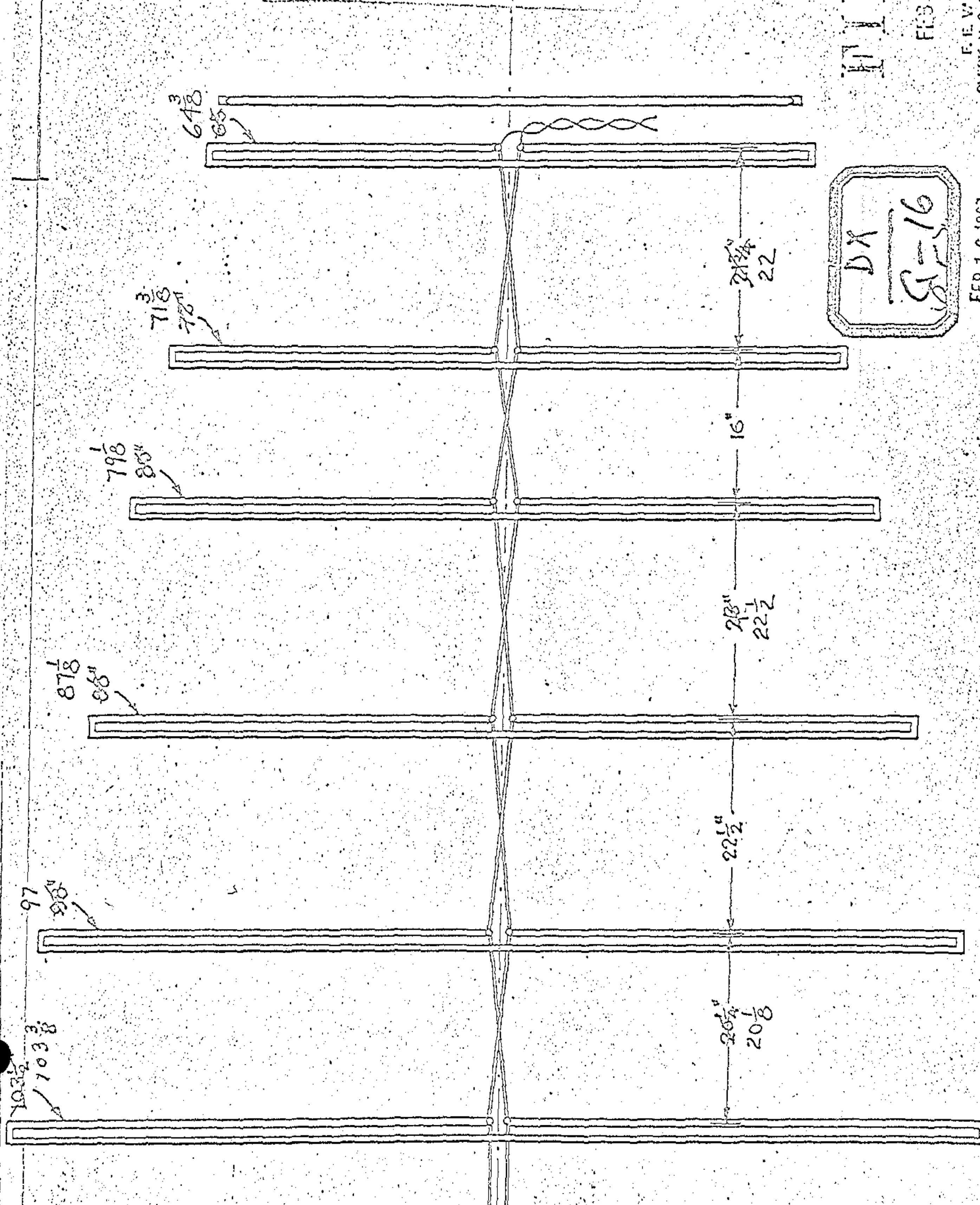
BY H. B. Grover

ATTORNEY

DX
E-4

APPENDIX C

CHANNEL MASTER
"K.O"-model 1023



APPENDIX D

June 26, 1934. N. KOOMANS 1,964,189

DIRECTIVE ANTENNA

Filed Sept. 11, 1928

Fig. 1.

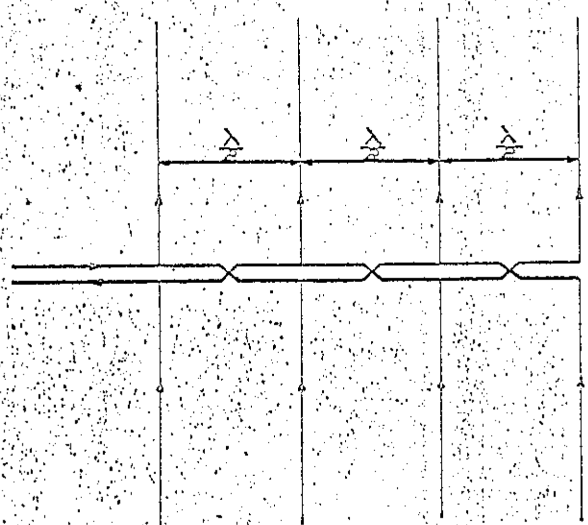
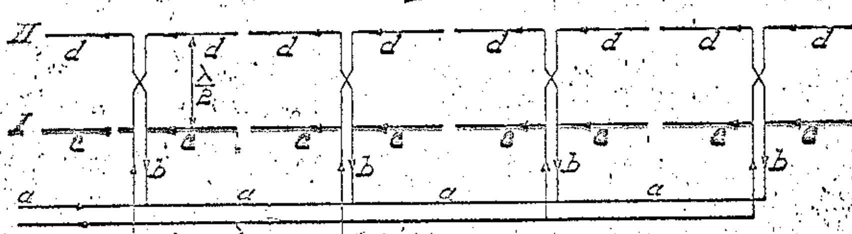


Fig. 2.



Inventor:
N. Koomans
By
Langner, Parry, Card & [illegible]
Attys

DX
E-1

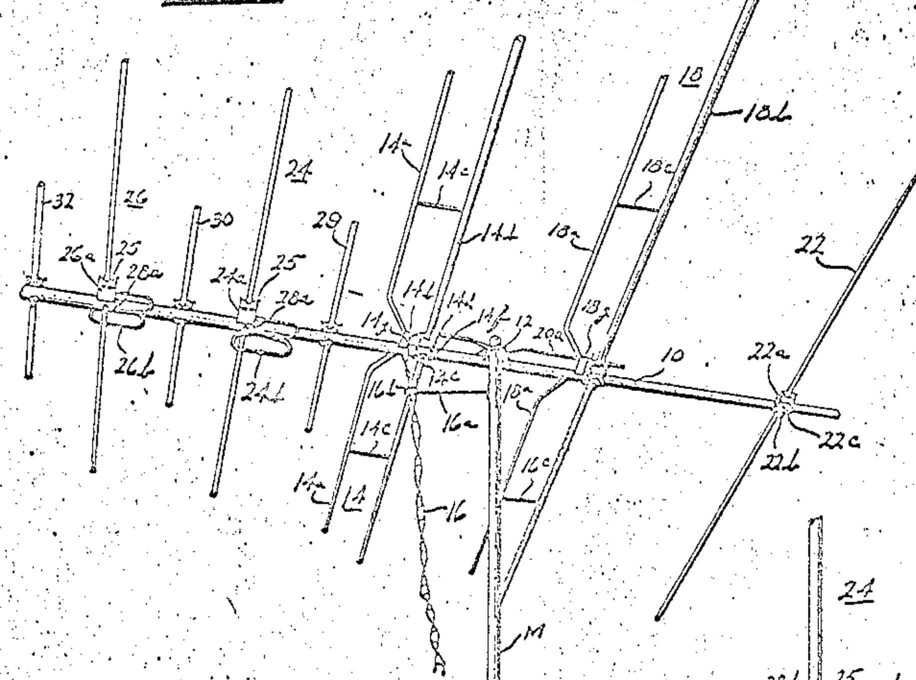
APPENDIX E

Jan. 18, 1955 J. R. WINEGARD 2,700,105

T. V. ANTENNA ARRAY

Filed July 26, 1954 2 Sheets-Sheet 1

FIG. 1



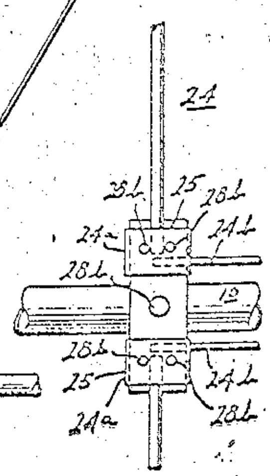


FIG. 3

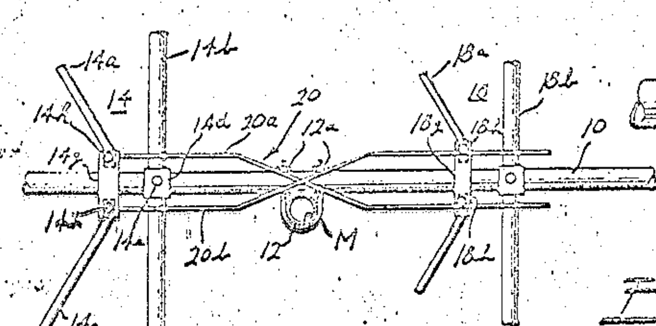


FIG. 2

INVENTOR.
John R. Winegard
BY
Baird, Freeman & Molinare
Att'y's.

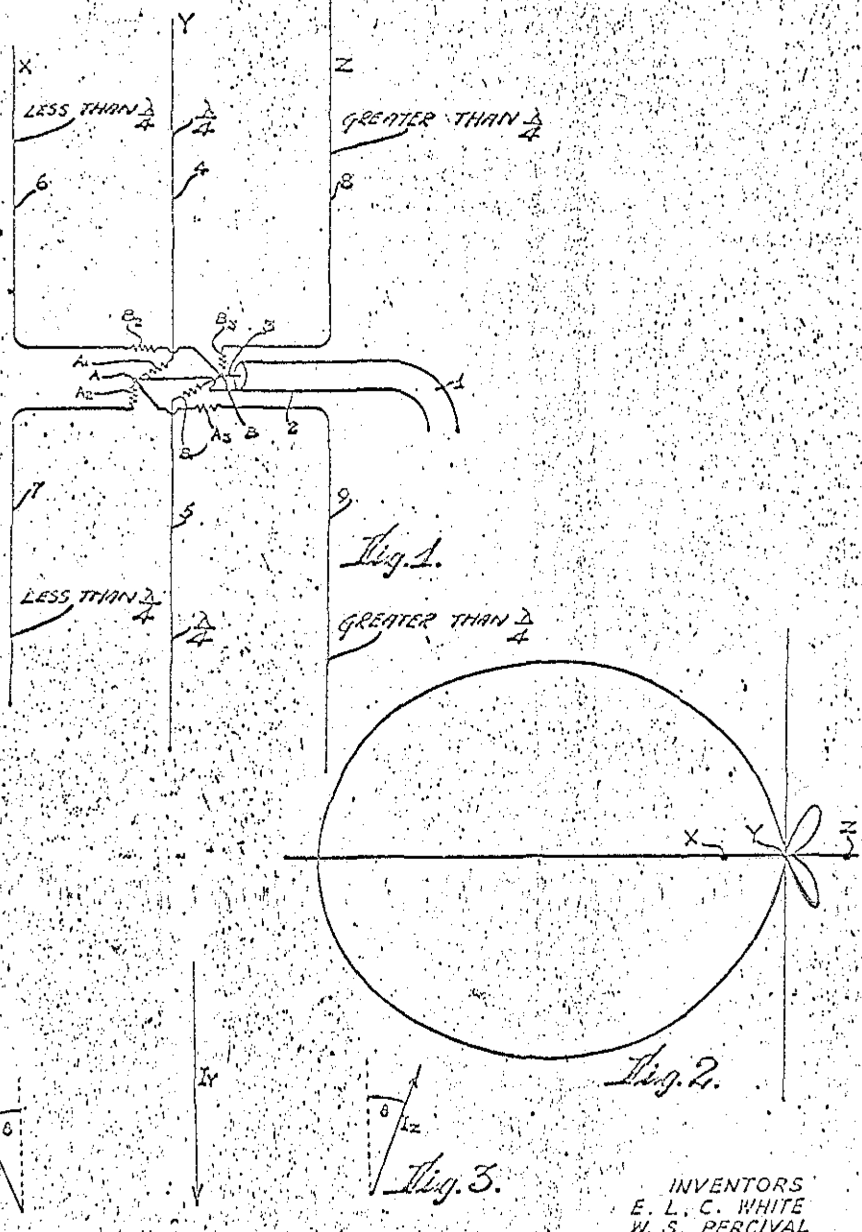
DX
D-1

APPENDIX F

Jan. 18, 1938. E. L. C. WHITE ET AL 2,105,569

DIRECTIONAL WIRELESS AERIAL SYSTEM

Filed April 6, 1936



INVENTORS
E. L. C. WHITE
W. S. PERCIVAL

BY H. B. Snover,
ATTORNEY

DX
E-3

LAW OFFICES

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE

CHICAGO 60606

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JOHN R. HOFFMAN

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

June 26, 1967

Mr. Isaac S. Blonder
Blonder-Tongue Laboratories Inc.
9 Alling Street
Newark, New Jersey 07102

RE: UIF v. BT v. JFD

Dear Ike:

According to my notes, Pete Mann had requested copies of technical reports relating to the Color Ranger antenna. I think this would include any report relating to its performance.

I would imagine Mann's reason for wanting them is to illustrate that your antenna has relatively constant gain and directivity throughout the television band.

I think he is probably entitled to the report, if you can find it. Of course, if you have looked and can't find it, I will be happy to refer him to Mr. Schenfeld.

Very truly yours,

Richard S. Phillips

RSP:iag

cc: Mr. R. H. Rines

June 20, 1967

Mr. Richard S. Phillips
Hofgren, Wegner, Allen
Stellman & McCord
20 North Wacker Drive
Chicago, Illinois 60606

Dear Dick:

The report you requested in your letter of May 24 is a Company Confidential on our Color Ranger 5 & 3 and should not have been sent out in the first place. It is not a field report which was originally requested by Pete Mann.

I can't imagine why he needs these reports anyway or what function they serve in the suit. If JFD wants to know any of these figures, all they have to do is ask Abe Schenfeld whom they hired away from us and who made up these reports in the first place.

Sincerely,

BLONDER-TONGUE LABORATORIES, INC.

Isaac S. Blonder
Chairman of the Board

ISB:dd

CC: Mr. Robert H. Rines

RECEIVED
JUN 21 1967
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

LAW OFFICES

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE

CHICAGO 60606

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AREA CODE 312

June 16, 1967

Mr. Robert H. Rines
Rines and Rines
No. Ten Post Office Square
Boston, Massachusetts 02109

Dear Bob:

This confirms my telephone conversation with your father.

After waiting for more than an hour this morning, Judge Hoffman said that we would have to go over until next fall. For some reason, however, he put the case on the call for June 30 for the assignment of a date to come in in the fall. The judge commented that cases would go on the fall calendar in numerical order. The antitrust action which has a lower number I believe has already been set for sometime in October, and I don't know whether he intends to hold you until after that. We may get a better idea on the 30th. At any rate, you and Ike will have to forego the pleasure of spending part of the summer with us.

In reviewing our file, I realized that the counterclaim for declaratory judgment with respect to the Foundation patents does not set up specifically the statutory bar of Quarterly Report No. 2 nor the allegation that Mayes was not the inventor of Re.25,740. There may be some other matters of affirmative defense which should also be added. I discussed this with Jack and we thought it best to take no action until Judge Hoffman has gone on his vacation. When someone else is handling the motions during the summer, we can go in with an amended answer. Let me have your thoughts on this, particularly with regard to the specific matters which should be added.

Do you wish to bring in any of the evidence from the other lawsuits by way of stipulation? If so, I think we should do it now rather than in September.

Very truly yours,

Dick

Richard S. Phillips

RSP:iag

cc: Mr. Isaac S. Blonder

LAW OFFICES
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CHICAGO 60606

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AREA CODE 312

June 16, 1967

Miss Marjorie A. Johnson
3405 Twenty-First Street
Rock Island, Illinois

RE: UIF v. BT v. JFD

Dear Miss Johnson:

Trial of the lawsuit against Blonder-Tongue Laboratories has now been postponed until fall. I will be in touch with you as soon as we have any definite information regarding the trial date.

Very truly yours,

Richard S. Phillips

RSP:iag

cc: Mr. Robert H. Rines

LAW OFFICES
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CHICAGO 60606

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May 29, 1967

Miss Marjorie A. Johnson
3405 Twenty-First Street
Rock Island, Illinois

Appt Calendar.

Dear Miss Johnson:

I have not been in touch with you as we have been uncertain when the case would go to trial. It was reset this morning for June 13, but we will not know until the 8th or 9th what the chances are of its being tried at that time. If it is not tried during June, it will probably be postponed until September.

Mr. Rines, who is handling the trial for Blonder-Tongue, has told me that he will probably wish to have you testify. I will let you know as there are changes in the schedule.

Very truly yours,

Richard S. Phillips

RSP:iag

cc: Mr. Robert H. Rines

LAW OFFICES

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June 1, 1967

Mr. Robert H. Rines
Rines and Rines
No. Ten Post Office Square
Boston, Massachusetts 02109

RE: UIF v. BT v. JFD

Dear Bob:

I talked this morning with one of the attorneys whose office is involved in both the antitrust and patent cases which have lower numbers than yours on Judge Hoffman's trial call. Yesterday both cases were reset for Monday, June 5. Judge Hoffman inquired as to the probable length of the antitrust trial and indicated that it would in all likelihood be put over until next fall. A personal injury case is being tried now and another follows it. I will check what happens next Monday and let you know.

Very truly yours,

Dick

Richard S. Phillips

RSP:iag

cc: Mr. John F. Pearne
Mr. M. Hudson Rathburn

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... -5 1967
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JAMES C. WOOD
STANLEY C. DALTON
RICHARD S. PHILLIPS
LLOYD W. MASON
TED E. KILLINGSWORTH
CHARLES L. ROWE
JAMES R. SWEENEY
W. E. RECKTENWALD
J. R. STAPLETON

WILLIAM R. McNAIR
JOHN P. MILNAMOW
DILLIS V. ALLEN
W. A. VAN SANTEN, JR.
JOHN R. HOFFMAN

June 9, 1967

Mr. Robert H. Rines
Rines and Rines
No. Ten Post Office Square
Boston, Massachusetts 02109

Dear Bob:

I discussed your problem concerning Mr. Schenfeld with Jack. He agrees that without evidence that JFD hired him away, or that he is giving them confidential information, it would be better not to take any action at this time.

I checked the report of the Zenith v. Admiral suit in Oklahoma City. There was not the discussion of former employees which I had thought was included in the decision. The judge merely mentioned in passing that the Admiral engineer in charge of copying the Zenith remote control had formerly been with Zenith.

Very truly yours,

Dick

Richard S. Phillips

RSP:iag

LAW OFFICES

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE

CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

June 12, 1967

VIA AIR MAIL

Mr. Robert H. Rines
Rines and Rines
No. Ten Post Office Square
Boston, Massachusetts 02109

RE: UIF v. BT v. JFD

Dear Bob:

I sat in for Judge Hoffman's trial call this morning. He has a personal injury case on trial and is holding another case to start as soon as this one is finished. His clerk advises me not to have witnesses available for Tuesday. I will be able to tell you more after we go before him tomorrow.

Very truly yours,

Dick

Richard S. Phillips

RSP:iag

Read to Peg to relay to RHR 6/15/67

LAW OFFICES

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE

CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

June 13, 1967

VIA AIR MAIL

Mr. Robert H. Rines
Rines and Rines
No. Ten Post Office Square
Boston, Massachusetts 02109

Dear Bob:

Judge Hoffman this morning asked that we come back on Friday. A criminal case is starting this morning. I doubt that it will be finished by Friday but we will keep track of it and let you know on Thursday if you should be here Friday morning.

There are other cases still active on the call and it is impossible to tell you now whether your case will be taken up before the court adjourns or put over until fall.

Very truly yours,

Dick

Richard S. Phillips

RSP:iag

LAW OFFICES

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE

CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

May 25, 1967

VIA AIR MAIL

Mr. Robert H. Rines
Rines and Rines
No. Ten Post Office Square
Boston, Massachusetts 02109

Dear Bob:

* I enclose a copy of a motion and affidavit we are serving and filing this afternoon.

It may be that Judge Hoffman has a soft spot for MIT graduates. Stranger things have happened.

Very truly yours,

Dick

Richard S. Phillips

RSP:iag

* Enclosure

McNENNY, FARRINGTON, PEARNE & GORDON
ATTORNEYS AT LAW
920 MIDLAND BUILDING
CLEVELAND, OHIO 44115

F. O. RICHEY (1878-1964)
HAROLD F. McNENNY
DONALD W. FARRINGTON
JOHN F. PEARNE
CHARLES B. GORDON
WILLIAM A. GAIL
RICHARD H. DICKINSON, JR.
THOMAS P. SCHILLER
LYNN L. AUGSPURGER

TELEPHONE
(216) 623-1040
CABLE ADDRESS
RICHEY
PATENT AND
TRADEMARK LAW
LLOYD L. EVANS
OF COUNSEL

May 25, 1967

RECEIVED
MAY 25 1967
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

Robert H. Rines, Esq.
Rines & Rines
10 Post Office Square
Boston, Massachusetts

Re: Log Periodic Patent Litigation

Dear Bob:

In attempting to organize the evidence I have accumulated in support of patent mismarking, unfair competition, etc. by JFD, I again reviewed the correspondence and other documents produced by the Foundation and by JFD over a year ago. Much of that material is of little or no value, and some is of value to our case but not to yours. However, a few items appeared to be of interest in connection with your case, and copies are enclosed. The enclosed copies are divided into two groups which I shall discuss briefly.

The stamped document numbers were put on the enclosed documents at the time they were produced. Those produced by the Foundation were stamped with a number beginning with the letter "A." Those produced by JFD were stamped with a number preceded by "JFD DOC. NO."

Among the first group of enclosed letters is one of September 6, 1962, which deals with the period of exclusivity provided in the license from the Foundation to JFD. Although the letter does not so state, I believe it is the fact that such period of exclusivity was selected to run for three and one-half years after allowance of a claim in the Isbell or Mayes et al. applications because both parties recognized that, until that time, no claims would have been allowed that would be applicable to any antenna contemplated by JFD for manufacture.

Nevertheless, as you are undoubtedly aware, JFD applied to its cartons and literature the numbers of patents that had issued at the time the license was granted and which clearly did not apply to the antennas JFD was making.

The second letter in this group, dated April 17, 1963, was apparently prompted by a response from Kay-Townes to a notice of infringement in which Kay-Townes questioned the applicability of patents enumerated in the JFD patent notices to any of the antennas JFD was making. This letter indicates that the Foundation, as late as April 17, 1963, was not aware of the patent notices being used by JFD since about September 1962. This letter raises the question of the propriety of such notices and asks that JFD advise as to the form of notices. Nevertheless, as acknowledged on page 3 of a sworn statement provided me by JFD (copy also enclosed), JFD made no change in its patent notices until about September 9, 1963 and presumably did not actually use the revised notices until somewhat after that date.

For some time after September 1963, the Foundation used the "one or more" type of patent notice, naming only the same three inapplicable patents "and additional patents pending." The last two letters of the first group enclosed herewith indicate that both the Foundation and JFD recognized the impropriety of that notice where none of the specified patents was applicable.

As late as November 1963, JFD put out an advertisement to be used by its customers and referring to advertisements in Look and Sunset magazines that contained a freak patent notice of the latter character that omitted the word "pending." A copy of this advertising form is enclosed for such value as it may have.

