BT

July 29, 1966
DATE PREPARED

July 29, 1966
EFFECTIVE DATE

REQUEST FOR CHANGE OF STATUS

TC#	LAST NAME	FIRST NAME	DATE OF EMPLOYMENT	JOB TITLE	COMPANY	DEPT.
1654	BALASH	Steve	8-5-63	Prod. Mgr. Home Prod.	BT Labs	Metals

☐ **TRANSFER AND/OR TITLE CHANGE** PROPOSED TITLE _____ DEPT. _____ COMPANY _____

Reason/Remarks _____

☐ **SALARY CHANGE** Present Rate _____ Proposed Rate _____

Reason/Remarks _____

☐ **CHANGE OF NAME, ADDRESS AND TELEPHONE NUMBER**

New Name _____ Telephone No. _____

New Address _____

Change in Insurance Coverage _____

SEPARATIONS

☐ **LEAVE OF ABSENCE:** From _____ To _____

Reason _____

☒ **TERMINATION** ☒ Resignation ☐ Discharge ☐ Layoff Last Day Worked July 29, 1966

Reason for Termination Felt unable to be creative at BT. Too restricted by company management.

FINAL RATING (hourly employees only)

FINAL RATING	QUANTITY OF WORK	QUALITY OF WORK	ADAPTABILITY	JOB KNOWLEDGE	ATTENDANCE	ATTITUDE
EXCELLENT				X		
GOOD	X				X	X
FAIR		X	X			
POOR						

CLEARANCE:

Badge ☐ Tools ☐ Credit Cards ☒

Agency Fees ☐ Equipment ☐ Cash Advances ☒

Rehire ✓ Yes _____ No

Reason Left unlikely for promotion with New Manager

☐ **OTHER CHANGES AND EXPLANATIONS:** _____

APPROVALS DEPARTMENTAL _____ PERSONNEL _____ WAGE COMMITTEE _____ MANAGEMENT _____ UNION _____

Follow Up
8/10

August 3, 1966

Mr. Jerome N. Balash
116 Oakland Avenue
Maplewood, New Jersey

Dear Jerry,

At your leisure, would you please return the plant key? It was mentioned Friday when you left, but it must have slipped your mind.

Hope everything is going well with you.

Regards,

R. B. Helhoski

RBH:dd

Harry J
In grateful Tribute

EXECUTIVE PERFORMANCE APPRAISAL

OF

Jerome Balash

June 1966 (Prepared 5/24/66)
DATE RATED

R B Wielowski
RATED BY

Required
Approved By: **Date**

Date Discussed with Employee

JOB DESCRIPTION

1. Date the job description was last reviewed. FEB 1966

2. Is it correct as it stands? Yes If not, make necessary changes or additions and bring it up to date.

3. Does it adequately list the responsibilities of the job? ~~Yes~~ No
ELIMINATE ANTENNA SALES

4. What are the standards of performance by which you will judge performance?

RELATED TO UHF CONVERTER & DISTR. PRODUCTS:

(a) SALES INCREASE BY PRODUCT LINE.

(b) ACCURACY OF SALES PROGRAMS EFFECTING THESE PRODUCT LINES.

(c) ABILITY TO SELL RSM/REP ON HIS PROGRAM.

(d) ABILITY TO TRANSLATE FIELD NEEDS.

(e) SALES TO KEY ACCTS.

(f) ABILITY TO GUIDE BT AS TO NEW PRODUCTS.

(g) ABILITY TO CREATE EFFECTIVE PROGRAMS WITHIN THE LIMITS SET BY MANAGEMENT.

Does he know them? Yes When were they discussed? Feb 1966

Job Performance

How has he performed the duties, responsibilities of his job? (List the measures of each key element in the job description.)

(A) SALES ARE HOLDING ON CONVERTERS & DOWN ON BOOSTERS, but up on Complans.

(B) His SALES PROGRAMS ARE TOO COMPLICATED & THEREFORE LOOSE EFFECTIVENESS

(C) He SELLS HIS program to REP/RSM WITH STRENGTH.

(D) He SELLS KEY ACCTS WELL

(E) He WRITES A GOOD PROGRAM, BUT CAN NOT STAY WITHIN THE LIMITS SET BY MANAGEMENT.

How well has he accomplished the goals established at the last review?

FINE -
PRIMARILY, HE WAS ASKED TO WRITE A THOROUGH & COMPLETE PROGRAM - HE IS DOING THIS. HE MUST NOW LEARN to LIVE WITHIN LIMITS SET & to CREATE FAR SIMPLER PROGRAMS.

A. What is your overall rating of this employee?

good.

He is moody & at times very hard to control. He is an excellent salesman. He knows his market & product but can not create simple uncomplicated programs.

B. How has his performance changed since his last rating?

He is writing formal programs.

C. What are his major strong points?

PRODUCT KNOWLEDGE
MARKET KNOWLEDGE
SALES ABILITY
ABILITY to HOLD group MEETINGS

D. What are his major shortcomings?

TOO CREATIVE
NO SENSE OF VALUE.
CAN NOT STAY WITHIN LIMITS - PERFORMANCE OR DOLLARS

E. What are the details of the self-improvement plan mutually agreed to?

1. What new areas will he work in?

NONE -
HE WILL CONCENTRATE ON NEW UHF MARKETS

2. How are you planning to broaden his experience and knowledge?

NO

3. What special assignments have been scheduled and for what purpose have they been assigned?

SELL EACH UHF MARKET TO MAX POTENTIAL.

4. What do you expect him to accomplish during the coming year?

- GET ALL THERE IS IN UHF
- PUT HIS STRONGLY IN CONTENTION FOR DIST. PRODUCTS.

5. What formal training have you agreed upon?-- what courses--schools--programs--will he attend--what special books or magazines, etc?

NONE

6. What dates have been set for review of progress towards goals?

JUNE 1967

BLONDER-TONGUE LABORATORIES, INC.
ADVERTISING DEPARTMENT

From AILEEN HAGUE *Date*.....

To.....

Re.....

Jack...

Is this on your or Jerry's desk?

See attached

J SALASH

Hammond Electronics Inc.

WHOLESALE ELECTRONIC SUPPLIES — P. O. BOX 3671 • ORLANDO, FLORIDA

May 31, 1966

Blonder Tongue
9 Alling St
Newaark, N.J.

Gentlemen:

In checking our records, we do not find that we have received your credit memo or replacement for merchandise returned to you on our Debit Memo # 5040 Dated 4-11-66.

We have enclosed a copy of this return for your convenience. Will you please let us have your prompt reply?

Very truly yours,

HAMMOND ELECTRONICS, INC.

W. L. Holbrook
Manager

WLH:jd

Enclosure

Hammond Electronics, Inc.

No. 5040

WHOLESALE RADIO, TV AND ELECTRONICS

P. O. BOX 3671 ORLANDO, FLORIDA PH. 241-6601

Debit Memorandum

Merchandise Returned For Credit

To Blonder Tongue

Date 4-11-66

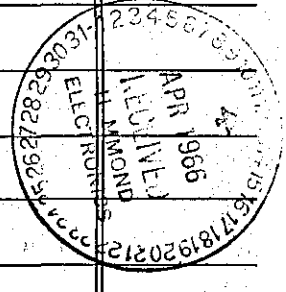
Address 9 Alling St.
Newark N.J.

From Jacksonville
(Store Location)

Return to

Via:

Quantity	Unit	Description	Price	Amount
		Adv Credit for McDuff		
		March 1966		
				$388.90
		Note:		
		McDuff sent a statement for	654.80	
		but they had only 388.90 credit		
		due until they purchase		
		more converters		
		JWB		



This Number Must Appear on Your Credit Memorandum

By J.W. Bryan Jr

ALPHABETICAL COPY

5/3/66

Jerry Balash

HammondElectronics claim
#5040 (McDuff, March)
$388.90

On April 18 I advised you that I couldn't authorize this further claim as we were already overspent in this market and suggested you discuss the matter with Dick Helhoski.

What decision was reached?

JEL/ah

J. E. Loog

memo from J. E. LOOG

To..... 4/18/66

Jerry Balash —

To date we have spent $1275.- in the area — exclusive of product giveaway.

We have sold $34,800 in converters — at 2½% for this means they have earned $870.

before any returns are taken into account.

I cannot justify the extra money — will you talk to Dick Hellmuth for approval — Thx

Hammond Electronics, Inc.

No. 5040

WHOLESALE RADIO, TV AND ELECTRONICS

P. O. BOX 3671 ORLANDO, FLORIDA PH. 241-6601

Debit Memorandum

Merchandise Returned For Credit

To Blonder Tongue Date 4-11-66

Address 9 Alling St. From Jacksonville (Store Location)

Newark N.J.

Return to [illegible] Via:

Quantity	Unit	Description	Price	Amount
		Adv Credit for McDuff March 1966		$388.90
		Note: McDuff sent a statement for 654.03 but they had only 388.90 credit due until they purchase more converters		
		Mack Cpy. 4 to Hammond Jacksonville		

RECEIVED APR 18 1966 B-T LABS ADVERTISING DEPT.