As is evident from the two preceding paragraphs herein, the list of patent notice forms on pages 2 and 3 of the JFD sworn statement is incomplete in failing to disclose the notice employed like Form B with only the three inapplicable patents being enumerated.

The second group of letters (Smith to Finkel of 10/28/64 and Mayes to Smith of 12/18/64) both discuss the significance of element spacing in a manner that is probably of greater interest to us than to you. The second of these letters, however, discusses the spacing of the parallel feeders of the "double boom" type of antenna, and this discussion may be of particular interest to you in your case.

It seems possible that our collection of information, admissions, etc. on various aspects of this litigation may include many details that would be helpful to your case but which we have not yet had an opportunity to discuss. I plan to be a spectator at the trial of your case if it should come up for trial in the near future as indicated, and will be available at that time for any discussion you might consider helpful. However, knowing the difficulty of working new ideas into a case while the case is being tried, I am wondering if you would consider it worthwhile for us to get together sometime prior to your trial for making available to you every bit of information and every idea which you might find helpful. After all of the work we have done in preparing our case, I would hope that we could contribute something, and it is a part of my job for my client to do this if possible.

Sincerely,

John

JFP:jh
Enclosures

cc: Richard S. Phillips, Esq.

LAW OFFICES

JFD DOC.NO. 50

MERRIAM, SMITH & MARSHALL

THIRTY WEST MONROE STREET

CHICAGO 3

CHARLES J. MERRIAM
SAMUEL B. SMITH
JEROME B. KLOSE
NORMAN M. SHAPIRO
WILLIAM A. MARSHALL
BASIL P. MANN
ALVIN D. SHULMAN

TELEPHONE
FINANCIAL 6-5750

September 6, 1962

Mr. Edward Finkel
JFD Electronics Corporation
6101 Sixteenth Avenue
Brooklyn 4, New York

Re: License Agreement Between University of Illinois Foundation and JFD Electronics Relating to Antenna Inventions

Dear Ed:

The Board of Directors of the University of Illinois Foundation at its meeting held today (Thursday, September 6, 1962) approved a modification of the license agreement above identified. The grant clause will be modified to the extent that the period of exclusivity will extend for 3-1/2 years subsequent to the allowance of a claim in either application Serial No. 26,589 or Serial No. 59,671 which is not a claim involved in interference with Marconi, or it will cover a period of 2-1/2 years subsequent to the issuance of a U.S. patent based on either of the said applications, whichever period is the longer.

To illustrate, if a claim were allowed say October 1, 1962, the exclusive period would run for a period of 3-1/2 years from that date if a patent should issue sooner than one year subsequent to October 1, 1962. On the other hand, even if a claim were to be allowed in one of the applications on say October 1, 1962 but the first patent on either named application did not issue until say January 1, 1964, you could hold your exclusive license period until July 1, 1966, which would be a longer period than 3-1/2 years subsequent to October 1, 1962 basing the supposition on the date of claim allowance.

I presume in view of this Board approval the existing agreement can be modified by a separate side letter which Mr. Colvin will write to you in duplicate and which you can accept on behalf of the corporation. This plan would seem to me to be preferable to reexecuting the agreement, but we want to afford you an opportunity to make your choice.

A copy of this letter goes forward to Mr. Faber so that he will be alerted to the situation existing.

Sincerely,

Samuel B. Smith

Samuel B. Smith

SBS:jg

ccs: Mr. Sidney G. Faber
Mr. James C. Colvin

LAW OFFICES

MERRIAM, SMITH & MARSHALL

THIRTY WEST MONROE STREET

CHICAGO 3

TELEPHONE
FINANCIAL 6-5750

CHARLES J. MERRIAM
SAMUEL D. SMITH
JEROME B. KLOSE
NORMAN M. SHAPIRO
WILLIAM A. MARSHALL
BASIL P. MANN
ALVIN D. SHULMAN
R. JONATHAN PETERS
EDWARD M. O'TOOLE

April 17, 1963

Mr. Edward Finkel
JFD Electronics Corporation
15th Avenue at 62nd Street
Brooklyn 19, New York

Re: JFD Electronics Corp. License Under
University of Illinois Antenna Patents

Dear Ed:

Professor Paul Mayes of the University of Illinois received a letter from the Kay-Townes Antenna Company (print enclosed) concerning JFD Electronics Corporation products.

I would appreciate having you advise me how you are marking any antenna products now being sold. Ordinarily we would not be adverse to having a patent notice on goods which shows that the marketed product involved one or more of a group of patents. However, while you are licensed under the patents named in the Kay-Townes Antenna Company letter (note patent listed as 3,001,168 probably should have been listed as 3,011,168) I am somewhat doubtful that you are marketing any product which would fall within the scope of the identified patents. All of the patents relate to antenna structures which have radiation patterns and impedance characteristics which are essentially independent of frequency over wide bandwidths, but the antenna structure described is not of the general type provided by the LPV antenna.

For instance, in Dyson patent 2,958,081 (and not attempting to construe the patent in any respect) the conducting elements are wound so as to lie on a conical surface. In the Isbell patent 3,011,168 the elements are V-shaped and lie in different planes. However, the structure does provide a plurality of alternating slots and teeth which more or less characterize the general nature of the component described. In the DuHamel patent 2,985,879 the structure described is very much like the Isbell patent except that the limitations of the use of different planes is not present.

I think that Professor Mayes has done a credible job in his answer to the Kay-Townes Antenna Company but it would be helpful to me if you would send me a copy of your patent marking label or escutcheon, as the case may be, so that we will have some knowledge of how the patents are being

AOR 294

marked and what patents are being marked. It may well be that your marking includes patents owned by JFD Electronics Corporation in addition to those of the University of Illinois Foundation and if that is the case then, of course, we can give some thought to this problem.

In respect of the Kay-Townes Antenna Company, I would like to have you supply as much information as you can about the group. Is it a group that worked with or collaborated with Channel-Master? What type of antenna structures are sold by Kay-Townes Antenna Company? This group may be one that should be considered with respect to infringement matters provided, of course, we can promptly issue either or both the Mayes and Carrel case and the Isbell case. Your prompt comments will be appreciated and I hope that I may have them prior to the end of the week because all of Professor Mayes, Mr. Lo and I plan to see the Examiner on the Mayes and Carrel case on Monday, April 22.

Perhaps a few comments should be made to answer your April 15 letter, which is appreciated. The essential point is that the matter of the Isbell case is one that cannot be moved except at the wish of the Patent Office. You may recall in this regard that we are still involved in the interference with the Marconi group. We have asked for reconsideration of the decision in the interference relating to Count II which embodied the claim originating in the Kravis et al application. However, no decision on our petition for reconsideration has been received and, consequently, I am going to have to proceed to file a statement in the Patent Office that we will rely upon the dates asserted in our original preliminary statement. If we cannot manage to have the Examiner withdraw his decision then, of course, we are going to have to prove our case and this will involve, in all probability, the taking of depositions which will involve some time. I will let you know as soon as I can on what has happened, but I don't like to discourage you too much at this point.

Sincerely,

Original Signed by
SAMUEL B. SMITH
Samuel B. Smith

SBS:jg
Enc.: Kay-Townes Letter

ccs: Professor Paul E. Mayes
Mr. James C. Colvin

A0C295

3(6)

right file ?

J.F.D. License from U. of Ill. Foundation

April 15, 1964

Mr. Ed Finkel
Vice President-Sales
JFD Electronics Corporation
1462 Sixty Second Street
Brooklyn 19, New York

Dear Ed:

Thanks for your April 13 letter, with the enclosures of the numerous trade ads and consumer ads, as well as your most recent promotional pamphlets. I would like to have two additional copies of each of the recent promotional pamphlets.

Most of the problems raised by your advertising material relate to policy matters concerning the University of Illinois Foundation and the University itself. Those are matters upon which I cannot pass. I have, accordingly, sent all of your material to Mr. Colvin for his review and consideration and I should be able to advise you within the fifteen-day period concerning our views as to the propriety of all of the advertising. At the same time it will then be possible to give you a final indication of whether or not the material can be published with the understanding that you have complied with Paragraph 10 of the License, insofar as reference to the University or Foundation is concerned and with Paragraph 2, insofar as reference to the patents may be concerned.

I would like to know, however, what structures you are manufacturing or selling which you believe at the present time come within the teachings of the Dyson, Du Hamel and Isbell patents referred to, for instance, on page 4 of ELECTRONIC & APPLIANCE SPECIALIST for March, 1963. May I please have your comments at an early date.

Sincerely,

SBS:mn

Samuel B. Smith

A00070

Duplicate
A-00068

JFD

JFD ELECTRONICS CORP.

April 21, 1964

Merriam, Smith & Marshall
30 West Monroe Street
Chicago, Illinois

Attention: Mr. Sam Smith

Re: University of Illinois
and LPV

Dear Sam:

In reply to yours of April 15th, I enclose two additional copies of the pamphlets requested. There are other pieces in work which are at the printers right now. As soon as they are available I will send them on to you.

In reading your letter, I am a little concerned about your reference to Paragraph 2 of the agreement, referring to patents. If you recall, at the beginning we had not used the patent phrase properly and it was on your instructions that I changed the phrase to read, "Licensed under one or more of U. S. Patents 2,958,081; 2,935,879; 3,011,168; 3,108,280 and additional patents pending in U.S.A. and Canada. Produced by JFD Electronics Corporation under exclusive license from the University of Illinois Foundation."

You explained that it was not necessary that each and every patent be applicable to the specific product on which this phrase was printed, but so long as it referred to one of the patents, it was permissible.

A00229

JFD

JFD ELECTRONICS CORP.

Mr. Sam Smith (Cont.)

At the present time we are not selling any products that come under the Dyson, DuHamel and Isbell patents. However, in the very near future, we intend offering a log periodic Trapezoid indoor antenna which Paul feels comes under the Isbell patent.

I trust this is the information you desired.

Kindest regards.

Sincerely,

Ed Finkel

EF/ss
cc- P. Mayes
J. Colvin
S. Faber

COPY

A00230

October 28, 1964

Mr. Edward Finkel
Vice President-Sales
JFD Electronics Corporation
15th Avenue at 62nd Street
Brooklyn, New York 11219

Re: Knight MK-24

Dear Ed:

Your Mr. Tom Reeder has furnished information concerning the dimensions of length and spacing of the Knight MK-24 antenna. He has also supplied me with a drawing prepared by Mr. F. J. Dubson, carrying a date of September 26, 1964.

Judging from the arrangement of the V-elements, I find that we have in this particular antenna spacings which appear to be identical for all V-elements. The control of the length of the halves of the dipole elements arranged in V-formation is so erratic that there is really no multiplier which fits the situation. The scale factor for the dimensions which Mr. Reeder notes vary between .9 and .98, and this is about a 10 per cent variance.

Then, from the standpoint of the UHF end of the antenna I find that the spacings between adjacent dipoles at the highest frequency end correspond to the spacings at the lowest frequency end (restricting this definition to the UHF portion) and that the spacings for the intermediate frequencies covering six separate dipoles are 20 per cent less. This leads me to a situation which is confusing. It certainly looks as though there has been a very definite effort to avoid any possibility of coming within the terms of what we would call an "LPV Antenna."

A copy of this letter is being sent to Paul Mayes because I think we are now at a point where we should know a great deal about the antenna performance when operated under these peculiar spacings and dipole lengths, but to a novice, such as myself, it seemed to be

A00017

somewhat randomly selected.

I would be very reluctant to try to apply the structure of the Knight MK-24 antenna to presently held patents because so doing might open up a tremendous amount of prior art against which, strictly speaking, should have no relationship whatever to the nature of the invention. Thus, I hope I can have further comments from Paul Mayes and your engineers. At the moment, I am greatly confused.

Sincerely,

SBS:mn

Samuel B. Smith

cc: Sidney G. Faber, Esq.
Professor Paul E. Mayes

JFD DOC.NO. 80

December 18, 1964

Mr. Samuel B. Smith
Merriam, Smith & Marshall
30 West Monroe Street
Chicago, Illinois 60603

Re: Knight MK VHF-UHF antennas

Dear Sam,

Ed Finkel has requested that I elaborate and document in this letter some of the comments which have been given to you by phone heretofore concerning the above antennas.

I believe the Knight MK series of VHF-UHF antennas infringes upon Carrel and Mayes, patent number 3,150,376. In particular, claims 15-18 of said patent read directly upon the structures of the MK-12, MK-18, and MK-24 antennas. From the drawings of these antennas previously supplied, it is apparent that the zonal scale factors deviate only slightly from a median value except for a few selected elements.

The elements are "substantially coplanar" certainly within an engineering interpretation of the term as it pertains to a reasonable attainment of performance. In fact, the V-shaped elements could be said to be "exactly" coplanar. The method of construction using two booms to serve as both feed line and support for the dipoles is clearly illustrated in Figure 2 of the patent and the language of "substantially coplanar" should be interpreted in agreement with that drawing. The influence of changing the separation between the booms is clearly documented in Technical Report No. 52 of the University of Illinois Antenna Lab. entitled, "Analysis and Design of the Log-Periodic Dipole Antenna" by R. L. Carrel, a coinventor on the above-mentioned patent. I refer particularly to Figure 42 on page 89 of that report.

The formula for characteristic impedance of a two-conductor transmission line in air is well-known to be

$$Z_o = 120 \cosh^{-1} \frac{D}{d}$$

where D is the center-to-center separation and d is the diameter of the circular cylindrical conductors. (See, for example, Reference Data for Radio Engineers, third edition, Federal Telephone and Radio Corporation, page 323). Figure 42 of Carrel's report shows the variation of the impedance at the input of the antenna as it depends upon the characteristic impedance of the transmission line. It is possible, therefore, to control the input impedance of the antenna to some degree by changing the feed line impedance and this can be done by changing the ratio D/d above. When using the twin-boom construction, where the feeder must support the dipole elements, there will be a minimum value of d necessary for structural rigidity. Therefore to obtain a high value of input impedance it is necessary to increase the separation D.

Since the input impedance of television receivers is nominally 300 ohms and 300 ohm transmission line is used to connect antenna to receiver, it is desirable that the antenna impedance also be 300 ohms in order to transfer a maximum amount of the signal received at the antenna to the television set. From Carrel's curves it is seen that achieving an impedance near 300 ohms requires a high value of feeder impedance and thus the separation of feeder conductors which is too small will be detrimental to performance.

The question then arises as to the separations which would be permissable and still maintain the desired operation of the two-conductor feeder as a transmission line and the perpendicular conducting elements as dipoles. It is in this area that the meaning of the term "substantially coplanar" must be clarified. A conventional dipole ordinarily has two conducting rod elements which lie along a common axis. The electrical performance of the dipole is affected very little, however, if the axis of one element is displaced from that of the other by a limited distance. Since the judgement must be based upon the electrical performance, the limiting distance is best determined in terms of wavelengths at the operating frequency. It should be apparent that a separation of much less than one wavelength will produce very little change in electrical performance.

Similar considerations apply to the permissable separation of the conductors of the twin-boom feeder. The basic limitation on feeder separation is related to minimizing radiation from currents along the feeder conductors. In a balanced mode the current in one conductor is equal to but out of phase with the current at the corresponding point in the other conductor. Hence, the radiation field due to the current in one conductor tends to cancel that due to the current in the other and this is particularly effective for separations between conductors which are small in terms of the wavelength.

Consider now a typical case of the Knight MK antenna where D = 1.53", a = 0.437" where a is the width of the square feeder conductor. It is first recognized that the deviations caused by using feeder conductors of square rather than circular cross-section result in no change in the principle of operation. It is still possible to calculate an approximate value for the characteristic impedance of the feeder using the equation given above with d = a. It is further apparent that a separation of 1.53" is small compared to the wavelength, particularly at the lower end of the UHF operating band where most UHF television broadcasting currently is found. At 500 Mc, for example, the wavelength is approximately 2 feet. It is clear then, that relative to wavelength measure, the dipole elements of the Knight MK antennas are "substantially coplanar".

With regard to the spacing variations, let me state that the element lengths are more critical as to dimension than the element spacings. It is possible with some degradation in performance to permit spacing variations which are not considered to be optimum. It was with this in mind that claim 15 was submitted with language which does not specifically state how the dipoles are to be spaced.

I trust that the above discussion will provide the information you need. If further clarification is necessary, please call me.

Sincerely yours,

Paul E. Mayes
Professor

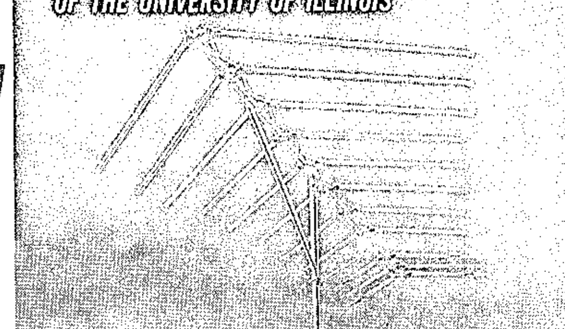
cc. Edward Finkel

A-14

ADVERTISED IN LOOK AND Sunset

LOG PERIODIC JFD LPV TV/FM ANTENNA

...FROM THE ANTENNA RESEARCH LABORATORIES OF THE UNIVERSITY OF ILLINOIS



. . . a remarkable new space antenna formula now adapted by JFD for sharper and clearer reception in glowing COLOR or vivid Black and White TV—plus FM Stereo!

$$\frac{L_{(n+1)}}{L_n} = \tau$$

The log-periodic antenna formula was developed by the Antenna Research Laboratories of the University of Illinois. Using this basic log-periodic formula, JFD Electronics has developed the log-periodic LPV TV/FM antenna that works wonders in reception. Snowy, faded pictures suddenly come aglow with radiant detail . . . "ghosts" and interference vanish . . . shows from distant stations come in crisp and steady. And if you like FM Stereo you can hear it at best with the same log-periodic LPV TV/FM antenna. LICENSED UNDER ONE OR MORE OF U.S. PATENTS 2,958,081; 2,985,879; 3,011,168 AND ADDITIONAL PATENTS

NO LAZY ELEMENTS—ENTIRE ANTENNA RESPONDS TO SELECTED CHANNEL

All antenna elements (not just some elements as in other antennas) respond to the channel you want—absorb maximum signal on every channel from 2 to 13, as well as on all FM Stereo frequencies. And the log-periodic LPV is made of lustrous gold alodized aluminum that stays like new!

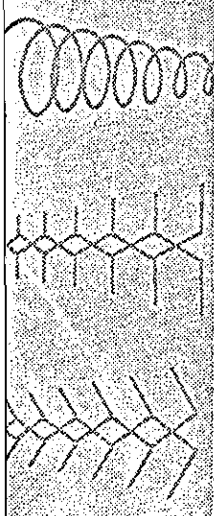
RECOMMENDED BY

Form No. 630LP Rev. litho in U. S. A. 11-63

ERA OF COMPROMISE IS OVER!

of the University of Illinois* Proved in Space Satellite Telemetry

HOW THE LOG-PERIODIC LPV MAKES ALL OTHER ANTENNAS OBSOLETE



The JFD LPV antenna is a direct descendant out of the logarithmic conical spiral antenna used on the Transit satellite. This basic design is FREQUENCY INDEPENDENT—it works like a conical waveguide to yield almost constant gain, matched impedance and a unidirectional polar pattern across an extremely wide band of frequencies.

Dipole version of spiral antenna has elements whose length and spacing is determined by formula derived from conical spiral geometry, so that antenna acts like a spiral with parts of coils missing. A logarithmic scaling multiplier ties the dipoles together into active multi-element cells for each frequency. Crossed phasing harness inserts a 180 degree phase shift between dipoles that cancels signals from rear, reinforces signals from front.

JFD's LPV antenna for TV and FM goes one step further—increases gain and front-to-back ratio while maintaining frequency independence. Forward V-ing of elements shrinks rear radiation lobes, narrows forward beam for sharp directivity, helping to eliminate ghosts and adjacent channel interference. Forward V also permits low band dipoles to contribute to high band gain by operating on the third harmonic mode.

For example: Operation of the JFD LPV-11 on the low band: The larger dipole cells resonate to the low band TV frequencies at their fundamental wavelength. Within each cell, one dipole absorbs the greatest amount of signal for any particular channel, adjacent dipoles pull in 60% more and the next two dipoles add 30% more signal. Many active dipoles working on each channel with constant impedance guarantee high gain.

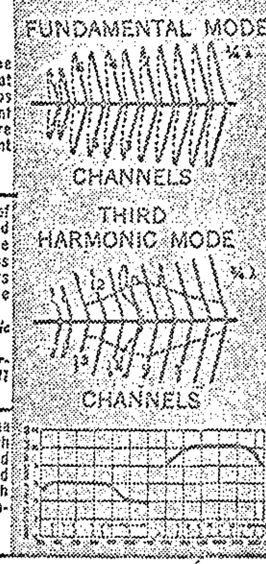
— — — *indicates current distribution on fundamental mode.*

On the high band: The third harmonic cell forms at the rear of antenna for channel 7 and as the frequency increases toward channel 13, the active region moves toward the apex of the antenna. It is this third harmonic operation which guarantees as much as 3¼ db. additional gain. Continuous and co-linear directors sharpen forward pattern and give peak performance across the entire VHF TV band.

— — — *indicates the current distribution for the third harmonic mode which will be received on all elements.*

• • • • • • *indicates the active region for channel 10, i.e., the different efficiencies with which the elements of the LPV-11 act on channel 10.*

The actual gain curves measured for the LPV-11 in the JFD Antenna Research Laboratories confirm this fact: Within the band for which it is designed (the principle will also be adapted for UHF and other uses), the log-periodic LPV's impedance, polar patterns and front-to-back ratio are virtually constant—with gain for each channel as high as that furnished by a comparable-sized single-channel Yagi.



Each antenna in the LPV series consists of an array of resonant V-dipoles and crossed phasing bars, constituting a group of "cells." The size of each cell differs from the one before it by a Logarithmic factor. For any particular frequency, the active portion of the antenna centers on the resonant dipole (equal to one-half wavelength at that frequency), with the adjacent elements also absorbing significant signal energy. The resonances of adjacent cells overlap, so that as the frequency increases or decreases, it is transferred smoothly from one cell to the next.

In effect, the signal is passed along as the frequency increases—the active area moving toward the apex or small end—until, as the fundamental harmonic reaches one end, the other end approaches resonance in the third harmonic. Conventional wide-band antennas are like rows of compartments, one for each channel desired, with sharp cutoffs. The log-periodic antenna is like a continually moving belt that accepts smoothly any frequency that hops aboard.

SEE THE JFD LOG-PERIODIC LPV AT YOUR JFD DISTRIBUTOR NOW—AND BE THE FIRST ONE IN YOUR AREA TO INTRODUCE AND PROFIT FROM THIS NEW ERA IN TV RECEPTION.

THE BRAND THAT PUTS YOU IN COMMAND OF THE MARKET

JFD

JFD ELECTRONICS CORPORATION
15th Avenue at 62nd Street, Brooklyn 19, N.Y.

JFD Electronics-Southern Inc., Oxford, North Carolina
JFD International, 15 Moore Street, New York, N.Y.
JFD Canada, Ltd., 51 McCormack Street, Toronto, Ontario, Canada
401-144 W. Hastings Street, Vancouver 3, B.C.

G P

THE GARFIELD PRESS INC. / PRINTERS AND LITHOGRAPHERS / 200 HUDSON STREET, NEW YORK, N.Y. 10013 / (212) WAlker 5-3984

J.F. D. Electronics Corporation
15th Avenue at 62nd Street
Brooklyn 19, New York

DATE Oct. 24th 1963
OUR ORDER NO. 6512
INVOICE NO. 1862
TERMS: NET 10TH E.O.M.