APR 13 1966

This Number Must Appear on Your Credit Memorandum

By J. W. Bryan Jr.

SHIPPING COPY

ANTENNA POLICY

ERNIE SISSON REGION ONLY

2 FREE FOR EACH 12

UNTIL 4/15/66 ONLY

APPROVED BY HAG 4/6/66

Procedure
to include Jack -
Paul & Ken

6/8/66 -- Jack: Did you know about this? Attached is first one I came across; there are probably several more.

Distributor Lauradin Dist. Corp

City, State Dejarkana Ark. Dept.

Invoice #	Invoice Date	Quantity Ordered			Spiffs Paid			Free		
		3	5	10	3	5	10	3	5	10
12346	5/23/66		12	48					2	8
12347	5/23/66	12	24	36				2	4	6
12430	5/29/66	12	24	36				2	4	6

BLONDER-TONGUE

Laboratories Inc. / 9 Alling St., Newark, N. J. 07102 / 201 MArket 2-8151

April 13, 1966

Mr. Richard Hyde, Jr.
Hyde Electronics Co., Inc.
888 South Lipan Street
Denver, Colorado 80223

Dear Dick:

We have received your request for the return of the following samples:

28 UHF Dart	2 UHF Ranger	1 BTX-11
1 BTD-44	1 ABLE U2	1 CMA-11
	1 CMA-13	

There is a policy at B-T which was set up in order to eliminate the confusion of acquiring, demonstrating and returning samples. The policy was written whereby a manufacturer's rep was sold a limited amount of sample equipment at substantial discounts below the best price on our sheet. These discounts varied as they were intended to bring the product "below factory price."

The entire idea was to keep this product from being returned to us after being sent to the field at this "low" discount price. We would only have to resell at further discount price on a "onesy" basis.

The understanding is that when a rep receives a B-T sample at this reduced price he will:

1. Utilize the sample to further the sale of the product
2. Sell the sample off to recoup his investment

Therefore, Richard, may I suggest that you apply your sales talent to this inventory and sell it - don't send it back to me.

Sincerely,

BLONDER-TONGUE LABORATORIES, INC.

R. B. Helhoski
Director of Marketing

CC: G. Sisson, W. A. Ullrich
J. N. Balash, S. M. Stone

DATE PREPARED

EFFECTIVE DATE

REQUEST FOR CHANGE OF STATUS

TC#	LAST NAME	FIRST NAME	DATE OF EMPLOYMENT	JOB TITLE	COMPANY	DEPT.

☐ **TRANSFER AND/OR TITLE CHANGE** _____ PROPOSED TITLE _____ DEP'T. _____ COMPANY

Reason/Remarks _____

☑ **SALARY CHANGE** Present Rate _____ Proposed Rate _____

Reason/Remarks _____

☐ **CHANGE OF NAME, ADDRESS AND TELEPHONE NUMBER**

New Name _____ Telephone No. _____

New Address _____

Change in Insurance Coverage _____

SEPARATIONS

☐ **LEAVE OF ABSENCE:** From _____ To _____

Reason _____

☐ **TERMINATION** ☐ Resignation ☐ Discharge ☐ Layoff Last Day Worked _____

Reason for Termination _____

FINAL RATING (hourly employees only)

FINAL RATING	QUANTITY OF WORK	QUALITY OF WORK	ADAPTABILITY	JOB KNOWLEDGE	ATTENDANCE	ATTITUDE
EXCELLENT						
GOOD						
FAIR						
POOR						

CLEARANCE:

Badge ☐ Tools ☐ Credit Cards ☐

Agency Fees ☐ Equipment ☐ Cash Advances ☐

Rehire _____ Yes _____ No

Reason _____

☐ **OTHER CHANGES AND EXPLANATIONS:** _____

APPROVALS DEPARTMENTAL _____ PERSONNEL _____ WAGE COMMITTEE _____ MANAGEMENT _____ UNION

ORIGINATING DEPT. COPY

United States Patent Office 3,150,376 Patented Sept. 22, 1964

3,150,376

MULTI-BAND LOG PERIODIC ANTENNA

Robert L. Carrel, Richardson, Tex., and Paul E. Mayes, Champaign, Ill., assignors to The University of Illinois Foundation, a non-profit organization of Illinois

Filed Apr. 3, 1964, Ser. No. 357,226
18 Claims. (Cl. 343—792.5)

This invention relates to antennas. More particularly it relates to antennas having unidirectional radiation patterns that are essentially independent of frequency over wide bandwidths. Still more particularly, the antennas of the invention are designed to cover intermittent bands of frequencies which cover a wide range from the lowest frequency band to the highest.

In the copending application of Dwight E. Isbell, Serial No. 26,589, filed May 3, 1960, and in application of the inventors herein, Serial No. 59,671, filed September 30, 1960, now U.S. Patent No. 3,108,280, dated October 22, 1963, there are described certain antennas comprising coplanar arrays of dipoles or V-elements having unusually wide bandwidths performance characteristics over which bandwidths the antennas are essentially frequency independent. These antennas have input impedances which are nearly constant with unidirectional patterns and directivities comparable to yagi arrays. As described in the applications above named, the arrays comprise a number of elements which may be linear dipoles of V-elements, arranged in side-by-side relationship in a plane. The lengths of the dipoles or the developed lengths of the V-elements (i.e., the length when the sides of the V-elements are rotated to form a linear dipole) and the spacing between adjacent dipoles or V-elements are designed to vary by approximately chosen scale factors according to a definite mathematical formula, with each of the elements being fed at its midpoint by a common feeder which has appropriate phasing between successive elements. The elements which are used to make up the arrays vary progressively in length in accordance with the scale factor selected.

In the linear dipole version, described in the aforementioned Isbell application, the length of the longest dipole element corresponds to about ½ wavelength at the low frequency limit of the antenna's effective range, while the shortest element has a length corresponding to about ⅜ of a wavelength at the upper frequency limit. On the other hand, the antennas described in the present inventors' copending application, Serial No. 59,671, in which the elements are V-shaped, have increased directivity at frequencies above the ½ wavelength mode of operation and therefore have effective frequency ranges which are greater than those of a comparable linear dipole antenna.

The antennas of the instant invention are related to those described above, but differ therefrom in that the former are designed so that their effective frequency range is not continuous from the high limit to the low limit but is rather broken up into a number of discrete bands within which bands the antenna performs satisfactorily. There are a number of instances in which antennas of this type will be found particularly useful. For example, the frequencies assigned to VHF and UHF television transmission are divided into a number of discrete frequency bands. Thus, television channels 2, 3, and 4 of the lower VHF range cover frequencies from 54 to 72 mcs., the mid-VHF band containing television channels 5 and 6 extends from 76 to 88 mcs. and the upper VHF band, including television channels 7-13, extends from 174 to 216 mcs., while television channels 14-83 of the UHF band extend from 470 to 890 mcs.

An antenna made in accordance with the present invention can effectively cover all of the above frequency bands, but not the intervening ranges between the bands of interest, and this antenna is considerably smaller in overall size and weight and, therefore, less expensive than an antenna designed to cover continuously the entire range of television frequencies from 54 to 890 mcs. Furthermore, the directive gain increases in the higher modes which are used to cover the higher frequency bands, thus making more effective use of the size of the structure.

Another application of the invention occurs in antennas designed for use by amateur radio operators whose transmissions are restricted by law to certain frequency bands. The "ham" radio operator is, therefore, interested in an antenna which performs effectively in those ranges in which he is free to operate and which need not be effective in the intervening frequency bands. Such an antenna can also be made in accordance with the invention in a smaller version than has been heretofore possible, without sacrificing bandwidth or directivity.

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

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

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

FIGURE 3 is a fragmentary view of an improved and preferred form of an antenna similar to that shown in FIGURE 2, as seen from a point directly in front of and above the narrow end of the antenna.

Referring to FIGURE 1, it will be seen that the antennas of the invention are composed of a plurality of elements, which may either linear dipoles, e.g., 11 and 12, or V-shaped elements, e.g., 13 and 14, or a combination of both as shown, arranged in side-by-side relationship. The elements are arranged in a number of zones, or groups, e.g., A, B, C, and D. The distinguishing characteristic of the zones found in the antenna is the fact that the ends of the elements within a zone fall on a pair of converging straight lines, as shown in the drawing. It is also characteristic of the antennas of the invention that the converging lines defining the ends of the elements in a given zone are not collinear with the corresponding converging lines associated with another zone of the antenna having the same type (i.e., linear dipole or V-element) of element. Thus, for example, since zones C and D are both comprised of linear dipoles, the converging lines defining their terminals are not collinear. This is also true of zones A and B which are also composed of similar elements. When adjacent zones are composed of dissimilar elements, however, as in the case of zones B and C, wherein B has V-elements and C has linear elements, the converging lines passing through the terminals of the elements of the zone may or may not be collinear. Furthermore, the angle formed by these converging lines, e.g., α_A in FIGURE 1, may or may not be equal for each zone, although all such angles preferably have values between about 20° and about 100°. In the antenna shown in FIGURE 1, α_A is represented as the angle defined by the converging lines passing through the outer ends of the elements in zone A. This angle might or might not be equal to that angle which would be formed on extending the lines passing through the ends of the elements of zone B to a meeting point. Similar considerations could be had relative to the angle which would result were a line to be drawn past the ends of all elements of zones C and D.