YOUR ORDER NO.	DESCRIPTION	AMOUNT	TOTAL
7160	10M L.P.V. Form 620LP Look/sunsey House Of Good Taste reprint flyer	279 00	
7171	10m L.P.V. Form 622 LP tv/fm antenna kits flyer	249 00	
	sales tax	21 84	
			567 84

ok ?? 11/1/63

CITY

TYPOGRAPHIC SERVICE INC.
305 East 45th Street, New York 17, N.Y.
MUrray Hill 6-2760

SOLD TO
JFD ELECTRONICS, CORP.
1462 62ND ST.
B'KLYN 19, NY

INVOICE No. 10183
CLIENT JOB No.
CLIENT ORDER No.
DATE 12/28/64

TERMS: NET CASH

CATV		
Composition		
Make-Up	168	70
Repro Proofs	6	00
	174	70
SALES TAX	6	99
Metal .... TOTAL	$181	69

To avoid a rental charge all metal must be returned within 90 days after date of this invoice.

CITY

TYPOGRAPHIC SERVICE INC.

305 East 45th Street, New York, N. Y. 10017
MUrray Hill 6-2760

SOLD TO
J F D ELECTRONICS, CORP.
1462 62ND ST.
B'KLYN 19, NY

INVOICE No. 719
CLIENT JOB No.
CLIENT ORDER No.
DATE 11/11/65

TERMS: NET CASH

COMMODITIES		
Composition		
Make-Up	14	60
News Proofs		
Repro Proofs	5	00
ADD'L COPY	12	50
	32	10
5% SALES TAX	1	60
Metal / TOTAL	$33	70

JFD ELECTRONICS CORP.

DEC 10 1965

CHECK NO.

1187

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~~800-04~~

NE

To avoid a rent[illegible]rge all metal must be returned within 90 days after date of this Invoice.

LICENSED UNDER ONE OR MORE OF U.S. PATENTS 2,958,081; 2,985,879; 3,011,168; 3,108,280; 3,150,376; 3,210,767, RE. 25,740 AND ADDITIONAL PATENTS PENDING IN U.S.A. AND CANADA. PRODUCED BY JFD ELECTRONICS CORPORATION UNDER EXCLUSIVE LICENSE FROM THE UNIVERSITY OF ILLINOIS FOUNDATION.

LICENSED UNDER ONE OR MORE OF U.S. PATENTS 2,958,081; 2,985,879; 3,011,168; 3,108,280; 3,150,376; 3,210,767, RE. 25,740 AND ADDITIONAL PATIENTS PENDING IN U.S.A. AND CANADA. PRODUCED BY JFD ELECTRONICS CORPORATION UNDER EXCLUSIVE LICENSE FROM THE UNIVERSITY OF ILLINOIS FOUNDATION.

3,108,280; 3-150,376; 3,210,767, RE. 25,740

CITY—719 JFD Elect 1P 11-15 lite relyon

DD-52 MUrray Hill 6-2760

all patents included

3-1 A

4-1 B

7-1 E

HL

FIREBALL DELUX TENNA PAKS THE ANTEN

FIREBALL DELUX TENNA PAKS THE ANTENNA INSTA

LICENSED UNDER ONE OR MORE OF U.S. PATENTS 2,958,081; 2,985,879; 3,011,168; 3,108,280; 3,150,376, RE. 25,740 AND ADDITIONAL PATENTS PENDING IN U.S.A. AND CANADA. PRODUCED BY JFD ELECTRONICS CORPORATION UNDER EXCLUSIVE LICENSE FROM THE UNIVERSITY OF ILLINOIS FOUNDATION.

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LICENSED UNDER ONE OR MORE OF U.S. PATENTS 2,958,081; 2,985,879; 3,011,168; 3,108,280; 3,150,376, RE. 25,740 AND ADDITIONAL PATENTS PENDING IN U.S.A. AND CANADA. PRODUCED BY JFD ELECTRONICS CORPORATION UNDER EXCLUSIVE LICENSE FROM THE UNIVERSITY OF ILLINOIS FOUNDATION.

Model 6719
best for locations
up to 75 miles

Model 6720
Best for locations up
to 125 miles

City 12443-1P JFD 3-4 6 lite relyon (WG)

C-33

MUrray Hill 6-2760

CITY

TYPOGRAPHIC SERVICE INC.
305 East 45th Street, New York, N. Y. 10017
MUrray Hill 6-2760

SOLD TO

JFD ELECTRONICS, CORP.
1462 62ND ST.
B'KLYN 19, NY

INVOICE No. 12443

CLIENT JOB No.

CLIENT ORDER No.

DATE 3/4/65

TERMS: NET CASH

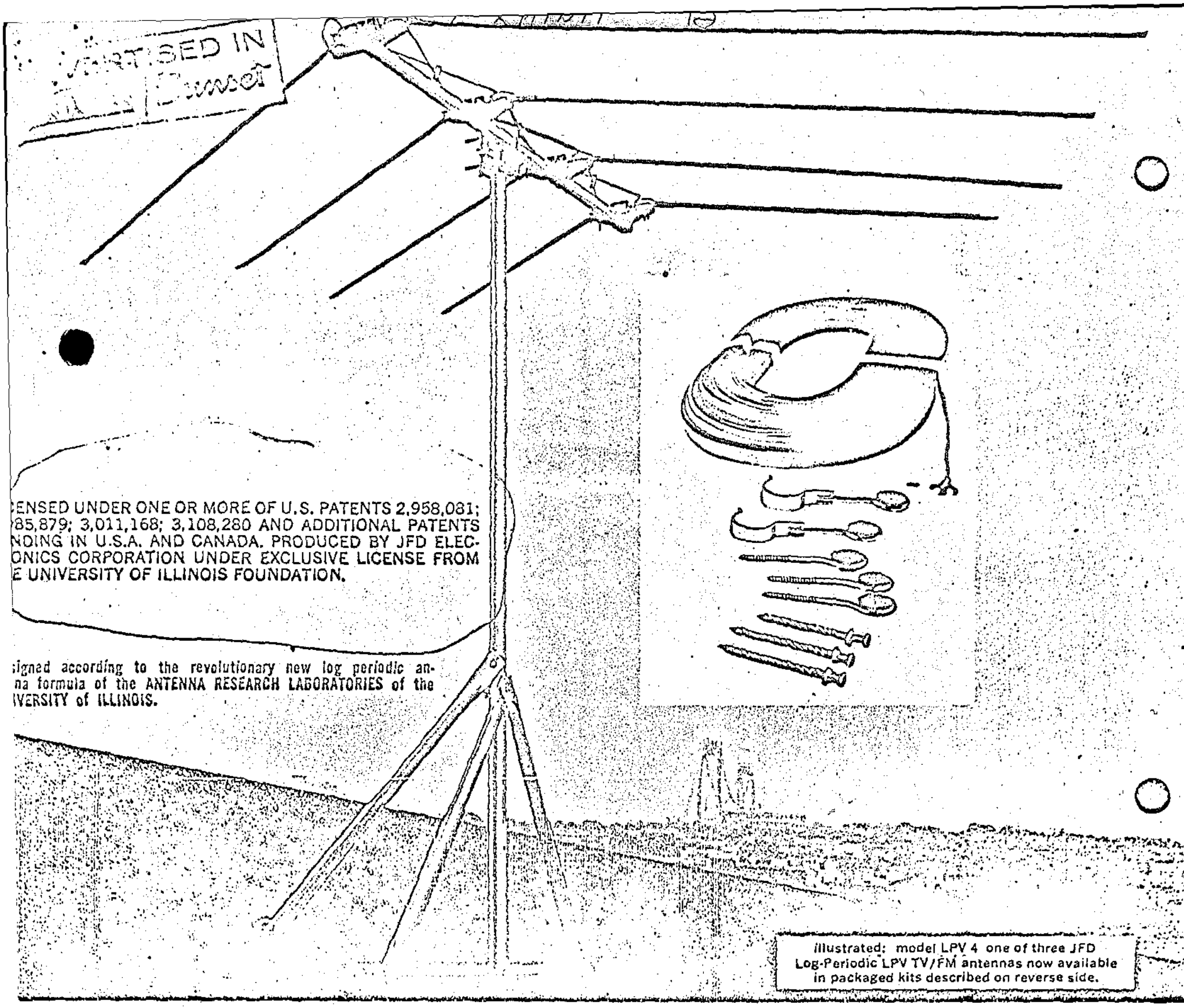
FIREBALL

Composition		
Make-Up	34	20
News Proofs		
Repro Proofs	2	50
	36	70
SALES TAX	1	47
Metal ... TOTAL	$38	17

JFD ELECTRONICS CORP.
PAID
APR 10 1965

149 800-01 CHECK 153

To avoid a rental charge all metal must be returned within 90 days after date of this invoice.



NOW—THE ANTENNA AMERICA KNOWS BEST IN THE KIT THAT SELLS BEST!

JFD LOG-PERIODIC TV/FM ANTENNA KITS!

$\frac{L_{(n+1)}}{L_n} = \tau$ —FEATURING HARMONICALLY RESONANT V-ELEMENTS OPERATING ON THE LOG-PERIODIC CELLULAR PRINCIPLE IN THE FUNDAMENTAL AND THIRD HARMONIC MODES

Take the tremendous popularity of the nation's most demanded antenna, add premium-quality installation accessories and you've got the antenna combination that zooms sales—the JFD Log-Periodic LPV TV/FM Antenna Kit.

You have your choice of any one of three Log-Periodic LPV antennas — the dramatic new antenna concept developed by the Antenna Research Laboratories of the University of Illinois and adapted for TV/FM reception by JFD. Regardless of location . . . local, suburban, or near fringe, there is a Log-Periodic LPV kit that will give your customer spectacular reception results in COLOR, black and white, and FM stereo.

With color set sales growing, two and three-set homes a fact, the best antenna makes sense for your reputation, your customer's reception. And that antenna is the JFD Log Periodic LPV.

And new Log-Periodic LPV kits not only perform better but look better, too. Their compact inline design and "flying-jet" appearance identify the home owner as a knowledgeable individual who wants the best. The lustrous AAA® Gold Bond Alodized construction of the Log-Periodic LPV also helps tell the world that it's different!

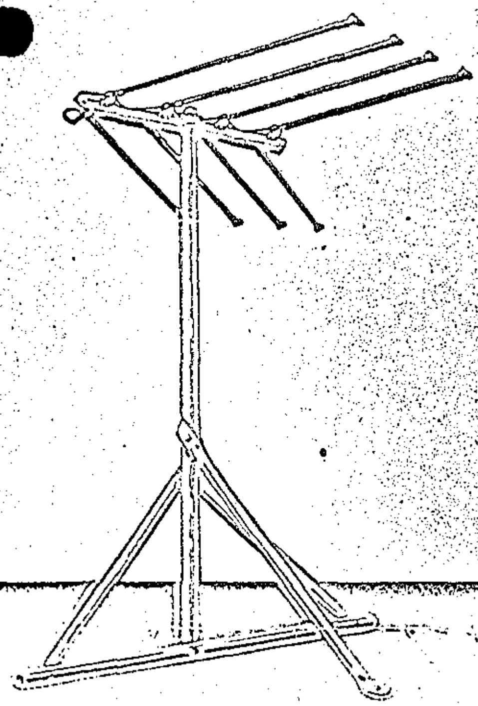
JFD LPV $\frac{L_{(n+1)}}{L_n} = \tau$

AT THE MOMENT OF TRUTH, THE PICTURE IS THE PROOF — THE JFD LOG PERIODIC WORKS BEST!

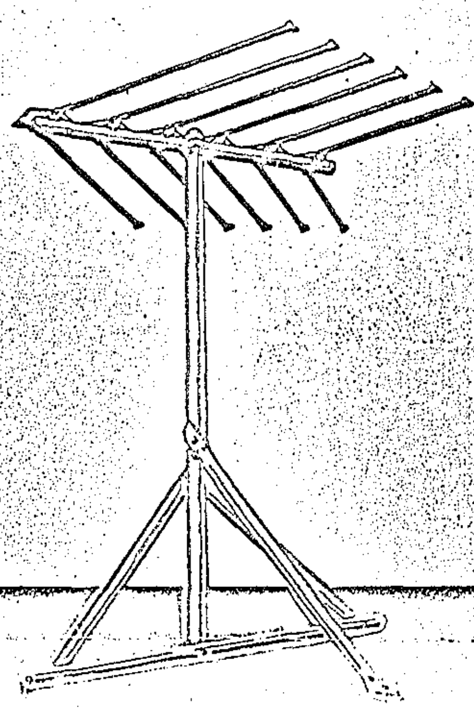
LOG-PERIODIC

JFD LPV TV/FM ANTENNA KITS!

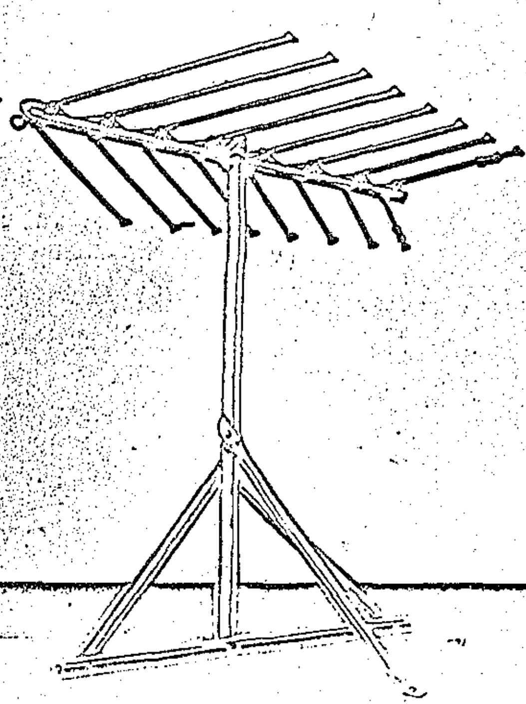
- Deliver More Yet Cost No More!
- Engineered for Maximum Picture Power — Color and Black and White
- Styled to Improve Home Appearance
- Provides Superb FM Stereo
- Complete Ready-to-Install Kit
- Ideal for Attics, Mobile Homes, Cottages



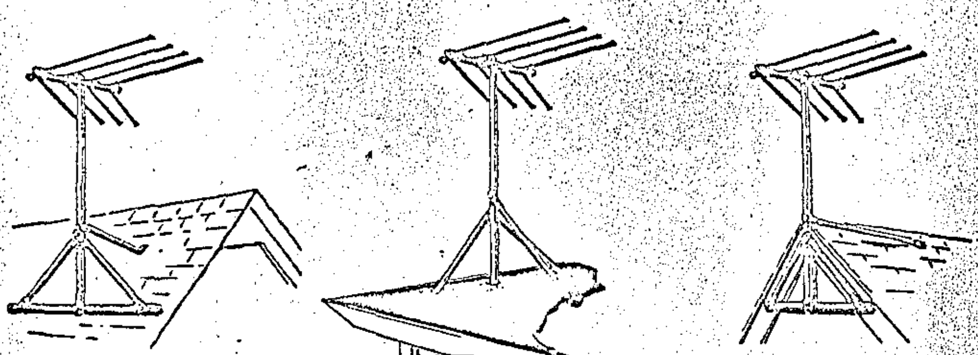
model LPV-4PM Kit. 4 Active Cells for LOCAL USE UP TO 50 MILES FROM TRANSMITTER. $21.95 list



model LPV-6PM Kit. 6 Active Cells for USE UP TO 75 MILES FROM TRANSMITTER. $29.95 list

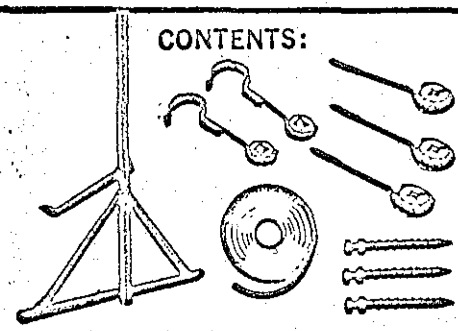


model LPV-8PM Kit. 8 Active Cells for USE UP TO 100 MILES FROM TRANSMITTER. $37.95 list



Versatile is the word for the JFD Tri-Mount and Mast. Goes up in minutes on flat, slanted or vertical surface . . . on eave, end, or peak of roof. Needs no guy wires. Made of lustrous gold alodized aluminum.

CONTENTS:



- One LPV4, LPV6 or LPV8 Log-Periodic LPV Gold Alodized TV/FM antenna
- 50 ft. 300 ohm polyethylene twin lead
- *Three 3½" wood screw eye stand-offs (T3)*
- Two mast stand-off (SPT125)
- Three self-sealing nails
- Gold Alodized Aluminum Tri-Mount that Installs Anywhere

Form No. 622LP litho in U. S. A. 9-63

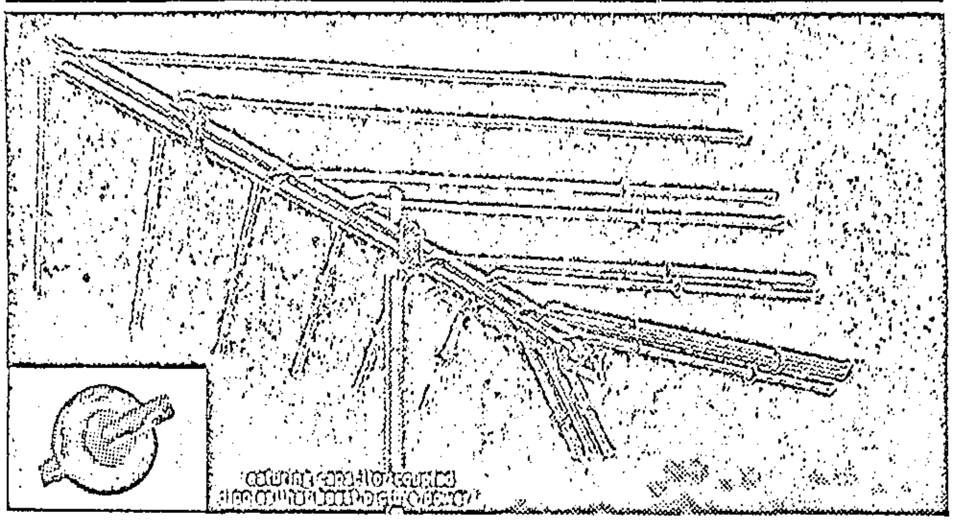
JFD

JFD ELECTRONICS CORPORATION

15th Avenue at 62nd Street, Brooklyn, N. Y. 11219

JFD Electronics-Southern Inc., Oxford, North Carolina
JFD International, 64-14 Woodside Ave., Woodside 77, N. Y.
JFD Canada, Ltd., 51 McCormack Street, Toronto, Ontario, Canada

Get the New UHF channel 0000



Plus all other channels from 2 to 83!

JFD LPV

WITH NEW SPACE AGE

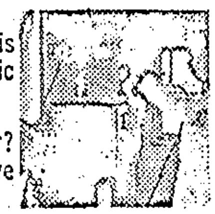
CAP-ELECTRONIC DIPOLE

Log Periodic

TV/FM ANTENNA

It's here!... the first combination VHF/UHF/FM antenna that receives all channels from 2 to 83... all FM and FM Stereo stations—yet uses only one down-lead.

JFD eliminates need for cumbersome and expensive antenna hodgepodges. The secret is in the patented JFD capacitor-coupled periodic design that pulls in powerful reception on every TV and FM station, including the new UHF channels. No other antenna features this electronic advance.



Developed from research performed at the University of Illinois Antenna Research Laboratories, the JFD All-Channel Log Periodic works especially well on color — even FM Stereo.

Why settle for less than the best reception your set can deliver? Let us install the JFD Cap-Electronic Log Periodic today and solve your reception problems now and in the future.

HOW THE JFD CAP-ELECTRONIC LOG PERIODIC LPV WORKS BETTER

No lazy elements! All antenna elements (not just some elements as in other antennas) respond to the channel you want—absorb maximum signal from channels 2 to 83, as well as on FM/Stereo. Why? Because the JFD LPV is designed according to the amazing new log periodic formula used by space scientists for satellite tracking and communication.

Selected by

SEE THE JFD CAP-ELECTRONIC LOG PERIODIC LPV AT THE WORLD'S FAIR

Featured at the spectacular House of Good Taste Exhibit and installed on more World's Fair pavilions than any other TV antenna.

Licensed under one or more of U. S. Patents 2,958,081; 2,985,879; 3,011,168; 3,108,280; 3,150,376 and additional patents pending in U. S. A. and Canada. Produced by JFD Electronics Corporation under exclusive license from the University of Illinois Foundation.

PHONE TODAY! SEE THE DIFFERENCE!

Mat No. 341 3 Cols. x 154 = 462 lines

ORegon 4-4600

GRAMERCY LANE PHOTOENGRAVING CORP.

131 EAST 23RD STREET, NEW YORK 10, N. Y.

Invoice № 5650

W.T. # 3473

C.P.O. #

J. F. D. Electronics Corp.

Date 11 19 64

1 coarse screen silh. combination 834			
1 Extra line negative 61			
1 positive negative 48			
1 tint negative 40			
2 Extra ht. negatives @40 80			
1043 @.075	78.23		
Setting up	28.00		
Extra finishing	18.00		
*25 Mats @.64	16.00		
		140.23	

833-01
LPV WE
118

M360 2 Cols. X 64 lines = 128 lines

ORegon 4-4600

GRAMERCY LANE PHOTOENGRAVING CORP.

131 EAST 23RD STREET, NEW YORK 10, N. Y.

Invoice № 7912

J. F. D. Electronics Corp.
1462 62nd St.
Brooklyn, N.Y.
Att. Miss Bertstein

W.T. # 5632

C.P.O. #

Date 3 23 65

1 line cut	107 @.075	8.03	
50 Mats @.30		15.00	
		23.03	
	Postage charge	1.66	24.69

833-B-01

JFD ELECTRONICS CORP.
PAID
APR 1 0 19..
CHECK

SHIP SAFE

Carolina CONTAINER COMPANY

Manufacturers of Corrugated Containers

HIGH POINT
NORTH CAROLINA PHONE 883-7146
27261

OUR ORDER NO. CUST. NO. 62307 INV. DATE October 22, 1964

Inv. No. L 00768

SOLD TO

J.F.D. Electronics Corp.
1462 62nd Street
Brooklyn 4, N. Y.

ALL CLAIMS MUST BE MADE UPON RECEIPT OF GOODS.

INTEREST CHARGED ON PAST DUE ACCOUNTS.

TERMS: LESS 1% FOR CASH WITHIN TEN DAYS OR NET 30 DAYS.

SHIPPED VIA

NO. BDLS.	NO. IN BDL.	TOTAL	SIZE	BOX NO.	TEST	PRICE	AMOUNT
		1	Printing Die for Small Die on LPV VU Boxs red			$ 350.00	$ 350.00

1470

OK to pay

500-01

JFD ELECTRONICS CORP.
PAID
NOV 10 1964

CHECK NO.

SQ. FT.

CAROLINA CONTAINER COMPANY

MANUFACTURERS OF
Corrugated Paper Products
HIGH POINT, N. C. 27261

PHONE 883-7146

OUR ORDER NO. AB 8401 CUST. NO. 54885 (F) INV. DATE Dec 18, 1963

Inv. No. K 00894

SOLD TO
J.F.D. Electronics Corp.
1462 62nd. St.
New York, N.Y.

JFD ELECTRONICS CORP.
PAID
JAN 10 1964

ALL CLAIMS MUST BE MADE UPON RECEIPT OF GOODS.

INTEREST CHARGED ON PAST DUE ACCOUNTS.

TERMS: LESS 1% FOR CASH WITHIN TEN DAYS OR NET 30 DAYS.

SHIPPED VIA # 56 Oxford, N.C.

CHECK NO.