It will be seen from FIGURE 1 that zones A and B are composed of a plurality of V-elements, each of which consists of a pair of arms, e.g., 16 and 17, defining an apex in the middle of the V-element, said V-elements

being arranged in a herringbonelike pattern. The arms of a given V-element are equal in length and the related arms of the several V-elements within a zone, i.e., the arms on the same side of a line passing through the apexes of the V-elements, are preferably substantially parallel to each other.

In a similar manner the linear dipoles which constitute zones C and D of the antenna of FIGURE 1 are each composed of a pair of arms, e.g., 18 and 19, which are equal in length and which are preferably substantially parallel to the corresponding arms of the other dipoles within the zone. With respect to all zones, i.e., both those consisting of V-elements and those formed of linear dipoles, it is preferred that the antenna be symmetrical about a line passing through the midpoints of the linear dipoles and the apexes of the V-elements, respectively, as shown.

The antenna is fed at its narrow end from a conventional source of energy, depicted in FIGURE 1 by way of illustration only as alternator 21, by means of a balanced feeder line consisting of conductors 22 and 23. It will be seen that the crossed feeder lines 22 and 23 are twisted between connections to consecutive or adjacent elements of the antenna.

The length of an element (dipole or V-element) in the antenna shown in FIGURE 1 is designated herein as L_n^X, where n is used to designate any element in the zone which is designated as X. Thus, for example, the longest element in the antenna of FIGURE 1, which is the longest dipole of group D, is designated as L_1^D, meaning element No. 1 of zone D. Thus, in general, the subscript (n) indicates the order of the particular element in the group designated by the superscript (X). It will be further seen that in the case of V-elements, such as those of zone B, the effective length of a V-element is taken to be the length which the arms of the V-element have when developed so that these arms are collinear. As shown, the length L_1^B is the developed length of V-element 13.

The lengths of the elements in the antennas of the invention, and the spacing between these elements are related by a scale factor τ which is constant within a given zone and is defined by the following equations:

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

where τ^X is a constant having a value less than 1, L_n^X is the length of a dipole (or the developed length of a V-element) in zone X of the antenna, $L_{(n+1)^X}$ is the corresponding length of the adjacent smaller element in group X, ΔS_n^X is the spacing between the element having the length L_n and the adjacent larger element in group X, and $\Delta S_{(n+1)^X}$ is the spacing between the element having the length L_n and the adjacent smaller element in group X.

In the foregoing, it will be observed that the same scale factor, τ, may be used to determine both dipole length and spacing. This will, under normal conditions, represent optimum operational conditions. However, if efficiency of a lesser degree can be tolerated, it is, at times, possible to operate with a different scale factor for determining the dipole length from that which determines spacing. At such times, a scale factor τ_1 may be used to determine the dipole length and a scale factor τ_2 may be used to control spacing the dipole sections.

Each dipole and the feeder connecting thereto in the region between one dipole pair and the next adjacent dipole pair may be regarded as a "cell." The lengths of dipoles and the spacings then are so selected by the determined scale factors that the combination of dipole lengths and spacings, when combined as here described, provide the desired substantially uniform wideband responses in the desired frequency ranges.

As noted above, the elements comprising the antennas of the invention may be either linear dipoles or V-elements. With respect to the latter, the arms of the individual V-elements are inclined to point in the direction of decreasing element size so that the apex of each of the V-elements points in a direction away from the angle formed by the lines passing through the extremities of the individual elements. The angle, ψ, formed at the apexes of the V-elements by the arms thereof, preferably has a value between about 30° and 150°.

It will be noted that in FIGURE 1 the angle α_A is that formed by the lines passing through the extremities of the elements in zone A. In a similar manner, although not shown in the drawing, the lines passing through the extremities of the elements in zones B, C, D, etc., could be extended to form similar angles α_B, α_C, α_D, respectively. Each of these angles α_B, α_C, α_D, etc., may be equal to each other, and in the preferred embodiment of the antenna are equal, but this is not a necessary condition. In any event, it is preferred that these angles, whether or not they are equal to each other, have values within the range from about 20° to 100°.

The advantages of the antennas of the invention stem from the discovery that when a given antenna is in operation at a certain frequency there are involved only a few of the elements of which the antenna is formed. It has been found possible, therefore, to remove from the antenna structure those elements which are not involved at this frequency and bring the adjacent parts of the antenna together to close the gap which would exist, and it has been further found that this modification of the antenna is possible without affecting the performance on either side of the excluded region. Taking the antenna of FIGURE 1 as an example, the element which would have formed the fourth element of Zone D is not required when the antenna is operated at a frequency which is dependent on the lengths of elements 1, 2 and 3. Accordingly, and since the antenna is not intended to operate at a frequency represented by this hypothetical fourth element, the element can be omitted from the antenna with a consequent saving in size, weight, and cost, without, however, adversely affecting the operation of the remaining elements in the antenna at their characteristic frequencies. In a similar manner the elements which would normally have appeared in the antenna between zones A and B have been omitted with no adverse effects on the operation of the antenna at the frequencies corresponding to the elements found in zones A and B.

The antennas of the invention contain a plurality of zones or groups as defined above, all of which may contain linear dipoles and some V-elements as desired. The use of V-elements in the antennas of the invention rather than dipoles increases the directivity of the antennas and also permits more effective utilization of a given antenna, since the same structure can be used in several frequency modes to achieve coverage of different frequency bands. In the case of an antenna zone or group consisting entirely of straight dipoles, the effective frequency range of such a zone is that in which the low limit corresponds to the frequency at which the largest element in the zone is about ½ wavelength long, and the upper frequency limit to the frequency at which the smallest dipole in the group is about ⅜ wavelength long. In general, therefore, it may be said that the frequency range of a straight dipole group of elements corresponds to the mode of operation in which the lengths of the dipoles in the group are about ½ wavelength long. As the frequency is raised above the upper limit of the ½ wavelength mode in the group, the elements will also be found to radiate or receive effectively at frequencies in which the dipoles are about ⅔ wavelengths long (the ⅔ wavelengths mode), ⅝ wavelengths long (the ⅝ wavelengths mode), and so on. At frequencies above the ½ wavelength mode, however, the pattern of a straight dipole group becomes multilobed and is therefore of limited usefulness. By inclining the arms of the dipoles to form V-elements, it has been found

that a single lobe of improved directivity may be obtained as the frequency is raised from the ½ wavelength mode through the intervening ranges to the ⅝ wavelengths mode and beyond. For each mode of operation there exists an optimum value for the angle ψ, ranging from about 114° for the ½ wavelength mode to about 62° for the ⅝ wavelengths mode. By using a compromise value for ψ within this range, however, a zone of V-elements can be made to achieve acceptable performance over several modes of operation, thereby increasing its effective range. This result is possible since many of the elements forming the antenna array are used at more than one frequency.

The construction of a practical 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 24 and 26, to which are attached the arms which form the V-elements and the straight dipoles. It will be noted that each of the arms making up one straight dipole, e.g., 29 and 31, or one V-element, e.g., 27 and 28, is connected to a different one of said conductors 24 and 26. Moreover, considering either one of conductors 24 and 26, consecutive arms along the length thereof extend in opposite directions. It will be seen that this construction has the effect of alternating the phase of the connections between successive elements, as depicted schematically in FIGURE 1. Although the elements of the antenna of FIGURE 2 are not precisely coplanar, differing therefrom by the distance between the parallel conductors 24 and 26, in practice this distance is usually small so that the arms of the elements are substantially coplanar and the advantages of the invention are maintained. In some instances, however, it may be advantageous to bend the individual arms, e.g., 32 and 33 in FIGURE 3, close to the point of attachment to the feeder lines 24' and 26', so as to position all the arms in the same plane. The antennas of FIGURES 2 and 3 may be conveniently fed by means of a coaxial cable, e.g., 34 and 34' positioned within conductor 26 or 26', the outer conductor of the cable making electrical contact with the conductor 26 or 26' and the central conductor 36 or 36' of the cable extending to and making electrical connection with conductor 24 or 24' as shown.

In addition to the type of construction shown in FIGURES 2 and 3, practical antennas made in accordance with the invention can use a balanced feeder line which is twisted between connections to successive dipoles or V-elements. Other suitable means for accomplishing the desired phasing, such as transmission line loops or stubs, can also be used.