NO. BDLS.	NO. IN BDL.	TOTAL	SIZE	BOX NO.	TEST	PRICE	AMOUNT
112 1	10 2	1122	S & S Sheet 31 x 71 x 1½	LPV-U21	200	$555.90	$623.72
22 1	100 44	2244	Pads 30½ x 3	"	200		

570
550

OUTDOOR ANTENNA (01)

DATE RECEIVED MERCHANDISE 12/29/63
41,477
SQ. FT.

PLACED & LOCATION

REMARKS:

Via Their Truck

Rec'd By 15TH AVE. 16TH AVE.

No.NC 07607

BARCO INCORPORATED

COPY

CAROLINA CONTAINER COMPANY

MANUFACTURERS OF
Corrugated Paper Products
HIGH POINT, N. C. 27261

PHONE 883-7146

OUR ORDER NO. AB 5879 CUST. NO. 54885 (F) INV. DATE Dec 18, 1963

Inv. No. K 00892

SOLD TO
J.F.D. Electronics Corp.
1462 62nd St.
Bew York, N.Y.

JFD ELECTRONICS CORP.
PAID
JAN 10 1964

ALL CLAIMS MUST BE MADE UPON RECEIPT OF GOODS.

INTEREST CHARGED ON PAST DUE ACCOUNTS.

TERMS: LESS 1% FOR CASH WITHIN TEN DAYS OR NET 30 DAYS

SHIPPED VIA # 76 Oxford, N.C.

AB - Oxford

NO. BDLS.	NO. IN BDL.	TOTAL	SIZE	BOX NO.	TEST	PRICE	AMOUNT
			CHECK NO.				
213 1	10 6	2136	S & S Sheet 43 x 33 x 1½	LPV-U15	200	$398.45	$851.09
21 1	200 72	4272	Pads 42½ x 3	"	200		
			53,902 SQ. FT.				

DATE RECEIVED MERCHANDISE 12/29/63

500-01

1155

OUTDOOR ANTENNA (01)

TOTAL N OF PIECE
TOTAL W
CONDITIO
GIVEN TO
PLACED &

Via - Their truck

15TH AVE. 16TH AVE.

Rec'd By Brown

VARCO INCORPORATED

No. NC 07606

CAROLINA CONTAINER COMPANY

MANUFACTURERS OF
Corrugated Paper Products
HIGH POINT, N. C. 27261

PHONE 883-7146

OUR ORDER NO. AB 7978 CUST. NO. 54885(F) INV. DATE Dec 18, 1963

SOLD TO
J.F.D Electronics Corp.
1462 62nd St.
New York, N.Y.

A

Inv. No. B 00893

ALL CLAIMS MUST BE MADE UPON RECEIPT OF GOODS.

INTEREST CHARGED ON PAST DUE ACCOUNTS.

TERMS: LESS 1% FOR CASH WITHIN TEN DAYS OR NET 30 DAYS.

SHIPPED VIA # 56 Oxford, N.C.

NO. BDLS.	NO. IN BDL.	TOTAL	SIZE	BOX NO.	TEST	PRICE	AMOUNT
84 63 1	10 20 13	2113	S & S Sheet 29½ x 32 x 1½	LPV-U9	200	M pcs $295.15	$623.65
21 1	200 26	4226	Pads 29½ x 3	"	200		
75 1	20 9	1509	S & S Sheet 29½ x 32 1½	LPV-U5	200	295.15	445.38
15 1	200 18	3018	Pads 29½ x 3		200		
			62,302 SQ. FT.				$1069.03

JFD ELECTRONICS CORP.
PAID

DATE RECEIVED JAN 2 3 1964
MERCHANDISE
CHECK NO.
12/29/63 500-01

OUTDOOR ANTENNA (01)

CONDITION:

INSPECTED BY:

GIVEN TO Steve Krahn

REMARKS:

PLACED & LOCATION

15TH AVE. 14TH AVE.

By

No.NC 07608

CAROLINA CONTAINER COMPANY

MANUFACTURERS OF
Corrugated Paper Products
HIGH POINT, N. C. 27261

PHONE 883-7146

OUR ORDER NO. 2489 CUST. NO. 57195 (F) INV. DATE March 4, 1964

SOLD TO
J.F.D. Electronics Corp.
1462-62nd St.
Brooklyn, N.Y.

A

Inv. No. K 04584

ALL CLAIMS MUST BE MADE UPON RECEIPT OF GOODS.

INTEREST CHARGED ON PAST DUE ACCOUNTS.

TERMS: LESS 1% FOR CASH WITHIN TEN DAYS OR NET 30 DAYS.

SHIPPED VIA #65 Oxford, N.C.

NO. BDLS.	NO. IN BDL.	TOTAL	SIZE	BOX NO.	TEST	PRICE	AMOUNT
139 1	15 13	2098	5 Panel Folder 12 3/4 x 3½ x 45 3/4	LPVB ZU-10	200	$272.70	$572.12
			29,460 SQ. FT.				

OUTDOOR ANTENNA (01)

560-61

JFD ELECTRONICS CORP.
P A I D
MAR 26 1964

CHECK NO.

CONDITION

GIVEN TO

PLACED & LOCATION

15TH AVE.

16TH AVE.

Rec'd By

No NC 0005

CAROLINA CONTAINER COMPANY

MANUFACTURERS OF
Corrugated Paper Products
HIGH POINT, N. C. 27261

PHONE 883-7146

OUR ORDER NO. 2490 CUST. NO. 57195(F) INV. DATE March 6, 1964

SOLD TO
JFD Electronics Corp.
1462 62nd. St.
Brooklyn, N. Y.

A

Inv. No. K 04748

ALL CLAIMS MUST BE MADE UPON RECEIPT OF GOODS.

INTEREST CHARGED ON PAST DUE ACCOUNTS.

TERMS: LESS 1% FOR CASH WITHIN TEN DAYS OR NET 30 DAYS.

SHIPPED VIA # 70 Oxford, N.C.

NO. BDLS.	NO. IN BDL.	TOTAL	SIZE	BOX NO.	TEST	PRICE	AMOUNT
68	15	1020	5 panel folder 14½ x 3½ x 45 3/4	LPV-ZU-20	200	$304.85	$310.95

15,665 SQ. FT.

A OUTDOOR ANTENNA (01)

500-01

JFD ELECTRONICS CORP.
PAID
MAR 24 1964

CHECK NO.

GIVEN TO Steve Krohn

INSPECTED BY:

PLACED & LOCATION

REMARKS:

Vit — Klein Truck

15TH AVE. 16TH AVE.

By

No.NC 09980

CAROLINA CONTAINER COMPANY

MANUFACTURERS OF
Corrugated Paper Products
HIGH POINT, N. C. 27261

PHONE 883-7146

OUR ORDER NO. ABCD 3296 CUST. NO. 61526(F) INV. DATE Sept 24, 1964

Inv. No. E 14297

SOLD TO
JFD Electronics Corp.
1462 62nd St.
Brooklyn, N.C.

ALL CLAIMS MUST BE MADE UPON RECEIPT OF GOODS.

INTEREST CHARGED ON PAST DUE ACCOUNTS.

TERMS: LESS 1% FOR CASH WITHIN TEN DAYS OR NET 30 DAYS.

SHIPPED VIA # 72 Oxford, N.C.

NO. BDLS.	NO. IN BDL.	TOTAL	SIZE	BOX NO.	TEST	PRICE	AMOUNT
24 1	10 3	243	5 panel folder 13¼ x 6 3/8 x 127½	LPV-VU-1	8250	$1229.40	$298.74
9 1	25 18	243	Scored pad 14 x 39 7/8	"	200		
9 1	25 18	243	" " 12 5/8 x 49½	"	200		
12 1	20 3	243	" " 20 5/8 x 127½	"	200		

A OUTDOOR ANTENNA (01)

17,740
SQ. FT.

136

JFD ELECTRONICS CORP.
P
OCT 10 1964
500-01
CHECK NO.

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CAROLINA CONTAINER COMPANY

MANUFACTURERS OF
Corrugated Paper Products
HIGH POINT, N. C. 27261

PHONE 883-7146

OUR ORDER NO. 3299A-B-C-D CUST. NO. 61526 (F) INV. DATE September 28, 1964

Inv. No. K 14492

SOLD TO
J.F.D. Electronics Corp.
1462-62nd St.
Brooklyn, N.Y.

ALL CLAIMS MUST BE MADE UPON RECEIPT OF GOODS.

INTEREST CHARGED ON PAST DUE ACCOUNTS.

TERMS: LESS 1% FOR CASH WITHIN TEN DAYS OR NET 30 DAYS.

SHIPPED VIA #60 Oxford, N.C.

NO. BDLS.	NO. IN BDL.	TOTAL	SIZE	BOX NO.	TEST	PRICE	AMOUNT
24 1	10 3	243	5 Panel Folder 13½ x 6½ x 112½	LPV-VU-15	250	$1156.35	$280.99
9 1	25 18	243	Scored Pad 14 x 54 3/4	"	200		
9 1	25 18	243	Scored Pad 14 x 42	"	200		
12 1	20 3	243	Scored Pad 21 x 112½	"	200		
			16,418 SQ. FT.				

JFD ELECTRONICS CORP.
PAID
NOV 10 1964

CHECK NO.

REMARKS:

Rec'd By

No.NC 16705

CAROLINA CONTAINER COMPANY

MANUFACTURERS OF

Corrugated Paper Products

HIGH POINT, N. C. 27261

PHONE 883-7146

AB 3297-8 CUST. NO. 61525(F) INV. DATE Sept 23,1964

Inv. No. K 14202

JFD Electronics Corp.
1462 62nd St.
Brooklyn, N. Y.

ALL CLAIMS MUST BE MADE UPON RECEIPT OF GOODS.

INTEREST CHARGED ON PAST DUE ACCOUNTS.

TERMS: LESS 1% FOR CASH WITHIN TEN DAYS OR NET 30 DAYS.

VIA # 73 Oxford, N.C.

NO. BDLS.	NO. IN BDL.	TOTAL	SIZE	BOX NO.	TEST	PRICE	AMOUNT
30	10	300	5 panel folder $7\frac{1}{2}$ x $6\frac{1}{2}$ x 126	LPV-VU-12	200	$664.70	$199.41
12	25	300	Scored pads 14 x $33\frac{1}{4}$	"	200		
22 1	10 2	222	5 panel folder $7\frac{1}{2}$ x $6\frac{1}{2}$ x 118	LPV-VU-9	200	646.75	143.58
8 1	25 22	222	Scored Pad 14 x $39\frac{1}{4}$	"	200		
							$342.99

JFD ELECTRONICS CORP.
PAID
OCT 10 1964
CHECK NO. 19,519

SQ. FT.

500-

A OUTDOOR ANTENNA (01)

LOCATION REMARKS:

15TH AVE.

No. NC 16574

SHIP SAFE

Carolina CONTAINER COMPANY

Manufacturers of Corrugated Containers

HIGH POINT
NORTH CAROLINA PHONE 883-7146
27261

OUR ORDER NO. AB 200 CUST. NO. 64622-P3 Phone (F) INV. DATE Jan 25, 1965

SOLD TO
JFD Electronics Corp.
1462 62nd St.
Brooklyn, N. Y.

Inv. No. L 05581

ALL CLAIMS MUST BE MADE UPON RECEIPT OF GOODS.

INTEREST CHARGED ON PAST DUE ACCOUNTS.

TERMS: LESS 1% FOR CASH WITHIN TEN DAYS OR NET 30 DAYS.

SHIPPED VIA # 62 Oxford, N.C.

NO. BDLS.	NO. IN BDL.	TOTAL	SIZE	BOX NO.	TEST	PRICE	AMOUNT
264 1	10 5	2645	5 panel folder 7½ x 6½ x 77 5/8	LPV-VU-6	200	$322.60	$853.28
26 1	100 45	2645	Pads 14 x 10	"	200		
			62,729 SQ. FT.				

DATE RECEIVED MERCHANDISE 1/27/65

5 00-01

JFD ELECTRONICS CORP.
PAID
FEB 10 1965

CHECK NO.

CONDITION:
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GIVEN TO
REMARKS:
PLACED & LOCATION
15TH AVE. 16TH AVE.
Rec'd By
No. NC22276

OWENS-ILLINOIS GLASS COMPANY, INC.

TALLY 3383

FOREST PRODUCTS DIVISION

POST OFFICE BOX 1469 Ⓘ SALISBURY, NORTH CAROLINA

32

Invoice Number	Our Customer Number
440-6421	170680

SOLD TO

J F D ELECTRONICS CORP.
1462 62ND STREET
BROOKLYN, N.Y.

A

JFD ELECTRONICS CORP.

Ship To (Same as "Sold To" unless typed here)

PAID

SAME-OXFORD, N.C. SEP 10 1964

TERMS: 1% 10 DAYS NET 30 — No Discount Allowed On Freight, Dies, or Misc. Items

MAIL CHECKS TO—Post Office Box 1469, Salisbury, N.C.

Invoice Date	Your Order No.	Our Order No.	Date of Order	Ship Via	F.O.B.	P-Prepaid C-Collect	Salesman No.
7-20-64	60120 60034	71443 71322		MAYBELLE	OXFORD	P	

C/P	QUANTITY ORDERED	BOX NO. OR SIZE	STYLE	TEST	NO. BUNDLES	AMT. PER BUNDLE	QUANTITY SHIPPED	QUANTITY BILLED	PRICE PER M	AMOUNT
	71322									
C	#1 1500	FB 500	5 PANEL FOLDER	200C	105 1	15 9	1584	1584	261.80	$414.69
C	#2 500	B-400	5 PANEL FOLDER	200C	52 1	10 12	532	532	365.30	194.34
	71443									
C	#1 200	LPL-FM-6	5 PANEL FOLDER	200C	22	10	220	220	474.00	104.28
C	#2 400	LPL-FM-8	5 PANEL FOLDER	200C	44 1	10 8	448	448	449.20	201.24 $914.55

DATE RECEIVED MERCHANDISE 7/21/64

500-01 83

A

OUTDOOR ANTENNA (01)

BILL OF LADING NO.	WEIGHT	FREIGHT RATE	TOTAL FREIGHT TAX INC.	Cash Discount Allowed if Paid Within 10 Days of Invoice Date.
	Ship. Min.			$ 9.15

We hereby certify that these goods were produced in compliance with all applicable requirements of Section 6, 7, and 12 of the Fair Labor Standards Act as amended, and of the regulations and orders of the United States Department of Labor issued under Section 14 thereof.

NO CLAIM ALLOWED UNLESS REPORTED ON RECEIPT OF GOODS

*C/P C-Designates Complete Shipment
P-Designates Partial Shipment

ORIGINAL INVOICE

Owens-Illinois Glass Company, Inc.

TALLY 4146
4167

FOREST PRODUCTS DIVISION

POST OFFICE BOX 1469 SALISBURY, NORTH CAROLINA

32

Invoice Number	Our Customer Number
440-7197	170680

JFD ELECTRONICS CORP.
PAID
SEP 10 1964

SOLD TO

J F D ELECTRONICS CORP.
1462 62ND STREET
BROOKLYN, N.Y.

Ship To (Same as "Sold To" unless typed here)

SAME-OXFORD, N.C.

CHECK NO.

TERMS: 1% 10 DAYS NET 30 — No Discount Allowed On Freight, Dies, or Misc. Items

MAIL CHECKS TO—Post Office Box 1469, Salisbury, N.C.

Invoice Date	Your Order No.	Our Order No.	Date of Order	Ship Via	F.O.B.	P-Prepaid C-Collect	Salesman No.
8-12-64	60465 60459	80626 80416		MAYBELLE	OXFORD	P	

C/P	QUANTITY ORDERED	BOX NO. OR SIZE	STYLE	TEST	NO. BUNDLES	AMT. PER BUNDLE	QUANTITY SHIPPED	QUANTITY BILLED	PRICE PER M	AMOUNT
	80416									
C	500	LPL-FM-4 500-01 A	5 PANEL FOLDER	200C	41 1	12 13	505	505	376.90	$190.33
	80626									
C	10000	11813-1202 500-02 G	RSC	200C	402 31 1 1	25 25 18 23	10866 816 10050 10866	10866	116.00	1260.46 $1450.79

A — OUTDOOR ANTENNA (01)

G — INDOOR ANTENNA (02)

1308 500-01
500-02

CAR		Ship. / Min.	WEIGHT	FREIGHT RATE	TOTAL FREIGHT (TAX INC.)	Cash Discount Allowed if Paid Within 10 Days of Invoice Date.	$ 14.51

We hereby certify that these goods were produced in compliance with all applicable requirements of Section 6, 7, and 12 of the Fair Labor Standards Act as amended, and of the regulations and orders of the United States Department of Labor issued under Section 14 thereof.

NO CLAIM ALLOWED UNLESS REPORTED ON RECEIPT OF GOODS

*C/P C-Designates Complete Shipment
P-Designates Partial Shipment

ORIGINAL INVOICE

ORIGINAL

PARK CONTAINER CORP.

Designers and Manufacturers

85 5TH AVE. PATERSON, N. J.

N. Y. LO 3-4900
N. J. MU 2-2626

PB 2289

J F D Electronics
6101 16th Avenue
Brooklyn, New York

SHIPPED TO:
J F D Electronics
Oxford, North Caralina

A

TERMS: 1% 10 DAYS ___ NET 30

INVOICE DATE	VIA	OUR ORDER NO.	YOUR ORDER NO.	SALESMAN
11-9-62	Covert	6998 6803	25875	HA

BDLS.	AMT. PER BDLS.	QUANTITY	NO.	DESCRIPTION	SIZE	STYLE	TEST	UNIT PRICE	AMOUNT
147 1	15 9	2214	# FB500	Our Job 40118		5PF	200	370.00	819.18
71 1	15 12	1077	# LPV-8	Our Job 24426		5 PF	200	515.50	555.19
71 1	15 10	1075	# LPV-6	Our Job 20521		5PF	200	447.00	480.53
70 1	15 18	1068	# LPV 4	Our Job 16148		5 PF	200	369.00	394.09
2	15	30	# AW 250	Our Job 626		5 PF	200	480.50	14.42
21	15	315	# JET 161	Our Job 5444		5 PF	200	354.50	111.67
									2375.08

A OUTDOOR ANTENNA (01)

ORDER CONTROL
PRICE CHECK
PURCHASE JOURNAL
EXTENSION
DEPARTMENT 500-01
PACKING & RECEIPT SLIP

J. F. D. ELECTRONICS CORP.
PAID
DEC 10 1962
CHECK

NO CLAIMS ALLOWED UNLESS REPORTED UPON RECEIPT OF GOODS — PRICES SUBJECT TO CHANGE WITHOUT NOTICE

ORIGINAL

PARK CONTAINER CORP.

Designers and Manufacturers

85 5TH AVE. PATERSON, N. J.

N. Y. LO 3-4900
N. J. MU 2-2626

PB 2714

SOLD TO: ORDER CONTROL
J F D Electronics Corp.
... 60th Avenue
Brooklyn, New York

SHIPPED TO:
J F D Electronics Corp.
Pinetree Road
Oxford, N.C.

500-01 $1,799.34
500-02 $ 630.52

EXTENSION
DEPARTMENT Bal - 500-01

TERMS 1% 10 DAYS — NET 30

INVOICE DATE	VIA	OUR ORDER NO.	YOUR ORDER NO.	SALESMAN
12-11-62	Covert Trk	7151 7298-7152-7318-	50555- 50506-50074-50270-	

BDLS.	AMT. PER BDLE.	QUANTITY	NO.	DESCRIPTION	SIZE	STYLE	TEST	UNIT PRICE	AMOUNT
82 1	10 11	831	# LPV 11	Our Job 24338	A	5PF	200	585.00	486.14
50	30	2x50x 1500	# 2150 M	Our Job 6815	G	F/OL	200	89.25	133.84
108 1	10 3	1083	# SX 711	Our Job 24301	A	5PF	200	451.50	488.97
107 1	10 7	1077	# 5	Our Job 16782	A	5PF	200	377.00	406.03
97 1	10 7	977	# RX 311-511	Our Job 17653	A	5PF	200	426.00	416.20
109 1	20 8	2188	# 2½ Blister	Our Job 26803	G	RSC	200	227.00	496.68
									~~2427.90~~ 2427.86

A OUTDOOR ANTENNA (01)

G INDOOR ANTENNA (02)

NO CLAIMS ALLOWED UNLESS REPOR...

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

UARCO INC. - WATSEKA, ILL.

ORIGINAL

PARK CONTAINER CORP.

Designers and Manufacturers

85 5TH AVE. PATERSON, N. J.

N. Y. LO 3-4900
N. J. MU 2-2626

PB 1898

SOLD
J.F.D. Electronics
6101 16th Avenue
Brooklyn, New York

SHIPPED TO:
(A)

TERMS: 1% 10 DAYS — NET 30

INVOICE DATE	VIA	OUR ORDER NO.	YOUR ORDER NO.	SALESMAN
10/16/62				

BDLS.	AMT. PER BDLE.	QUANTITY	NO.	DESCRIPTION	SIZE	STYLE	TEST	UNIT PRICE	AMOUNT
		1		Complete set of 2 Color Printing Dies # LPV					475.00

ORDER CONTROL
PRICE CHECK
PURCHASE JOURNAL
EXTENSION
DEPARTMENT
PACKING & RECEIPT SLIP

LPV4
LPV6
LPV8
500-0

J. F. D. ELECTRONICS CORP.
PAID
FEB 14 1963
CHECK No.

NO CLAIMS ALLOWED UNLESS REPORTED UPON RECEIPT OF GOODS. PRICES SUBJECT TO CHANGE WITHOUT NOTICE

ORIGINAL

PARK CONTAINER CORP.

Designers and Manufacturers

85 5TH AVE. PATERSON, N. J.

N. Y. LO 3-4900
N. J. MU 2-2626

PB 3190

SOLD TO:
J F D Electronics Corp.
6101 16th Avenue
Brooklyn, New York

SHIPPED TO:
J F D Electronics Southern
Pinetree Road
Oxford, N.C.

MAR 9 1963

(A) (G) (L)

500-01 $2,236.04
500-02 $144.59
500-06 $509.28

TERMS: 1% 10 DAYS — NET 30

INVOICE DATE	VIA		YOUR ORDER NO.	SALESMAN
1-31-63	Eovert Erk.	7608-7601-7672 7655-7573-7583-		HA

BDLS.	AMT. PER BDLE.	QUANTITY	NO. DESCRIPTION	SIZE	STYLE	TEST	UNIT PRICE	AMOUNT
			Your Order #					
100	10	1000	# LPV 14 verbal E.X. M/W Our Job 35420 A		5PF	200	779.00	779.00
110	10	1100	# B 400 (51010) 500-01 Southern Marble Our Job 25541 A		5PF	200	461.50	507.65
=145 1	15 10	2185	# Zip Kit #2 (51129) 500-01 Southern M/W Our Job 31125 A		5PF	200	300.50	656.59
89 1	60 28	5368	# A-10 (51072Y 500-06 Southern Our Job 11273 L		Sleeve	200	94.50	507.28
17 1	15 16	271	# HF 72 (51010) 500-01 Southern Our Job 5418 A		5PF	200	503.00	136.31
64 1	25 20	1620	# 11013-1402 (50983) 500-02 Southern Our Job 7360 G		F/OL	200	89.25	144.59
66 1	25 6	1656	# (51179) 500-01 Southern Our Job 7303 A		RSC	200	94.50	156.49
								2887.91

ORDER CONFIRM
PRICE CHECK
PURCHASE JOURNAL
EXTENSION
DEPARTMENT
CASHING & RECEIPT SLIP

G INDOOR ANTENNA (02)

MASTING (06)

A OUTDOOR ANTENNA (01)

REPORTED UPON RECEIPT OF

RICES SU

ORIGINAL

PARK CONTAINER CORP.

Designers and Manufacturers

85 5TH AVE. PATERSON, N. J.

N. Y. LO 3-4900
N. J. MU 2-2626

PB 2845

SOLD TO:
J F D Electronics Corp.
6101 16th Avenue
Brooklyn, New York

SHIPPED TO: Same

TERMS: 1 % 10 DAYS — NET 30

INVOICE DATE	VIA	OUR ORDER NO.	YOUR ORDER NO.	SALESMAN
12-26-62				

BDLS.	AMT. PER BDLE.	QUANTITY	NO.	DESCRIPTION	SIZE	STYLE	TEST	UNIT PRICE	AMOUNT
		1 Set		of 2Color #LPV-11 Printing Dies					475.00

ORDER CONTROL	
PRICE CHECK	
PURCHASE JOURNAL	
EXTENSION	
DEPARTMENT	
PACKING & RECEIPT SLIP	

A OUTDOOR ANTENNA (01)

NO CLAIMS ALLOWED UNLESS REPORTED UPON RECEIPT OF GOODS

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

Carolina CONTAINER COMPANY

Manufacturers of Corrugated Containers

HIGH POINT
NORTH CAROLINA PHONE 8
27261

OUR ORDER NO. CUST. NO. 62308 INV. DATE Oct. 22, 1964

Inv. No. L 0076

SOLD TO

J. F. D. Electronics Corp.
1462 62nd St.
Brooklyn 4, N. Y.

ALL CLAIMS MUST BE MADE UPON RECEIPT OF GOODS.

INTEREST CHARGED ON PAST DUE ACCOUNTS.

TERMS: LESS 1% FOR CASH WITHIN TEN DAYS OR NET 30 DAYS.

SHIPPED VIA

BDLS.	NO. IN BDL.	TOTAL	SIZE	BOX NO.	TEST	PRICE	AMOUNT
		1	Printing Die for Small Black Die onEPV Vu Boxes			$ 350.00	$ 350.00

JFD ELECTRONICS CORP.
PAID
NOV 16 1964
CHECK NO.

SQ. FT.

500-01

ORIGINAL

PARK CONTAINER CORP.

Designers and Manufacturers

85 5TH AVE. PATERSON, N. J.

N. Y. LO 3-4900
N. J. MU 2-2626

PB 3106

SOLD TO:
J F D Electronics Corp.
6101 16th Avenue
Brooklyn, New York

SHIPPED TO:

(A)

TERMS: 1% 10 DAYS — NET 30

INVOICE DATE	VIA	OUR ORDER NO.	YOUR ORDER NO.	SALESMAN
1-2963				

BDLS.	AMT. PER BDLE.	QUANTITY	NO.	DESCRIPTION	SIZE	STYLE	TEST	UNIT PRICE	AMOUNT
		1		SET OF PRINTING DIES					
				2 COLOR LPV 14					475.00

ORDER CONTROL
PRICE CHECK
PURCHASE JOURNAL
EXTENSION
DEPARTMENT
PACKING & RECEIPT SLIP

300-01

OUTDOOR
ANTENNA
(01)

REPORTED UPON RECEIPT OF GOODS

PRICES SUBJECT TO CHANGE WITH...

File

LAW OFFICES

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE

CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

May 23, 1967

Mr. Robert H. Rines
Rines and Rines
No. Ten Post Office Square
Boston, Massachusetts 02109

RE: UIF v. BT v. JFD

Dear Bob:

This confirms our telephone conversation. At the trial call this morning Judge Hoffman told us to report back on Thursday. I talked this afternoon with his clerk and found that the case presently on trial would not be finished today. There are two 1965 cases which are to report tomorrow. It is our information that both will go to trial and that both will be called before you. Of course, either or both of them might be settled or the court might juggle the order. The judge's clerk invited me to check back with him tomorrow after lunch. I will do so and call you with a report.

I understand that Ike will be unavailable next week and that you are unavailable the week following that. If the situation requires it, I will point this out to the court. I doubt that either circumstance will be given any weight.

Very truly yours,

Dick

Richard S. Phillips

RSP:iag

LAW OFFICES

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

AXEL A. HOFGREN
ERNEST A. WEGNER
JOHN REX ALLEN
WILLIAM J. STELLMAN
JOHN B. McCORD
BRADFORD WILES
JAMES C. WOOD
STANLEY C. DALTON
RICHARD S. PHILLIPS
LLOYD W. MASON
TED E. KILLINGSWORTH
CHARLES L. ROWE
JAMES R. SWEENEY
W. E. RECKTENWALD
J. R. STAPLETON

WILLIAM R. McNAIR
JOHN P. MILNAMOW
DILLIS V. ALLEN
W. A. VAN SANTEN, JR.
JOHN R. HOFFMAN

20 NORTH WACKER DRIVE
CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

May 22, 1967

Mr. Robert H. Rines
Rines and Rines
No. Ten Post Office Square
Boston, Massachusetts 02109

Dear Bob:

Although your case is not on the call until tomorrow, I went to Judge Hoffman's court this morning to see what was going on. He has a jury case on trial. It is just starting but I don't think it will take too long. I will know better tomorrow. There are at least four cases which will follow the one on trial before he gets to you. I am not sure what the first two are about as I had not run into them before. I will have additional information on this in a day or so. The third of the four cases is a patent case which may take a couple of weeks. The fourth is a private antitrust action. There was an attempt to shorten this by eliminating a Robinson-Patman claim by a motion on the pleadings, made this morning. Apparently a case was just decided in California which the defendant felt was a good precedent. The judge denied the motion as not timely, but may consider the case and permit argument on it before testimony is introduced. The third and fourth cases were told to report back on the 31st. I imagine we will be told to report at the same time.

If these cases ahead of you are not settled, it may be six weeks or even more before you are reached. On the other hand, a couple of settlements could move you to the top of the heap in a hurry.

Very truly yours,

Dick

Richard S. Phillips

RSP:iag

RECEIVED
MAY 24 1967
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

LAW OFFICES

HOFGREN, WEGNER, ALLEN, STELLMAN & MCCORD

AXEL A. HOFGREN
ERNEST A. WEGNER
JOHN REX ALLEN
WILLIAM J. STELLMAN
JOHN B. McCORD
BRADFORD WILES
JAMES C. WOOD
STANLEY C. DALTON
RICHARD S. PHILLIPS
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CHARLES L. ROWE
JAMES R. SWEENEY
W. E. RECKTENWALD
J. R. STAPLETON

WILLIAM R. McNAIR
JOHN P. MILNAMOW
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W. A. VAN SANTEN, JR.
JOHN R. HOFFMAN

20 NORTH WACKER DRIVE
CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

May 24, 1967

VIA AIR MAIL

Mr. I. S. Blonder
Blonder-Tongue Laboratories Inc.
9 Alling Street
Newark, New Jersey 07102

Dear Ike:

Pete Mann asked me to check on one aspect of the documents which you supplied in response to one of their requests. You have provided them with copies of two company confidential reports regarding tests of the Color Ranger. The documents we gave them covered tests of the Color Ranger 5 and the Color Ranger 3. The Color Ranger 3 report makes reference to a report on the Color Ranger 10 of which we do not have a copy. Would you have someone see if a report on the test of the 10 is available and, if so, send me a copy.

For your convenience in finding this material, I
* enclose copies of the two reports we have.

Very truly yours,

Richard S. Phillips

RSP:iag

* Enclosures

cc: Mr. R. H. Rines

RECEIVED
MAY 25 1967
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

Read to RHR over phone 5/19

LAW OFFICES

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE

CHICAGO 60606

AXEL A. HOFGREN
ERNEST A. WEGNER
JOHN REX ALLEN
WILLIAM J. STELLMAN
JOHN B. McCORD
BRADFORD WILES
JAMES C. WOOD
STANLEY C. DALTON
RICHARD S. PHILLIPS
LLOYD W. MASON
TED E. KILLINGSWORTH
CHARLES L. ROWE
JAMES R. SWEENEY
W. E. RECKTENWALD
J. R. STAPLETON

WILLIAM R. McNAIR
JOHN P. MILNAMOW
DILLIS V. ALLEN
W. A. VAN SANTEN, JR.
JOHN R. HOFFMAN

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

May 16, 1967

Mr. Robert H. Rines
Rines and Rines
No. Ten Post Office Square
Boston, Massachusetts 02109

Dear Bob:

Confirming my telephone call to your father, Judge Hoffman told us to come back next Tuesday. A patent case and a civil antitrust case are on his call for Monday. I will check the status of these two cases on Thursday and will attend the call the following Monday. I think it extremely unlikely that trial in your case will begin on Tuesday. I suggest, however, that you keep tabs on the whereabouts of your witnesses so that they can be reached without delay, if that should be necessary.

Very truly yours,

Dick

Richard S. Phillips

RSP:iag

PS: Judge Lynch, handling the Finney case, has held in abeyance action on the motion for summary judgment to see if your case goes to trial before Judge Hoffman. The schedule for briefing on the motion has not yet been set, and may not be.

RECEIVED
MAY 18 1967
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

May 17, 1967

Jerome M. Berliner, Esq.
Ostrolenk, Faber, Gerb & Soffen
Ten East Fortieth Street
New York, New York 10016

Re: JFD 3.223 - UIF v. B-T v. JFD

Dear Jerry:

As requested in your letter of May 9, 1967, we enclose herewith the original transcript of Jerome N. Balash's deposition.

Would you attend to getting this signed so as to be available in Chicago?

Very truly yours,

RINES AND RINES

By ______________________

RHR:H
Enclosure

OSTROLENK, FABER, GERB & SOFFEN
ATTORNEYS AT LAW
TEN EAST FORTIETH STREET
NEW YORK, N. Y. 10016

SAMUEL OSTROLENK
SIDNEY G. FABER
BERNARD GERB
MARVIN C. SOFFEN
SAMUEL H. WEINER
JEROME M. BERLINER
LOUIS WEINSTEIN
MARC S. GROSS
STEWART J. FRIED

MICHAEL S. PINELES
(ILL. & PA. BARS ONLY)
ROBERT C. FABER

PATENT CAUSES

AREA CODE 212
MURRAY HILL 5-8470

CABLE ADDRESS
"OSTROFABER" NEW YORK

c/ Balash 5/12/67

May 9, 1967

Robert H. Rines, Esq.
Rines and Rines
No. Ten Post Office Square
Boston, Massachusetts 02109

Re: JFD 3.223 - UIF v. B-T v. JFD

Dear Bob:

My records indicate that witness Jerome N. Balash has not been given the original transcript of his deposition for correction and signing.

Your reporting service states that such original transcript was mailed to you on March 14, 1967.

If you have the original transcript, kindly forward it to me or directly to Mr. Balash so that it will be available for trial of this Action.

If you do not have the original of the transcript in question, kindly advise and appropriate steps will be taken to rectify the situation.

Sincerely,

OSTROLENK, FABER, GERB & SOFFEN

Jerry

Jerome M. Berliner

JMB:cg

cg

Norman:
Letter to Jerry: Replying to your letter of May 9 we do not seem to have the original Balash deposition. Would you attend to getting any changes signed so as to be available in Chicago, or [illegible] Bob

RECEIVED
MAY 10 1967
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

LAW OFFICES
HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD
20 NORTH WACKER DRIVE
CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

May 12, 1967

Mr. Robert H. Rines
Rines and Rines
No. Ten Post Office Square
Boston, Massachusetts 02109

Dear Bob:

This afternoon I talked with Judge Hoffman's clerk. He would not make a commitment regarding when the Foundation case might go to trial. There are four or five cases to be called on Monday, but he does not know what action will be taken in them. A criminal case will be called before yours on Tuesday. By Monday morning he should be able to tell me whether the criminal case will go to trial. In any event, I will watch the call Monday morning in order that we can let you know as promptly as possible if there is a chance that you will go to trial Tuesday or shortly thereafter.

Very truly yours,

Dick

Richard S. Phillips

RSP:iag

RECEIVED
MAY 15 1967
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

LAW OFFICES
HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD
20 NORTH WACKER DRIVE
CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

fill

May 10, 1967

Mr. Robert H. Rines
Rines and Rines
No. Ten Post Office Square
Boston, Massachusetts 02109

Dear Bob:

Through an error, we received a second set of the articles by DuHamel and Berry, and DuHamel and Isbell from
* the library. We have a copy here so I am sending these on to you for your use.

Very truly yours,

Dick

Richard S. Phillips

RSP:iag

* Enclosures

RECEIVED
MAY 12 1967
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

A NEW CONCEPT IN HIGH FREQUENCY ANTENNA DESIGN

By: R. H. DuHamel and D. G. Berry
Collins Radio Company
Cedar Rapids, Iowa

Abstract

The application of unidirectional, wire, trapezoidal-tooth, log periodic antennas to h-f point-to-point communications is described. The antennas are placed over ground in such a manner that the vertical plane radiation pattern, as well as the azimuth pattern and input impedance, is essentially independent of frequency over the 3-to 30-mc range. Moreover, the design parameters can be chosen so that the upper half-power point will fall at any vertical angle from 70° down to a few degrees. The antennas are horizontally polarized with azimuthal beamwidths of 60°, low side lobes and gains ranging from 11 db to 18 db over an isotrope. Optimum elevation plane patterns for point-to-point paths as a function of extreme ionospheric virtual heights are defined, and antenna designs producing these patterns are given.

Introduction

The following remarks concern antennas for use on high-frequency point-to-point communication circuits. What constitutes an optimum elevation plane radiation pattern for such a circuit is discussed and the design of antennas producing these patterns is presented.

Communication by high-frequency sky wave depends upon refraction or reflection from the ionosphere. Because the character of the ionosphere changes from day to night, from season to season and with the sunspot cycle, the altitude at which refraction or reflection occurs, called the virtual height, may vary from about 100 to 350 km. Antennas in a point-to-point circuit using this propagation mode should ideally have elevation plane patterns whose maxima follow the virtual height of the ionosphere. Since the antenna required to achieve this performance is extremely complex, the next most ideal situation, if it could be accomplished with a relatively simple structure, would be a pattern whose half-power angles lie such that they intersect the extreme virtual heights encountered over a given fixed path at the control points (halfway between the two points for single-hop propagation). For instance, as illustrated in figure 1,

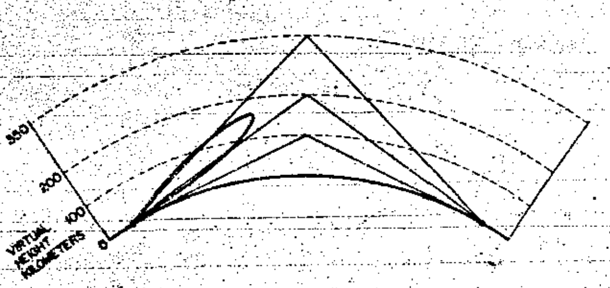


Fig. 1. Effect of virtual height on angle of departure and arrival.

if the virtual height ranged between 200 and 350 km, then the most satisfactory pattern for this point-to-point circuit would have its lower half-power angle intersect the ionosphere at a height of 200 km halfway between the two points, and its upper half-power angle intersect the ionosphere at the height of 350 km. By definition, then, the optimum elevation plane radiation pattern for this path would have maximum directivity in the vertical plane with the condition that the half-power angles intersect the control point at the extreme virtual heights. This simply means that the beam-width is fixed and that the radiation outside the beam should be minimum.

Such a criterion leads, of course, to an infinity of designs corresponding to the infinity of point-to-point path lengths. In order to reduce the number of designs, an antenna could be specified for a range of point-to-point great circle distances, say from 1,000 to 1500 km apart. Such an antenna would produce a radiation pattern having its upper half-power angle intersect the highest virtual height at the control point of the 1,000 km path and its lower half-power angle intersect the lowest virtual height at the control point of the 1500 km path. The optimum elevation plane pattern for a range of distances would be one that has these half-power angle characteristics and maximum directivity in the elevation plane. This pattern would have a lower vertical plane directivity than one that was optimum for a specific point-to-point circuit but would have a variation less than 3 db for a specific circuit in its design range.

In addition to the changing virtual height, the ionosphere has associated with it the property that it will not reflect electromagnetic energy propagating above a certain frequency, called the maximum useable frequency. This maximum useable frequency for a given point-to-point circuit is also dependent upon the time of day, season of year and sunspot cycle and consequently may vary widely over a period of years. Thus, if a single antenna is going to be used over a point-to-point circuit, it must be able to operate over perhaps as much as a 6:1 frequency range. In addition, the foregoing half-power criterion demands that the elevation plane pattern be independent of frequency over this extremely wide frequency range.

Horizontally polarized antennas in current use on this type of circuit such as rhombics, billboard arrays, dipoles, etc., have characteristics that fall far short of being ideal under conditions of changing virtual height and wide frequency range. These antennas are broadband in the sense that their input impedance remains relatively constant over a wide range of frequencies, but their radiation patterns are dependent on both the physical size of the antennas themselves and their height above ground. An antenna whose elevation plane main lobe is directed 20° above the earth at a given frequency may have a null at this angle at twice that frequency. Because of their widely changing elevation plane patterns, antennas of this type can cause a 15 or 20 db change in system gain from one set of ionospheric conditions to the next.

During the last several years there has evolved an antenna called the logarithmically periodic antenna which is geometrically simple and has the property that its patterns and impedance in free space are independent of frequency. If one of these structures is oriented over ground as shown in figure 2 with its vertex on the ground and its longest transverse wires elevated, then its elevation plane pattern will be horizontally polarized and independent of frequency. This is possible because the element pattern is independent of frequency and the element phase center is located a constant distance in wavelengths above ground. That is, as frequency is increased, the phase center moves down toward the element vertex in such a way as to remain a constant number of wavelengths from the vertex. The parameters of this antenna can be chosen so that its upper half-power point can be as high as 70° above the horizon, while another set of parameters will yield a lower half-power point within a few degrees of the horizon. For a given point-to-point circuit where the highest and the lowest virtual height that will be encountered are known, an antenna can be designed so that its upper half-power angle will intersect the highest virtual height and the lower half-power angle the lowest virtual height at the control point, thereby guaranteeing that degradation of the system gain due to the antenna will never be more than 3 db regardless of ionospheric conditions.

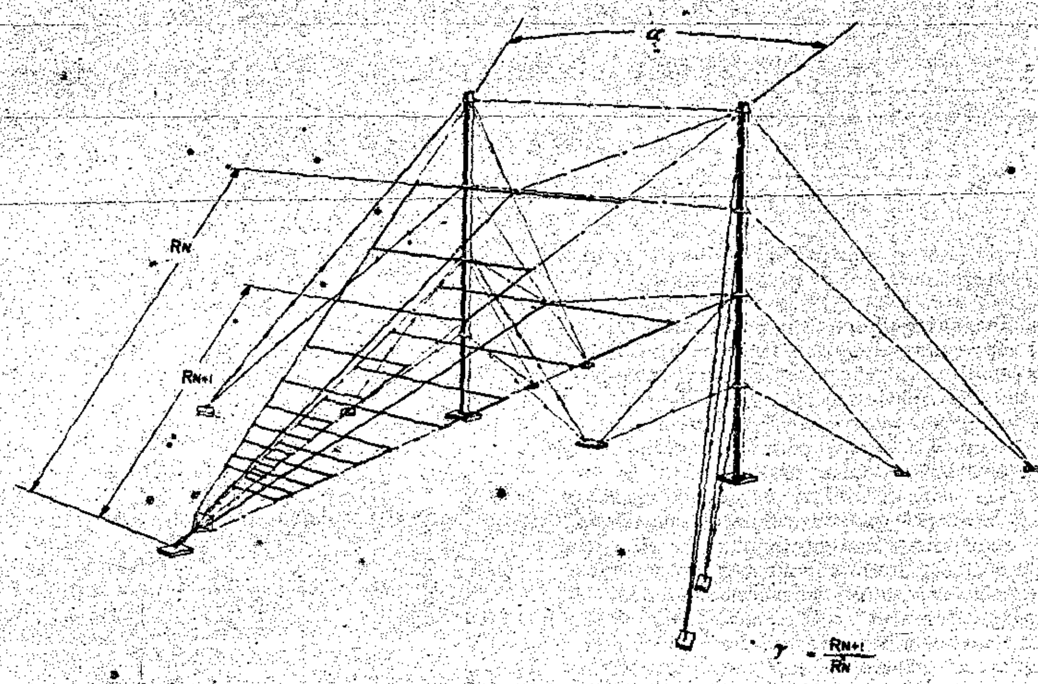


Fig. 2. Two-element log periodic array inclined with respect to ground.

Point-to-Point Log Periodic Antenna

Log periodic antennas that will be discussed here will be of the wire trapezoidal-tooth type. Each element is described by the parameters α and τ (figure 2) as has been discussed in previous papers[1, 2]. The electrical characteristics of the element required for the determination of array radiation patterns are element radiation pattern, phase center characteristics and the relative phase of the field emanating from the element. All of these characteristics are quasi frequency independent, that is, they have a small variation over a period of frequency. The pattern beamwidths, for instance, will vary less than 10% over a period. Groups of these log periodic elements can be arrayed in various manners[2]. The discussion in this paper will be limited to two elements arrayed in the vertical plane such that they are polarized in the direction perpendicular to the plane of the array, the array being described by the angles ψ_1 and ψ_2 (figure 3).

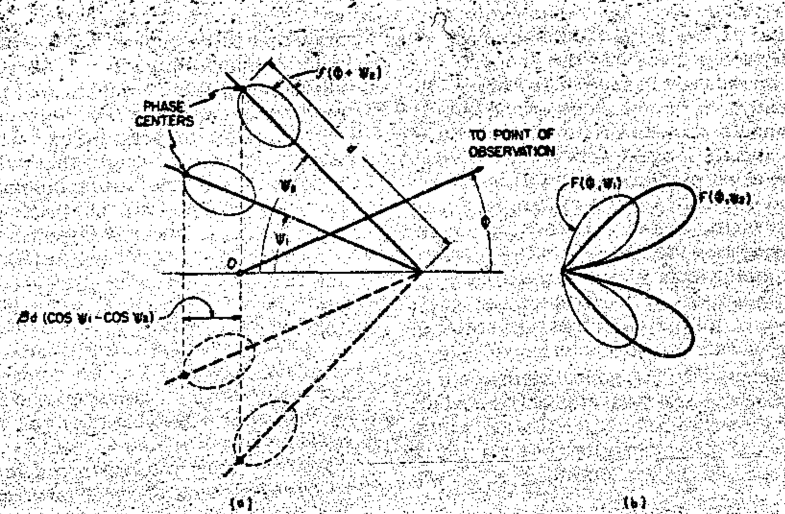
Using the origin, 0 in figure 3, as a reference point, the array pattern may be written as

$$E = F(\phi,\psi_1)\, e^{j\left[\gamma - \beta d(\cos\psi_1 - \cos\psi_2)\cos\phi\right]} + F(\phi,\psi_2) \qquad (1)$$

where $F(\phi,\psi)$ is the group pattern of an element and its image. It is given by

$$F(\phi,\psi) = f(\phi+\psi)\, e^{j\beta d \sin\psi \sin\phi} - f(\phi-\psi)\, e^{-j\beta d \sin\psi \sin\phi} \qquad (2)$$

where $f(\phi)$ is the element pattern, d is the distance to the phase center and γ is the phase by which element number 1 leads element number 2. The analysis and synthesis of this type of array is complicated by the fact that the element patterns, which are unidirectional, point in different directions, as illustrated in figure 3a. The group pattern (pattern of an element and image) which are of the split beam variety are shown in figure 3b. The outer element of the array and its image form the group pattern with the



$$E = F(\phi,\psi_1)\,e^{j[\gamma-\beta d(\cos\psi_1-\cos\psi_2)\cos\phi]} + F(\phi,\psi_2)$$

$$F(\phi,\psi) = f(\phi+\psi)\,e^{j\beta d\sin\psi\sin\phi} - f(\phi-\psi)\,e^{-j\beta d\sin\psi\sin\phi}$$

Fig. 3. Geometry of log periodic array over ground.

split beams closest together. The exponential term of equation (1) represents the phase difference between the two group patterns. The term $\beta d(\cos\psi_1 - \cos\psi_2)$ represents the apparent phase space difference *between the two group patterns.* The array pattern, is simply the sum of the group patterns with the variable phase difference taken into account. As mentioned in the introduction, an optimum pattern for a given range of circuit distances fixes the upper and lower half-power points and implies that the side-lobe level outside of these limits should be small. Thus, the objective is to determine the most economical antenna configuration which will produce the optimum pattern. This involves an optimum choice of the five design parameters α, τ, ψ_1, ψ_2 and γ, which is no simple problem.