As an example of the invention, an antenna was constructed in a manner similar to that shown in FIGURE 3 containing two zones of elements, a group of V-elements, such as group A in FIGURE 1, and a group of linear dipoles, such as group C. The antenna was made using 0.125" diameter tubing for the balanced line and 0.050" diameter wire for the arms of the elements. The arms were soldered to the feeder line and the array was fed by a miniature coaxial cable inserted into one of the conductors of the balanced line. The antenna had a total of 12 elements, of which 6 were contained in a zone of linear dipoles partially defined by $\tau=0.90$. The linear dipoles ranged in length from about 7.5 inches to about 4.4 inches, the zone having a length of about 2 inches. The antenna also contained a group of six V-elements ($\psi=70°$) ranging in developed length from about 3.3 inches to about 2.6 inches, the group of elements having a length of about 1.1 inches, and being further defined by $\tau=0.95$. This antenna was a scale model of one designed to cover the 15 meter, 10 meter, 6 meter and 2 meter bands of amateur radio transmission. For the 15 and 10 meter bands the antenna was operated in the ½ wavelength mode as a linear dipole array. The 6 meter band was covered by the V-elements of the antenna in the ½ wavelength mode and the 2 meter band was covered by the same V-elements in the ⅝ wavelength mode. This antenna was found to perform acceptably over this range, although the performance in the 6 meter band was somewhat inferior to the other bands which were covered. This deficiency, however, could have been rectified by providing an additional large element in the group of V-elements.

It is believed evident from the above description that the antennas of the invention can be designed to cover discrete frequency bands within a wide overall range as desired. By using the principles of the invention, the antenna can be made smaller in length and consequently cheaper to construct that has heretofore been possible, without, however, sacrificing performance within the desired frequency bands.

This application constitutes a continuation-in-part of U.S. patent application Serial No. 76,075, filed by the inventors herein named on December 15, 1960, now abandoned, and a continuation-in-part of U.S. patent application Serial No. 299,715, also filed by the inventors herein named and carries a filing date of August 5, 1963, now abandoned.

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 covering an intermittent range of frequencies comprising an array of a plurality of substantially coplanar elements, said elements being arranged in a plurality of zones, the ends of the elements in each of said zones falling on a pair of converging lines, the lines passing through the ends of the elements in any zone being non-collinear with at least one pair of the corresponding lines associated with any other zone, the elements within any zone being arranged in substantially parallel side-by-side relationship and progressively increasing in length and spacing, the ratio of the lengths of any two adjacent elements within any one of said zones being given by the formula

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

where L_n is the length of the larger of said adjacent elements, L_{n+1} is the length of the adjacent smaller element, and τ is a constant having a value less than 1, the spacing between the elements of any zone being given by the formula

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

where ΔS_n is the spacing between the element having the length L_n and the adjacent larger element, ΔS_{n+1} is the spacing between the element having the length L_n and the adjacent smaller element, and τ has the significance previously assigned, said elements being fed by a common feeder which alternates in phase between successive elements.

2. The antenna of claim 1 in which the elements in at least one of said zones are parallel dipoles.

3. The antenna of claim 1 in which the elements in at least one of said zones are V-elements arranged in a herringbonelike arrangement, each of said elements having a pair of equal arms defining an apex, the apexes of said V-elements lying on a straight line, the corresponding arms of said elements being parallel.

4. The antenna of claim 3 wherein the angle formed by the arms of any V-element at the apex thereof has a value within the range from about 50° to about 150°.

5. The antenna of claim 1 wherein the angles formed by the lines passing through the ends of the elements in said zones have values within the range from about 20° to about 100°, and the values of the constant τ associated

with said zones lie within the range from about 0.8 to about 0.95.

6. A broadband unidirectional antenna covering an intermittent range of frequencies comprising an array of a plurality of substantially coplanar conducting elements, said elements being arranged in a plurality of zones, the ends of the elements in each of said zones falling substantially on a pair of converging lines, the lines passing substantially through the ends of the elements in any zone being non-collinear with at least one pair of the corresponding lines associated with any other zone, the elements within any zone being arranged in substantially parallel side-by-side relationship and progressively increasing in length, the ratio of the lengths of any two adjacent elements within any one of said zones being determined by a zonal scale factor established by the ratio of the length of one conducting element to the length of the next adjacent and longer conducting element to establish the length scale factor, the spacings of one conducting element to the next smaller element and the spacing of the same conducting element to the next longer conducting element with each zone establishing the spacing scale factor, and where each scale factor in each zone is a constant, and a common two-conductor feeder connected to all of the elements with adjacent conductor elements being connected to different conductors of the feeder.

7. The antenna of claim 6 in which the elements in at least one of said zones are parallel dipoles extending in a direction substantially perpendicular to the axis of the feeder.

8. The antenna of claim 6 in which the elements in at least one of said zones comprises V-elements arranged in a herringbonelike arrangement, each of said elements having a pair of equal arms defining an apex, the apexes of said V-elements lying on a straight line, the corresponding arms of said elements being parallel, and in which at least one other zone comprises dipole elements extending substantially normal to the feeder axis.