The element pattern $f(\phi)$ depends only upon the parameters α and τ and to a small extent on the size of the wire from which they are made. Figure 4 is a plot of E- and H-plane beamwidths as a function of the parameters α and τ. It can be seen that the H-plane beamwidth can vary over a wide range depending upon choice of parameters while the E-plane beamwidth is insensitive to changes of α and τ. It can also be seen that for a given τ there is an α that produces a minimum E- and H-plane beamwidth. *Figure 5 shows the H-plane beamwidths of a single* element as a function of the size of the wire from which it is made. It can be seen that this parameter has a relatively small effect on the pattern compared to parameters α and τ.

The group pattern is a function of the element pattern, the distance, d, to the phase center and the angle ψ. The variation of d/λ with α is shown in figure 6 as a function of α over the range of τ that the element patterns are frequency independent. It can be seen that the phase center is nicely behaved and moves toward the element vertex as the angle α is increased from 10° to 45°. The two beams of the

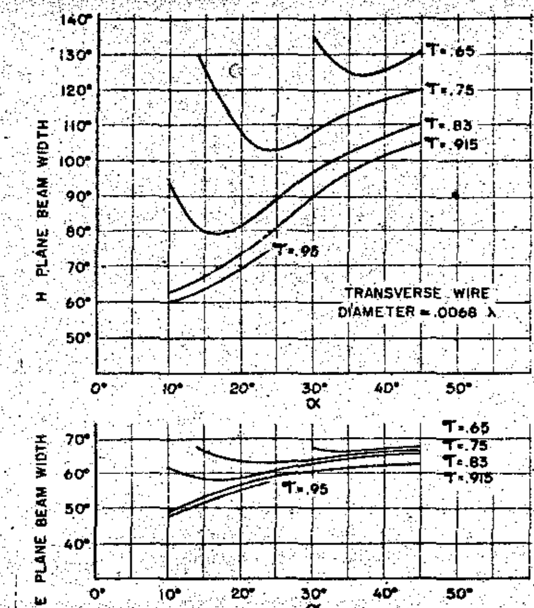


Fig. 4. Single-element beamwidths vs. α with τ as parameter.

group pattern are directed at an angle above and below the horizon given approximately by $\sin^{-1}\left[\lambda/4d\,\sin\psi\right]$. This direction is approximately independent of the element beamwidth provided that 2ψ is less than the element beamwidth.

In terms of the simple pattern description, the determination of the most economical antenna configuration boils down to an optimum choice of the two

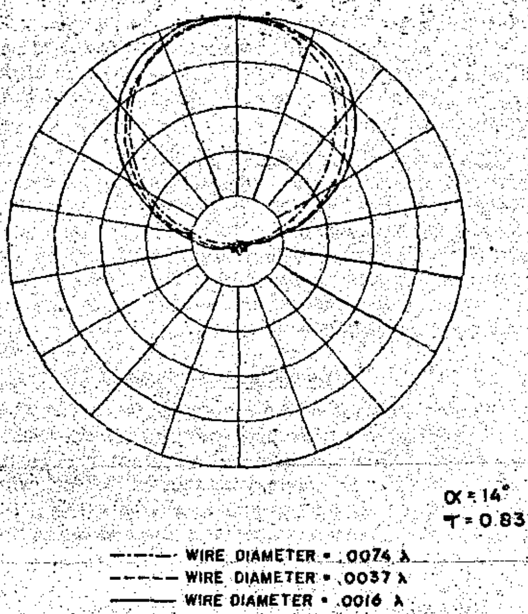


Fig. 5. Effect of transverse wire size on single-element H plane pattern.

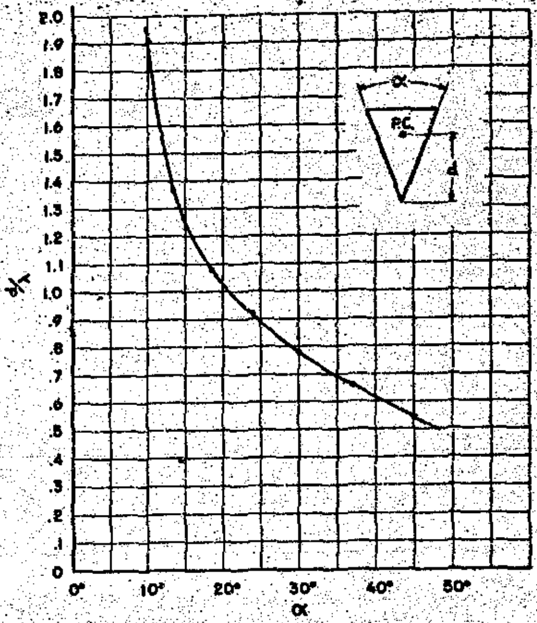


Fig. 6. Distance from apex to phase center in wavelength vs. α of single elements.

group patterns and their relative phasing. The phasing of the lower element is controlled by scaling the dimensions of the element according to the phase rotation principle discussed elsewhere[1,2]. Briefly, if all dimensions of an element are multiplied by $\tau^{\gamma/2\pi}$ and a new element is constructed to these dimensions, the relative phase of the radiation between it and the original element will be γ. Experimental results indicate that γ will vary ±15° around the design γ over a period of frequency.

At first thought, it might be assumed that γ should be chosen so that the exponential term is 0 when ϕ is equal to the design beam direction. However, calculations have shown that the array gain can be increased somewhat by letting γ take on values different from this. The reason for this is that the two groups of elements form in essence a two-element end-fire array with spacing equal to $\beta d(\cos\psi_1 - \psi_2)$. It is well known for end-fire arrays that the optimum phasing is not obtained when the elements are phased such that the radiation fields are in phase in the end-fire direction. Since the patterns for the two groups have different shapes and amplitudes, the conventional Hansen-Woodyard or Dolph-Tchebyscheff condition[3] cannot be applied. No new condition has been derived. Attempts to determine optimum group patterns have also been unsuccessful.

Because of this complexity and the large number of design parameters, it was decided to compute the radiation patterns and gains over a large range of the design parameters and then analyze these data to determine the most economical design for various distance ranges.

In the following sections the effect of the various parameters on calculated patterns is discussed. Comparisons between calculated and measured patterns are made and some other experimental aspects are touched on. Finally, designs that produce patterns for three path distance ranges are presented.

Theoretical Results

Radiation patterns and directivity in the H-plane of two-element arrays over perfect ground were calculated on an IBM 650 computer. Values of α from 10° to 45° were used for various values of ψ_1 and ψ_2. The element pattern used was that produced by the value of τ near the minimum that would allow frequency-independent operation. This is consistent with the desire to use a minimum amount of material in an antenna that if designed to be used down to 2 or 3 mc will be quite large. This value of τ for an α of 10° is 0.83; for an α of 14°, 0.80; for α's of 18.7°, 24° and 30°, 0.75; and for α's of 37° and 45°, 0.65. For purposes of computation the actual element pattern was approximated by elementary trigonometric functions as shown in figure 7. Approximation by series would have been more accurate, but it was felt that the small increase in accuracy that would be achieved did not warrant the additional computation time that would be required.

For each value of α, ψ_1 and ψ_2, the phase γ_1 of the first element with respect to the second was varied to secure a maximum value of H-plane directivity. It was found that by optimizing the phase, quite a large increase in directivity could be achieved. Figure 8 illustrates the effect of phasing on antenna pattern and directivity. It can be seen that in this case a 4-db increase in directivity was achieved by phasing over what would have been achieved had the elements been identical.

It was found that for a given value of ψ_1, as ψ_2 was increased from ψ_1, the directivity would increase up to a point and then diminish as ψ_2 got larger. The increase in directivity as ψ_2 is increased up to a point is due to an increase in aperture in the vertical

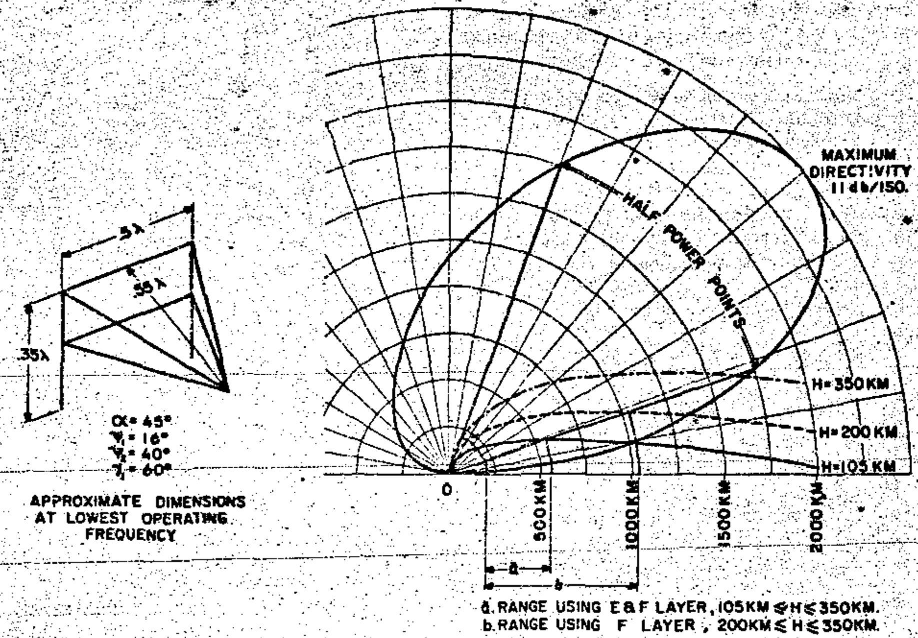


Fig. 11. Design parameters and characteristics of an antenna for use on paths of 200 km to 1,040 km in length.

here are theoretical, that is, they are not corrected for mutual coupling. *Figure 11 illustrates the elevation* plane pattern and the approximate dimensions at its lowest operating frequency of an antenna for use between 200 and 1040 km. Superimposed on the plot are curves giving the radiation elevation angle (for single hop) for a given virtual height and great circle path distance. The curve for a height of 105 km represents the average *height of the E layer. The curves for 350 km and 200* km represent the approximate maximum and minimum heights of the F layer. It can be seen that lines from the origin to the half-power points of the pattern intersect the virtual height curves at various distances. The line to the lower half-power point intersects the virtual

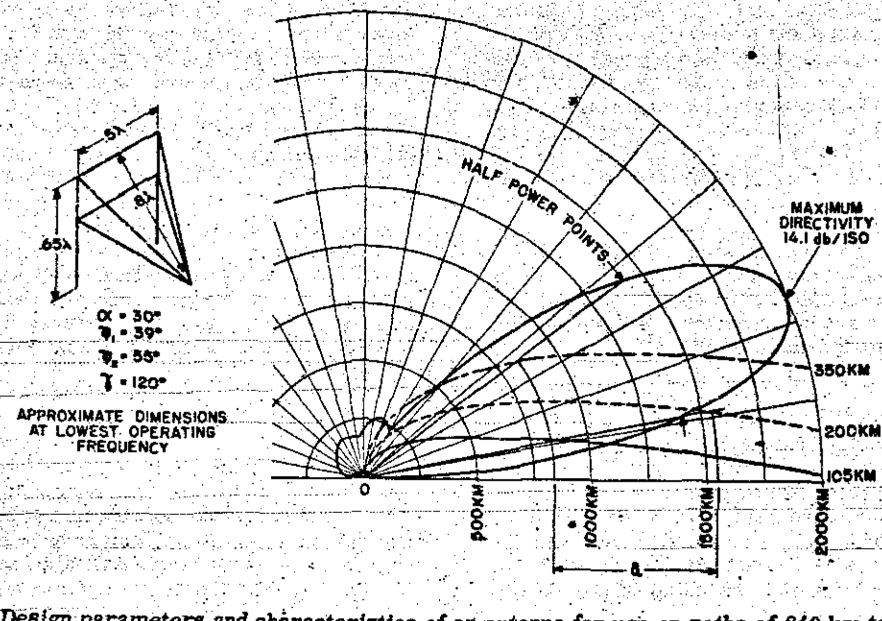


Fig. 12. Design parameters and characteristics of an antenna for use on paths of 840 km to 1,550 km in length.

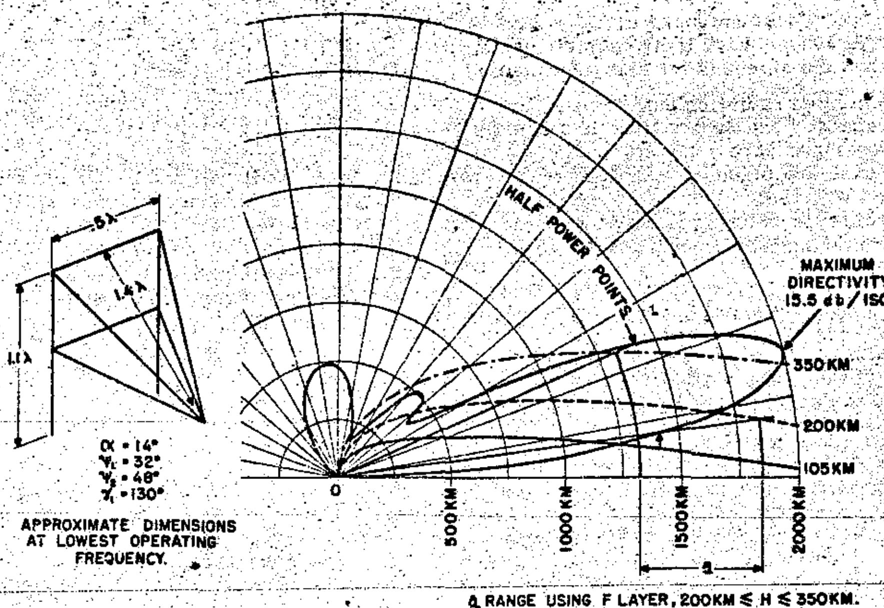


Fig. 13. Design parameters and characteristics of an antenna for use on paths of 1,320 km to 1,850 km in length.

height equals 350 km curve at about 1650 km; the virtual height equals 200 km curve at about 1040 km; and the virtual height equals 105 km curve at about 550 km. If the virtual height was always 350 km, then this antenna could be used up to ranges of 1650 km without having its directivity in the direction of the critical reflecting region more than 3 db down from its maximum directivity. If, however, the virtual height gets as low as 200 km, the path length for which this antenna would be suitable would be a maximum of 1040 km; if the virtual height was reduced to 105 km, the maximum range path over which this antenna could be used with less than 3-db degradation is reduced to 550 km. Similarly, a line drawn to the upper half-power point intersects the 350 km virtual height curve at about 200 km, limiting the minimum distance over which no more than 3-db degradation can be realized to that range. Consequently, this antenna can be used over paths from 200 to 550 km if the virtual height gets as low as 105 km. If the virtual height never gets below 200 km or if the maximum useable frequency for the 200-km layer is always higher than that for the 105-km layer, then this antenna is suitable for point-to-point paths that range in distance from 200 to 1040 km. The maximum directivity of this antenna is 11 db over that of an isotropic radiator. Therefore, over the recommended path lengths, the directivity will never be less than 8 db over an isotrope. To give an idea of the physical size of this antenna, if its lower operating frequency was 2 mc, its height would be about 170 ft and its width about 250 ft. Of course, if its lowest operating frequency was 4 mc, these dimensions would be halved.

Figures 12 and 13 give the same information for longer path lengths as figure 11 did for the short range antenna. For antennas recommended for use between 840 and 1550 km and between 1320 and 1850 km their maximum directivities are respectively 14.1 db and 15.5 db over that of an isotropic radiator. As would be expected, the dimensions of these antennas, as shown in these two figures, are progressively larger in terms of wavelengths. However, for these longer paths, it would not be expected that the lower frequencies in the high-frequency spectrum would be needed. Consequently, the sizes are not prohibitive. The patterns of all three of these antennas in the azimuth plane of maximum directivity are approximately the same as the element E-plane patterns. The absolute gains of these antennas were arrived at by comparing them to a standard gain horn and were measured to be within a few tenths of a db of the value estimated from the half-power beamwidths in both planes.

Conclusions

It has been shown that by inclining log periodic elements to ground so that their vertices are at ground level, elevation plane radiation patterns are achieved that are independent of frequency to within the same degree as the parameters of the ground over which they are located are independent of frequency. Information on element pattern and phase center and the effect of phasing is sufficient to design an antenna whose performance will not decrease the system gain over a given point-to-point circuit by more than 3 db. Three antenna designs have been recommended that will cover all point-to-point paths that lie between 200 and 1850 km apart. The directivities of these antennas vary from 11 db to 15.5 db over that of an isotropic radiator. Approximately another 3 db may be gained by arraying two of these arrays azimuthally so as to narrow the azimuth beamwidth. In this manner, gains of greater than 18 db over an isotrope can be achieved. For points that are more distant than 1850 km, antennas that produce radiation at lower elevation angles are required. These antennas have α angles of the order of 5° to 10° and have their back elements elevated higher than the antennas for shorter ranges.

Vertically polarized radiation patterns that are independent of frequency can be produced in a manner similar to that described here. The log periodic elements in this case are oriented with their transverse wires vertical and with their vertices on the ground. The analysis of this type of array is made more complex by the difficulty in taking into account the effect of imperfect ground.

Acknowledgment

Thanks are due to R. D. Gorman who fabricated and tested many of the antenna models and R. P. Rhodes who programmed the problem and secured the data from the IBM 650 computer.

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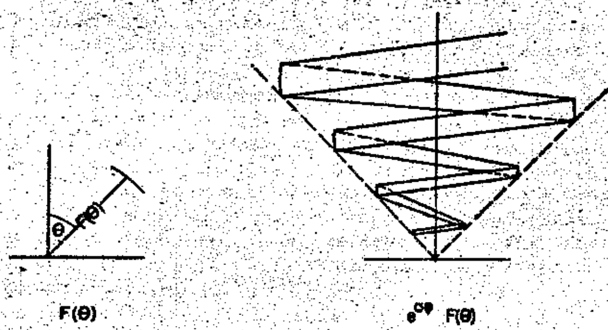

Fig. 3

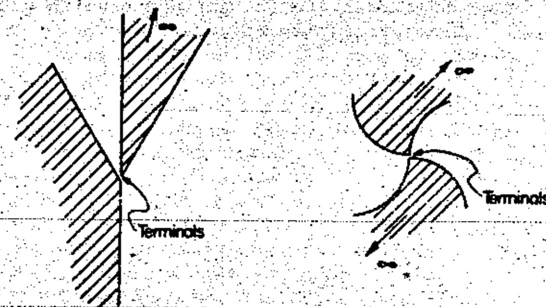

Fig. 6

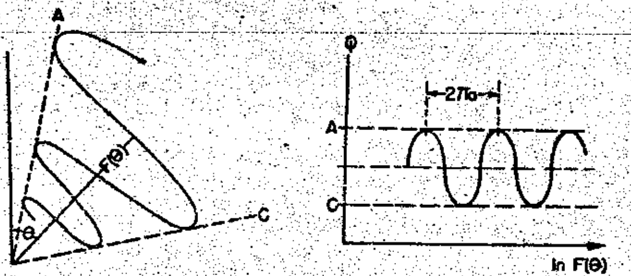

Fig. 4

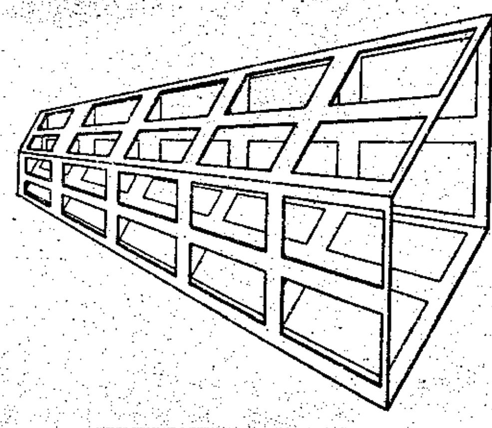

Fig. 7

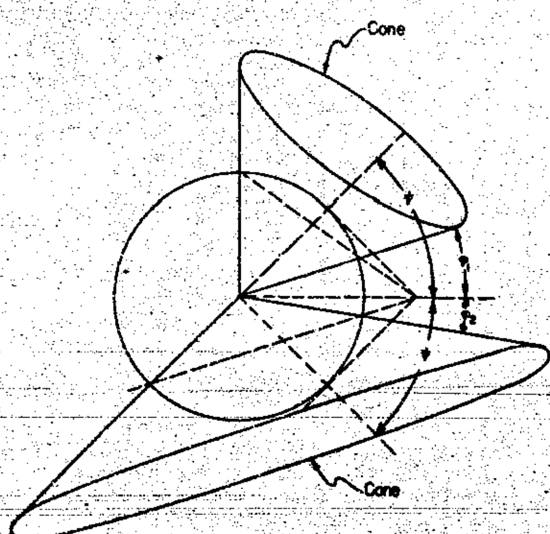

Fig. 5

BROADBAND LOGARITHMICALLY PERIODIC ANTENNA STRUCTURES*

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Summary

Antenna structures for which the input impedance and radiation patterns vary periodically with the logarithm of the frequency are described. For a particular class of these structures the variation of the electrical characteristics over a period is negligible, the result being an antenna for which the impedance and patterns are essentially independent of frequency over bandwidths greater than ten to one. The antennas are linearly polarized and bi-directional beams of approximately equal principal plane beamwidths are obtained. The beamwidth may be controlled to a considerable extent by the geometry of the structure.

Introduction

The design of broadband antennas has been the subject of many investigations over the years. Although some success has been achieved in obtaining broadband impedance characteristics, it is only recently that broadband impedance and pattern characteristics have been obtained. The use of the term broadband has been rather loose. It has, in the past, been used to describe antennas operating over a 2 or 3 to 1 band even though their patterns and impedance may vary widely over that range. Its use here is intended to have the meaning of performance which is essentially independent of frequency over the band of frequencies considered.

This investigation has been concerned with a new approach to the design of broadband antennas. The method consists of designing the antenna structure so that its characteristics are periodic with the logarithm of the frequency. If, then, the variation of the antenna characteristics over a single period are small or negligible the result is a broadband antenna. Although this may appear to be a backward approach, its merits will become evident when the results are examined. Suffice it to say, at this point, that bandwidths of ten to one have been obtained by this method with evidence that even much greater bandwidths are possible.

In the following sections, some design principles for broadband antennas will be described and the experimental results for logarithmically periodic structures will be presented.

Design Principles

The antennas described in this report embody three basic design principles. The first of these is the "angle" concept which is a design approach wherein the geometry of the antenna structure is described, so far as is practical, by angles rather than lengths. The second principle makes use of the fact that the input impedance of an antenna identical to its complement is independent of frequency. These first two principles are the subject of the preceding paper[1] and will be mentioned only briefly here. The third, which will be introduced in this report, consists of designing the antenna structure such that its electrical properties repeat periodically with the logarithm of the frequency.

An antenna described completely by angles, such as an infinite biconical antenna, would make an ideal broadband radiator since its operation is independent of frequency. In practice, however, the antenna must be of finite length and although the input impedance approaches a constant value with increasing frequency the radiation characteristics usually vary considerably due to what has been termed the "end effect". To date the most successful broadband angular antenna is the logarithmic spiral.[2, 3] Experimental results, over a ten to one bandwidth, have demonstrated that the patterns and impedance are essentially constant except for a rotation of the pattern with frequency. Apparently the "end effect" (or the effect of finite length) is negligible for the logarithmic spiral antenna.

The relationship of the impedance of a plane metal sheet antenna to its complementary slot antenna yields the basis of the second design-principle. If the shape is such that the metal sheet antenna is equal to its complement it will have a theoretical input impedance of 60π ohms, this result being independent of frequency. This gives a design approach for an antenna having a constant input impedance and although it also requires a structure of infinite extent it puts no restrictions on the shape of the elements other than the identical complement condition. A few examples of shapes having identical complements are shown in a figure of reference 1. These are generated by dividing a plane into four equal quadrants, the areas of which are alternately conductor and free space. The lines dividing the quadrants may take any shape whatsoever and a condition for equal

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**Now with Collins Radio Company, Cedar Rapids, Iowa.

complement is satisfied if when any dividing line is rotated 90°, about the center, it is coincident with the adjacent dividing line.

A logarithmically periodic antenna is defined here as an antenna structure for which the electrical properties vary periodically with the logarithm of the frequency. As will be shown, the logarithmically periodic antenna is a simple modification of an angular antenna. This modification is successfully used to reduce the "end effect". Although the modification causes, in general, a variation of the electrical properties with frequency, the magnitude of the variation is sometimes very small, the result being a broadband antenna.

A precise definition of logarithmically periodic structures may be obtained by considering the transformation

$$z = \ln w .$$

where w and z are complex numbers. Letting $w = \rho e^{j\Theta}$ and $z = x + jy$, it is easily shown that

$$\rho = e^x \text{ or } x = \ln \rho$$
$$\Theta = y .$$

With this transformation, circles and radial lines in the w plane are mapped into vertical and horizontal lines, respectively, in the z plane.

Let us consider now how the angular structures, in the w plane, are mapped into the z plane. As shown in figure 1, the "bow tie" antenna is transformed into horizontal parallel strips and the equiangular spiral antenna is transformed into inclined parallel strips. A logarithmically periodic structure is formed by introducing periodic variations on the parallel strips in the z plane and then transforming to the w plane. A few examples are shown in figure 2. Figures 2(a) and 2(b) show logarithmically periodic slot and tooth structures. The teeth in figure 2(c) are formed by sinusoidal curves in the z plane. It is also possible to introduce logarithmically periodic variations in the equiangular spiral but the usefulness of this is doubtful because the "end effect" for the spiral is practically negligible. It will be noticed that in the w plane all dimensions involved in the definition of a logarithmically periodic structure are proportional to their distance from the origin or feed point. In figure 2(a), the slots are bounded by the radii R_n, r_n and the subtended angle β. The radii R_{n-1}, R_n, R_{n+1}, . . . form a geometric sequence of terms where the geometric ratio is defined by

$$\tau = \frac{R_{n+1}}{R_n} .$$

The radii r_{n-1}, r_n, r_{n+1}, . . . form a similar sequence having the same geometric ratio. The width of the slot is defined by

$$\sigma = \frac{r_n}{R_n} .$$

It can be seen that infinite structures of this type have the property that, when energized at the vertex, the fields at a frequency f will be repeated at all other frequencies given by $\tau^n f$ (apart from a change of scale) where n may take on any integral value. When plotted on a logarithmic scale, these frequencies are equally spaced with a separation or period of ln τ; hence the name logarithmically periodic structures.

By probing the fields along several logarithmically periodic antenna structures, it has been found that the fields decay very rapidly after passing the point where a resonant discontinuity exists. The slots in figure 2(a) which are approximately a half-wavelength long and the teeth in figure 2(b) which are approximately one quarter wavelength long are considered to be resonant discontinuities. This decay of the fields past the point of a resonant discontinuity has been found to cause the "end effect" to be small or negligible for all logarithmically periodic structures tested.

There are an *unlimited number of different* logarithmically periodic antenna configurations possible. Because of the limited time available only structures having tooth-like discontinuities similar to that of figure 2(b) have been investigated to date.

Experimental Results

Description of Experimental Models

The antenna models investigated were constructed as shown in figure 3. The conducting sheet, from which the antennas were cut, was of light gauge copper sheet (approx. .020 inches thick). For extremely broad band applications, the thickness of the sheet should be made proportional to the distance from the vertex. The periodic discontinuities are in the form of teeth connected to a triangular conducting strip. The ratios τ and σ are determined as in the preceding section and it is seen that in order for the structure to be equal to its complement (in the infinite case), the requirement that the sum of the angles α and β be equal to 90° is necessary. A small area near the center was left as solid conductor since continuation of the obstacles, in that direction, requires an infinite number of teeth of zero width in the limit. The smallest teeth near the center will determine the upper frequency limit of periodic operation while the radius R_1 and presumably the angles α and β (length of teeth) will determine the lower frequency limit. For all models tested the ratio σ was taken equal to the square root of the ratio τ providing a ratio of tooth to slot width which is the same for all rows of teeth. The structure was fed across the vertex with a coaxial line laying on one of the triangular sheets. The outer conductor was bonded to the sheet and the inner conductor was extended across the vertex and connected to the other triangular sheet.

Performance of a Logarithmically Periodic Structure Identical to its Complement

A model of the type shown in figure 3 was constructed with the following values affixed to the variables:

$$R_1 = 10 \text{ inches}$$
$$\tau = .81$$
$$\sigma = \sqrt{\tau} = .9$$
$$\alpha = 45°$$
$$\beta = 45°.$$

The input impedance of the antenna was measured over the band 400 to 1600 mc. Figure 4 shows the results, plotted on a Smith impedance diagram, referred to the feed point and relative to 50 ohms. The input impedance is seen to be fairly constant with the locus of points centered about a resistance level of approximately 150 ohms. The discrepancy between this value and that of the predicted 60π ohms (189 ohms) is assumed to be due to the finite thickness and length of the elements, the presence of the feed cable and the unavoidable introduction of some series reactance at the feed point.

Radiation patterns of this structure were measured and found to be of fairly uniform shape over a better than 10 to 1 band. Figure 5 defines the coordinate system and figure 6 shows patterns in the two principal planes measured at frequencies of 1525 and 1700 mc. These patterns were found to be typical of the patterns in both planes at other frequencies. For the purpose of demonstrating the bandwidth obtained with this laboratory model, radiation patterns for the plane $\phi = 0$ are shown in figures 7 through 9 which cover a better than ten to one bandwidth. The pattern at 5000 mc (figure 9d) is seen to have degenerated somewhat in symmetry and this is felt to be due to the difficulty in maintaining perfectly coplanar elements when using such thin material for the construction.

Contrary to what might be expected, the maximum radiated power (along the z axis) has its electric field polarized in the yz plane, whereas for a similar structure, without the periodic obstacles, the normal polarization would be in the xz plane.

Performance with Variation of Tooth Angle α

Several additional models were measured which had tooth angles ranging from $\alpha = 20$ degrees to $\alpha = 60$ degrees. In each case the angle β was adjusted so that the sum of α and β was 90 degrees and the structure was thus maintained equal to its complement. The ratio τ was .81 for all models and σ was held equal to $\sqrt{\tau}$.

Input impedance and radiation patterns were measured for each of the antennas constructed. The impedance of each model was found to be essentially the same as that shown in figure 4, the only significant differences being the low frequency limits of constant input impedance. It was found that as the tooth angle α was decreased, holding R_1 fixed, the tooth lengths become shorter and the low frequency limit was raised. For example, the low frequency limit for nearly constant input impedance was approximately 800 mc for the structure with 20 degrees of teeth, whereas it was approximately 400 mc for 45 degrees of teeth. Radiation patterns, in the plane $\phi = 0$, typical of each antenna tested are shown in figures 10 through 12. Examination of these patterns indicates that the performance of the antenna is not peculiar to a particular tooth angle; in fact, the patterns are remarkably similar for all models tested. The largest observed differences are found in the relative amplitude of the E_θ polarization which is seen, in general, to increase with decreasing tooth angle. This is to be expected since if the angle α went to 0 degrees the radiation would be entirely of E_θ polarization. It is also observed that the E_ϕ patterns for $\alpha = 20$ degrees have degenerated somewhat in shape and this is also as would be expected.

Performance with Variation of the Ratio τ

The parameter τ determines, what may be considered, the bandwidth of a period of operation. That is,

$$\frac{f_1}{f_2} = \tau$$

where f_1 and f_2 are two frequencies exactly one period apart ($f_2 > f_1$). If the bandwidth of a period can be increased without causing significant variations in the radiation patterns, then the ratio τ can be decreased and the antenna will retain its broadband properties. One advantage to decreasing τ is that the number of teeth required between any two radii of the structure is reduced and construction is simpler near the feed point. That is, the teeth become fewer and have greater separation for the same values of R_1 and the minimum tooth spacings could become an important consideration for high power operation.

Models of the logarithmically periodic structure, of the type shown in figure 3, having geometric ratios τ equal to .70, .50, .25, and .15 were constructed. In each case the ratio σ was taken equal to $\sqrt{\tau}$ and the structure was made identical to its complement. The angles α and β were each 45 degrees and the radius R_1 was maintained at ten inches.

Radiation patterns of the models having τ equal to .70, .50, and .25 were measured and are shown in figures 13 through 16. Inspection of these patterns show the most significant effect of reducing the ratio τ to be an increase of the directivity of the antenna in both principal planes. The average half power beamwidths (this is the average of both principal plane patterns for several frequencies over the band) for the various values of τ are listed in table I.

TABLE I.
AVERAGE H. P. BEAMWIDTH VS. THE PARAMETER τ

τ	Average H. P. Beamwidth in Degrees
.81	73
.70	70
.50	55
.25	38

This result was an unexpected one and increases to a considerable extent the flexibility of logarithmically periodic antenna structure of this type. The ratio τ becomes a parameter for controlling the beamwidth of the antenna without affecting its other characteristics. Since an increase in directivity generally corresponds to an increase in physical aperture size, it is to be expected that the lower limit of frequency independent operation, for a given radius R_1, will be raised. This was found to be the case although not demonstrated by the data presented. For example, the antenna having τ equal to .25 has fairly constant half-power beamwidths of approximately forty degrees, as shown, from 900 mc/sec up in frequency. The beamwidth, however, was found to broaden rapidly below 900 mc/sec to approximately seventy degrees at 700 mc/sec. The frequency of 900 mc/sec is thus considered the low limit of frequency independent operation for the antenna having τ equal to .25 and R_1 equal to ten inches. The low frequency limits of antennas having τ equal to .70 and .50 with R_1 equal to ten inches were not investigated but are expected to be between 450 and 900 mc/sec, which represent these limits for τ equal to .81 and .25 respectively. The result of this is simply that, in order to increase the directivity of the antenna for a given band of frequencies, the minimum size of the aperture must be increased as well as reducing the ratio τ.

The patterns shown in figure 17 are for τ equal to .15. These patterns were measured in the plane $\phi = 0°$ and as is seen, the performance has deteriorated somewhat. The E_θ polarization is much higher at some frequencies and the general shape of the pattern is seen to vary.

The effect of varying the tooth angle has not been investigated for τ of ratios other than .81 but it is expected that similar changes in performance characteristics would occur.

Periodic Structures Not Having Identical Complement

All of the antennas discussed thus far have had shapes identical to their complements and, as a result, have had input impedances near 180 ohms. For the best match then, the line feeding the antenna must have a characteristic impedance near this value. It would be desirable if the input impedance of the periodic structure could be varied to match its characteristic impedance to that of available transmission lines.

A model of the periodic antenna was constructed in order to determine whether the input resistance level could be reduced without interfering with the broadband properties. This was accomplished by increasing the angle β without changing α. The expected result of this would be an increase in the capacity of the structure and a corresponding decrease in the characteristic impedance. The model tested was constructed with the following values for the various parameters,

R_1 = 10 inches
τ = .81
σ = .9
α = 45°
β = 75°

Since the sum of the angles α and β is not equal to 90°, the antenna is not equal to its complement and the input impedance would be expected to be some value other than 189 ohms.

It was found that the mean resistance level had been reduced to approximately 100 ohms, but that the impedance locus had spread out. This result led to the conclusion that it would be best to use a structure identical to its complement and fed by a wide band tapered or stepped transformer.[4,5] Radiation patterns were measured over the frequency band 1000 to 1500 mc covering more than one period of the structure. No degradation of the patterns, compared to the identical complement antennas was observed.

Conclusions

The experimental results obtained during this investigation demonstrate a promising new approach to the design of antennas whose performance is essentially independent of frequency. The method described provides a means of obtaining linearly polarized, bidirectional antennas having approximately equal and constant principal plane beamwidths over bandwidths of greater than ten to one. The directivity, which is essentially constant for a given geometry, can be varied over a substantial range by the alteration of a single parameter. This result is of particular significance since it provides a means of controlling the beamwidth of the antenna separate from other considerations with the exception of overall size for a given band.

The major portion of this work has been restricted to investigation of two dimensional structures of the type shown in figure 3. This class of antenna structures displays remarkably broadband characteristics over large ranges in the various design parameters but represents only one of an unlimited number of possible configurations which embody the logarithmically periodic concept. There is, at this time, no evidence to suggest that the structures of the particular type investigated are of optimum shape to give the best broadband results. It is possible that improved performance or perhaps some new characteristics are available through variations in the general configuration. At least one such possible variation is suggested in figure 2(c). The design principles can also be extended to three dimensional structures.

Acknowledgement

The authors gratefully acknowledge the assistance of Mr. N. Kuhn and Mr. W. James, in obtaining the experimental data necessary to carry out this investigation, and the suggestions of Professor V. H. Rumsey, which aided in forming the original concepts leading to this design approach. Appreciation is also extended to Mr. V. Rash, who assisted in constructing the many experimental models needed during the course of this work.

References

1. V. H. Rumsey, "Frequency Independent Antennas", Paper #339, National IRE Meeting, New York, 1957.

2. J. D. Dyson, "Equiangular Spiral Antenna", Fifth Annual Symposium on the U. S. A. F. Antenna Research and Development Program, Robert Allerton Park, University of Illinois, Oct. 1955. (Abstract classified secret.)

3. J. D. Dyson, "An Experimental Investigation of Equiangular Spiral Antenna", Sixth Annual Symposium on the U. S. A. F. Antenna Research and Development Program, Robert Allerton Park, University of Illinois, Oct. 1956, (Abstract classified secret.)

4. S. B. Cohn, "Optimum Design of Stepped Transmission-Line Transformers", Trans. IRE, V. MTT-3, April 1955, p. 16

5. R. W. Klopfenstein, "A Transmission Line Taper of Improved Design". Proc IRE., V44, Jan 1956, p. 31.

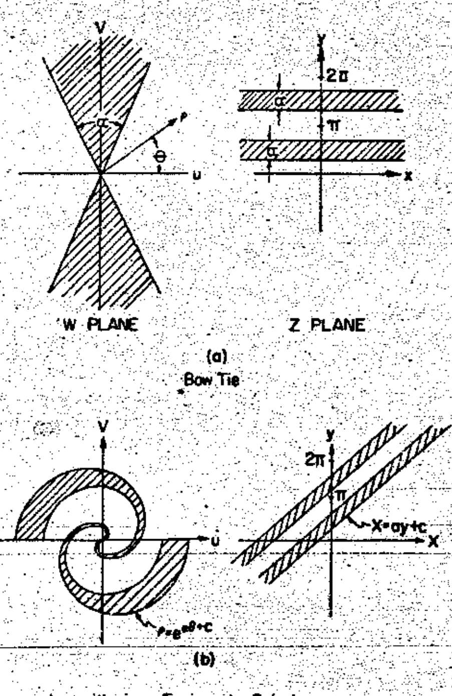

Fig. 1
Angular structures.

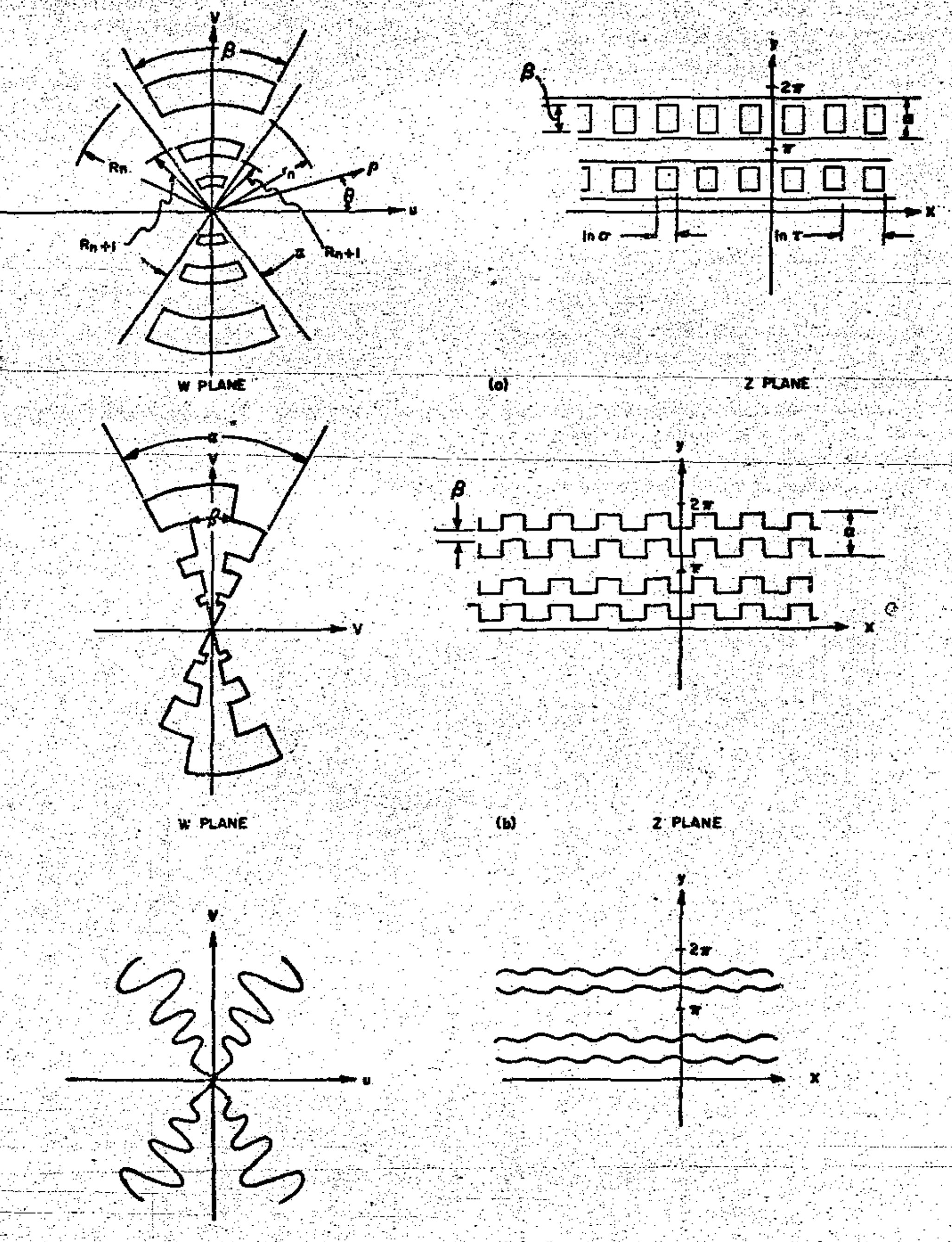

Fig. 2
Logarithmically periodic structures.

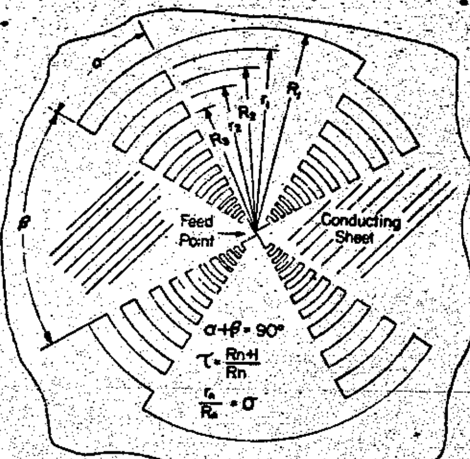

Fig. 3
Experimental model configuration.

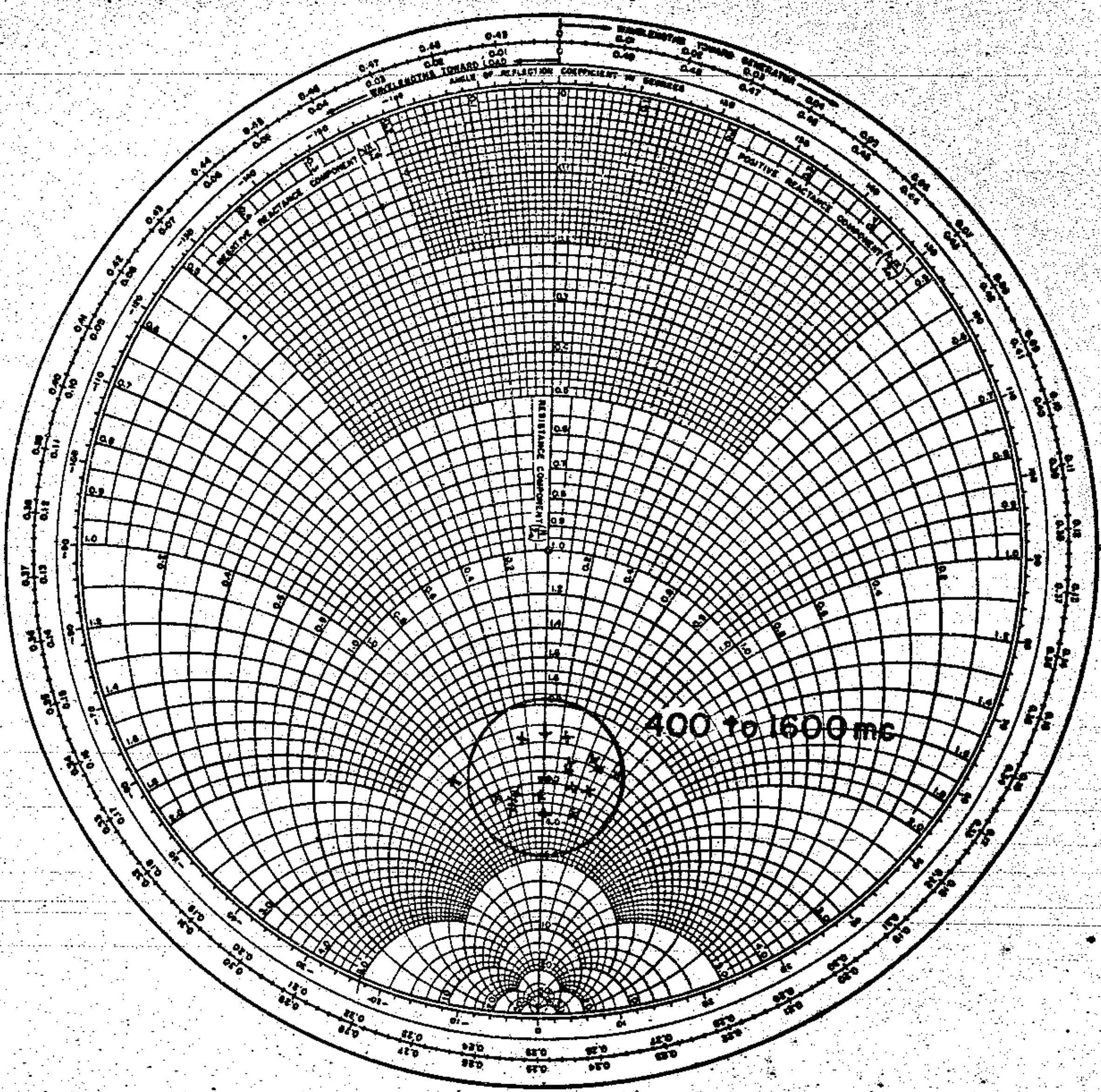

Fig. 4
Input impedance of self complementary model.

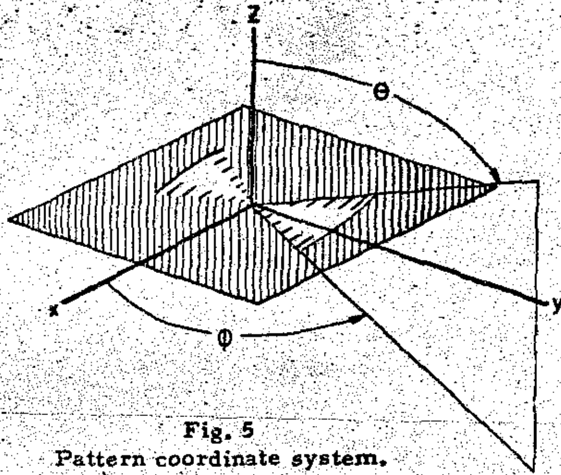

Fig. 5
Pattern coordinate system.

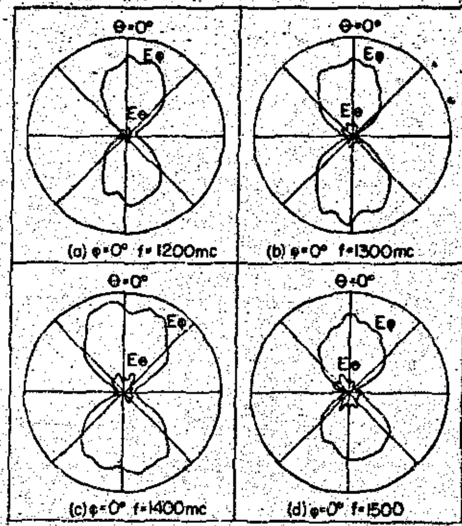

Fig. 8
Radiation patterns for $\alpha=\beta=45^{\circ}$, $\tau=.81$.

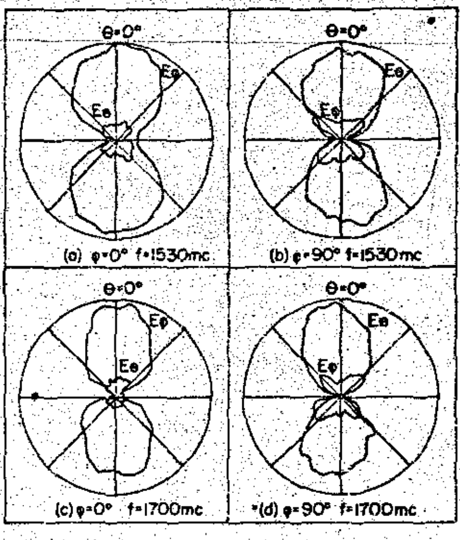

Fig. 6
Typical principal plane radiation patterns for $\alpha=\beta=45^{\circ}$, $\tau=.81$.

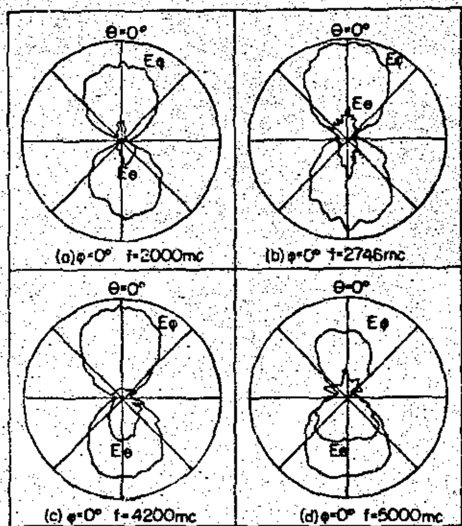

Fig. 9
Radiation patterns for $\alpha=\beta=45^{\circ}$, $\tau=.81$.

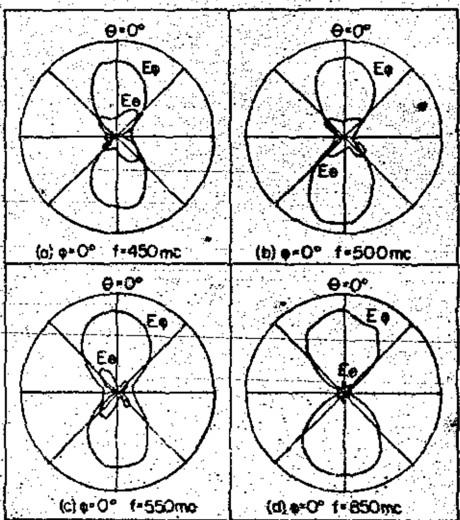

Fig. 7
Radiation patterns for $\alpha=\beta=45^{\circ}$, $\tau=.81$.

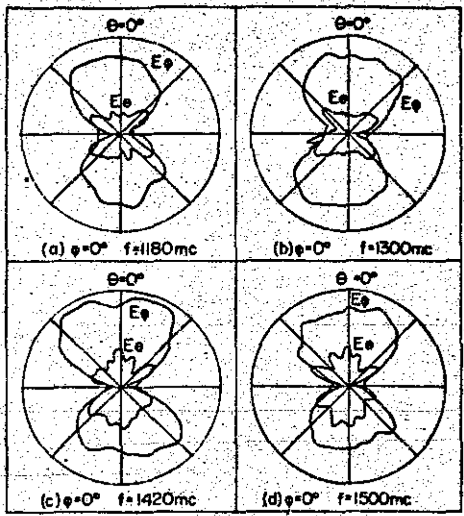

Fig. 10
Radiation patterns for $\alpha = 20^\circ$ $\beta = 70^\circ$ $\tau = .81$.

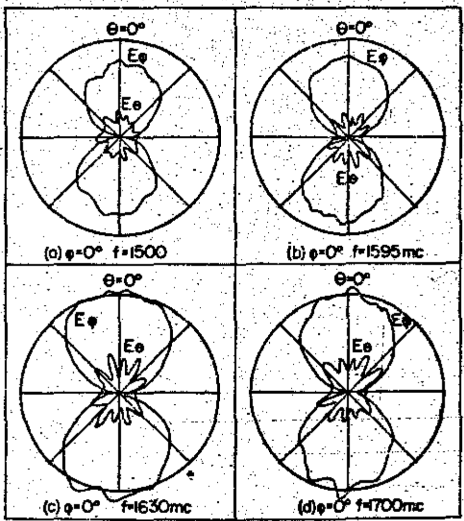

Fig. 11
Radiation patterns for $\alpha = 30^\circ$ $\beta = 60^\circ$ $\tau = .81$.

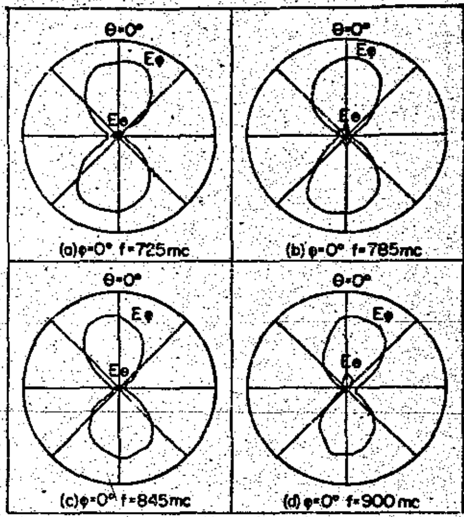

Fig. 12
Radiation patterns for $\alpha = 60^\circ$ $\beta = 30^\circ$ $\tau = .81$.

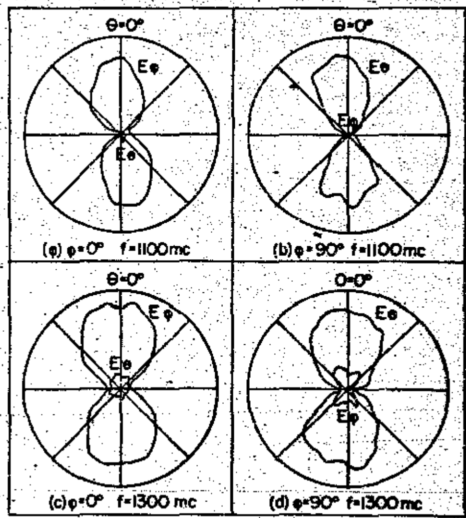

Fig. 13
Radiation patterns $\alpha = \beta = 45^\circ$ $\tau = .70$

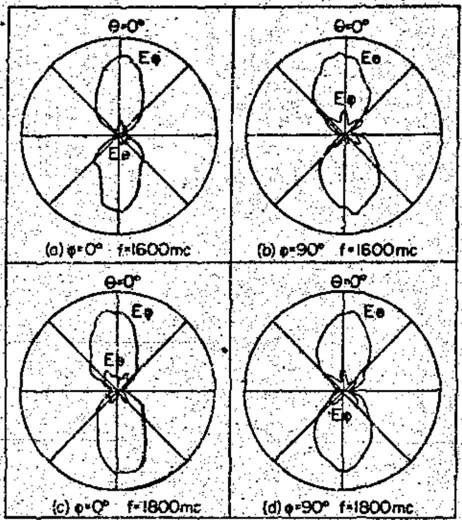

Fig. 14
Radiation patterns $\alpha = \beta = 45^{\circ}$ τ = .50.

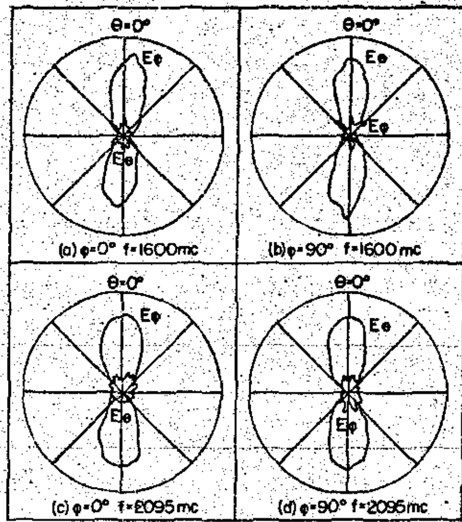

Fig. 16
Radiation patterns $\alpha = \beta = 45^{\circ}$ τ = .25.

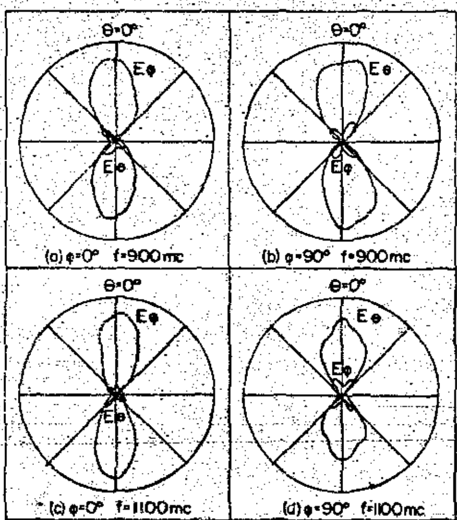

Fig. 15
Radiation patterns $\alpha = \beta = 45^{\circ}$ τ = .25.

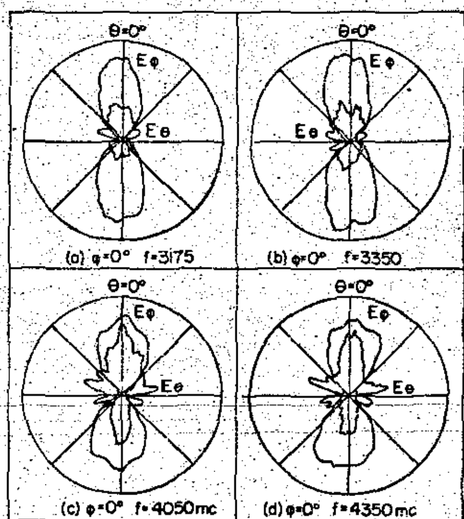

Fig. 17
Radiation patterns $\alpha = \beta = 45^{\circ}$ τ = .15.

LAW OFFICES

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE

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May 2, 1967

Cy Belmont
5/5/67

Mr. Robert H. Rines
Rines and Rines
No. Ten Post Office Square
Boston, Massachusetts 02109

Dear Bob:

I have borrowed from Keith Kulie the transcript of testimony in the Winegard suit and the Lawler deposition taken by JFD. I also have a copy of the Collins Radio publication by DuHamel and Orr, March 31, 1958. Shall I hold this material here or send it to you?

It might save time at the trial to select now the material you would like to bring in by stipulation.

Very truly yours,

Dick

Richard S. Phillips

RSP:iag

McNENNY, FARRINGTON, PEARNE & GORDON
920 MIDLAND BUILDING
CLEVELAND, OHIO 44115

RECEIVED
MAR 22 1967
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

March 21, 1967

Richard S. Phillips, Esq.
Hofgren, Wegner, Allen, Stellman & McCord
20 North Wacker Drive
Chicago, Illinois 60606

C O P Y

Dear Dick:

Many thanks for your two letters of March 16th and your subsequent letter of March 20 sending me copies of the Mayes depositions taken on behalf of Blonder-Tongue and exhibits referred to in the course of those depositions. There is a considerable amount of information in those depositions of interest to me in connection with The Finney Company suit. However, one of the portions of particular interest relates to the report Exhibit B-49 describing work at Collins Radio and showing how the Isbell antenna was derived from the wire structure of DuHamel. Since I do not yet have a copy of that particular exhibit, I would greatly appreciate your supplying me with a copy or loaning me your copy for duplication in our office if it is particularly voluminous.

I assume that Bob Rines brought you up to date on our conference at the Cleveland Airport while he was en route to Boston early last week. We reviewed together at that time some of the evidentiary material I have collected and which I thought would be of particular interest to him. Since much of that material is in the affidavit of Marjorie Johnson, her testimony at the trial of the Winegard suit, and the testimony of Dr. Mayes and Mr. Lawler taken on behalf of The Finney Company, copies of which you may already have procured from Keith Kulie, I have not duplicated that material for you or Bob. It seemed that I might only duplicate material already in your possession if I should do so. However, much of the material of interest will be incorporated in the Motion for Summary Judgment I am now preparing and hope to complete shortly. I promised Bob to send him a copy of that motion for comment before I file it.

I do not recall the dates in the near future when Bob plans to be out of the country again. It would be helpful to me to know those dates so that, if possible, I can get a copy of my Motion for Summary Judgment in his hands for comment before he leaves.

Sincerely,

John

JFP:jh

cc: Robert H. Rines, Esq.
Rines & Rines
10 Post Office Square
Boston, Massachusetts

LAW OFFICES

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AXEL A. HOFGREN
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STANLEY C. DALTON
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CHARLES L. ROWE
JAMES R. SWEENEY
W. E. RECKTENWALD
J. R. STAPLETON

WILLIAM R. McNAIR
JOHN P. MILNAMOW
DILLIS V. ALLEN
W. A. VAN SANTEN, JR.
JOHN R. HOFFMAN

March 21, 1967 Entd

Mr. Robert H. Rines
Rines and Rines
No. Ten Post Office Square
Boston, Massachusetts 02109

Dear Bob:

* I enclose a copy of a motion by JFD to dismiss its crossclaim with prejudice.

Very truly yours,

Dick

Richard S. Phillips

RSP:iag

* Enclosure

cc: Mr. I. S. Blonder (*)

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WILLIAM R. McNAIR
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W. A. VAN SANTEN, JR.
JOHN R. HOFFMAN

March 24, 1967

Mr. Robert H. Rines
Rines and Rines
No. Ten Post Office Square
Boston, Massachusetts 02109

RE: UIF v. BT v. JFD

Dear Bob:

I talked this afternoon with Pete Mann regarding the drawings we have supplied of Blonder-Tongue antennas. He inquired whether you would be willing to stipulate specific models as representative of all of them, so far as infringement is concerned. We also discussed the possibility of a stipulation that the element length and spacing is in accordance with the log periodic formula. It is my understanding that the dimensions do fit the formula and that the only question regarding infringement is with regard to the co-planar limitation in the claims. Would you be willing to stipulate to this?

Very truly yours,

Dick

Richard S. Phillips

RSP:iag

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J. R. STAPLETON

WILLIAM R. McNAIR
JOHN P. MILNAMOW
DILLIS V. ALLEN
W. A. VAN SANTEN, JR.
JOHN R. HOFFMAN

March 23, 1967

Mr. Robert H. Rines
Rines and Rines
No. Ten Post Office Square
Boston, Massachusetts 02109

Dear Bob:

I talked with John Pearne and got from him a list of the prior art he feels to be most pertinent. I am incorporating this in the list of exhibits.

He had talked to Ray DuHamel by telephone sometime ago and decided against using him as a witness. Ray has some financial interest in the patents and gave the indication that he might not be completely unprejudiced. John has not talked with Isbell or Carrel. I listed all three as possible witnesses.

Very truly yours,

Dick

Richard S. Phillips

RSP:iag

From Hofgren, Wegner, Allen . . .

R.S.P. J.R.H.

3

UNITED STATES DISTRICT COURT, NORTHERN DISTRICT OF ILLINOIS
EASTERN DIVISION

Name of Presiding Judge, Honorable BERNARD M. DECKER

Cause No. 66 C 567

Date March 22, 1967

Entered

Title of Cause: University of Illinois Foundation v. Blonder-Tongue v. JFD

Brief Statement of Motion: Motion to Dismiss Cross-Claim

MAR 24 196_
HOFGREN, WEGNER, ALLEN ... McCORD

The rules of this court require counsel to furnish the names of all parties entitled to notice of the entry of an order and the names and addresses of their attorneys. Please do this immediately below (separate lists may be appended).

Names and Addresses of moving counsel:
Myron C. Cass
SILVERMAN & CASS
105 West Adams Street, Chicago, Illinois 60603

Representing: Counterclaim Defendant, JFD ELECTRONICS CORPORATION

Names and Addresses of other counsel entitled to notice and names of parties they represent:
Hofgren, Brady, Wegner, Allen, Stellman & McCord
20 North Wacker Drive, Chicago, Illinois 60606
Defendant, BLONDER-TONGUE LABORATORIES, INC.
and
Merriam, Marshall, Shapiro & Klose
30 West Monroe Street, Chicago, Illinois 60603
Plaintiff, THE UNIVERSITY OF ILLINOIS FOUNDATION

Reserve space below for notations by minute clerk

On motion JFD Electronics Corp., Counterclaim Deft, order cross-claim hereby dismissed with prejudice & without costs.

Decker, J.

Xerox copy to R.H. Rines 3/24/67

RECEIVED
MAR 27 1967
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

Hand this memorandum to the Clerk.

[illegible]

[illegible]

[illegible] Electronics Corporation [illegible]

[illegible]

[illegible]

Declaratory judgment — [illegible]

[illegible]

[illegible]

Licensee may not take advantage of the Declaratory Judgment Act to obtain [illegible] of liability to defendant for [illegible] potential infringement in the past when defendant was [illegible] for such [illegible] patent, [illegible] plaintiff's liability to defendant as to future [illegible] has been [illegible] ... of its right in order to [illegible] ... there is a [illegible] ... exclusive license for [illegible] ... [illegible] for purpose of declaratory judgment to determine [illegible] validity without joinder of owner; [illegible] would have right to defend validity without joinder of owner [illegible] would require joinder over [illegible]; even if owner is not indispensable, [illegible] interested, [illegible] entertain a declaratory judgment [illegible] dismissing declaratory judgment [illegible]

Action by [illegible] Corporation against TRW Electronics Corporation, University of Illinois Foundation, and University of Illinois for declaratory judgment of patent invalidity and noninfringement, under 28 U.S.C. 2201 [illegible]. On motion by TRW Electronics Corporation to dismiss portion of complaint. [illegible] granted.

[illegible] USPQ [illegible]

[illegible] (Counsel [illegible]) both of New York [illegible], for plaintiff.

[illegible]

[illegible]

In [illegible] declaratory judgment of patent invalidity and noninfringement [illegible] decision of this Court [illegible] complaint [illegible] defendant [illegible] [illegible]

[illegible]

[illegible]

cc, To Bol[illegible]
3/17/67

OSTROLENK, FABER, GERB & SOFFEN

ATTORNEYS AT LAW
TEN EAST FORTIETH STREET
NEW YORK, N. Y. 10016

SAMUEL OSTROLENK
SIDNEY G. FABER
BERNARD GERB
MARVIN C. SOFFEN
SAMUEL H. WEINER
JEROME M. BERLINER
LOUIS WEINSTEIN
MARC S. GROSS
STEWART J. FRIED

MICHAEL S. PINELES
(ILL. & PA. BARS ONLY)
ROBERT C. FABER

PATENT CAUSES

AREA CODE 212
MURRAY HILL 5-8470

CABLE ADDRESS
"OSTROFABER" NEW YORK

March 13, 1967 Enr.

Robert H. Rines, Esq.
Rines and Rines
No. Ten Post Office Square
Boston, Massachusetts

Re: JFD 3.223 - UIF v. B-T v. JFD
66-C-567

Dear Bob:

On February 28, 1967, I sent you an original and two copies of a Stipulation concerning facts referred to in my prior letter dated February 20, 1967 with the expectation that you would execute such affidavit on behalf of your client.

My records indicate that we have not received a reply from you to the aforesaid letter of February 28, 1967.

Kindly give this matter your immediate attention since a relatively short time remains to prepare for trial of this Action.

Sincerely,

OSTROLENK, FABER, GERB & SOFFEN

Jerry
Jerome M. Berliner

JMB:cg

LAW OFFICES

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE
CHICAGO 60606

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AREA CODE 312

March 27, 1967

Mrs. Helen K. Thomas
219 South Dearborn Street
Chicago, Illinois 60604

RE: University of Illinois Foundation v.
Blonder-Tongue v. JFD

Dear Mrs. Thomas:

On behalf of Blonder-Tongue, we have agreed to waive the signature of Mr. Blonder to the transcript of his deposition, taken last October.

Very truly yours,

Richard S. Phillips

RSP:iag

cc: Mr. Myron C. Cass
Mr. Basil P. Mann
Mr. Robert H. Rines

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March 27, 1967

Mr. Isaac S. Blonder
Blonder-Tongue Laboratories, Inc.
9 Alling Street
Newark, New Jersey 07102

Dear Ike:

I had a call from Mann questioning whether he had received all of the drawings relating to the physical dimensions of the Ranger antennas. He has two specific questions. The Color Ranger 7 is shown on your drawing 2187-1G as having only three elements. Is this correct?

The materials you have sent me do not include dimensions for Color Ranger 15.

Very truly yours,

Richard S. Phillips

RSP:iag

cc: Mr. Robert H. Rines

LAW OFFICES
HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD
20 NORTH WACKER DRIVE
CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

March 27, 1967

Mr. Basil P. Mann
Merriam, Marshall, Shapiro & Klose
30 West Monroe Street
Chicago, Illinois 60603

Mr. Myron C. Cass
Silverman & Cass
105 West Adams Street
Chicago, Illinois 60603

Gentlemen:

In accordance with the pre-trial order, I enclose * a list of exhibits and a list of witnesses which Blonder-Tongue presently contemplates presenting at the trial. If any changes should be necessary, you will be informed promptly.

Very truly yours,

Richard S. Phillips

RSP:iag

* Enclosures

cc: Mr. Robert H. Rines