9. An aerial system for wide-band use over selected intermittent frequency ranges comprising a plurality of substantially coplanar elements arranged in a plurality of zones, at least one zone comprising a plurality of herringbonelike conducting V-elements arranged to terminate in planar relationship, at least one other zone comprising a plurality of parallel dipoles, a two-conductor balanced feeder connected to the elements forming each zone at substantially the inner end thereof, each two opposite V-elements and each two opposite parallel dipoles forming a pair constituting dipole halves, the connection from each adjacent conducting element of the dipole sections being to a different feeder, all of said elements being selectively spaced from each other, each element of each pair of conducting V-elements having arms of substantially equal length substantially defining an apex with the apexes of the plurality of V-elements all lying in substantially a straight line and terminating at the feeder, each of the parallel dipoles all lying in a common plane and also terminating at the feeder, the said V-elements and parallel dipoles of each pair being of different electrical lengths with successive V-elements and dipoles differing in electrical length with respect to each other by substantially the same scale factor, each V-element and each dipole and the feeder between successive V-elements and dipoles constituting a cell, and the selective spacings between adjacent dipoles decreasing from one end to the other with the greater spacing being between the longest dipoles and being such that the combination of V-elements and dipole lengths and spacings provides a substantially uniform wide-band response over a plurality of selected frequency bands, the connection between the V-elements and the dipoles and the feeder being made in such a manner that the directive gain of the antenna increases as operation shifts from one band to an adjacent band of higher frequencies, and means to connect the feeder to an external circuit at a location substantially removed from the longest of the V-elements and dipole elements and in the direction of the smallest of the elements.

10. An aerial system for wide-band use covering intermittent frequency ranges comprising an array of a plurality of substantially coplanar conducting elements arranged in a plurality of zones, the conducting elements of each zone being similar, at least one zone comprising a plurality of herringbonelike conducting V-elements planarly arranged, at least one other zone comprising a plurality of substantially straight and oppositely positioned conductor elements, a two-conductor balanced feeder connected to each of said conducting elements at substantially the inner end thereof, each two opposite V-elements forming a pair constituting dipole halves, each two oppositely positioned elements also forming a pair constituting dipole halves, the connection from each adjacent dipole section being to a different feeder, said V-elements of the zone being selectively spaced from each other, the elements of each pair of V-elements and each pair of oppositely positioned elements having arms of substantially equal length, the V-elements of one zone substantially defining an apex with the apexes of the plurality of V-elements all lying in substantially a straight line and terminating at the feeder and the oppositely positioned elements of a second zone also terminating at the feeder, the said dipoles of each pair being of different electrical lengths with successive dipoles in each zone differing in electrical length with respect to each other by substantially the same scale factor, each dipole and the feeder between successive dipoles constituting a cell, and the selective spacings between adjacent dipoles decreasing from one end to the other with the greater spacing being between the longest dipoles and being such that the combination of dipole lengths and spacings provides a substantially uniform wide-band response over a plurality of frequency bands bearing substantially harmonic frequency relationships to each other, the connection between the dipoles and the feeder being made in such a manner that the directive gain of the antenna increases as operation shifts from one band to an adjacent band of higher frequencies, and means to connect the feeder to an external circuit at a location substantially removed from the longest of the V-elements and in the direction of the smallest of the V-elements.

11. An aerial system for wide-band use covering intermittent frequency ranges comprising a plurality of pairs of substantially coplanar conducting elements, the elements being arranged in a plurality of zones, a two-conductor balanced feeder connected to each of said elements at substantially the inner end thereof, the elements within each zone being arranged in substantially parallel side-by-side relationship and progressively differing length and spacing, the connection from each adjacent element being to a different feeder, each pair of elements having arms of substantially equal length, the ratio of the lengths, of any two adjacent elements within any one of said zones being determined and substantially proportioned by a length scale factor established by the ratio of the length of one of the conducting elements to the length of the next adjacent longer conducting element so that the elements of each pair have different electrical lengths and successive elements with each zone differ in electrical length with respect to each adjacent element by substantially the same scale factor, each conductor and the feeder between successive conductors constituting a cell, the ratio of the spacing of one conducting element in each zone to the next smaller element and the spacing of the same conducting element in the said zone to the next longer conducting element also establishing a spacing scale factor, each of the scale factors having a value of less than unity so that the selective spacings between adjacent conductors differ from one end to the other with the greater spacing being between the longest conductors

and being such that the combination of conductor lengths and spacings provides a substantially uniform wide-band response over the zone, the connection between the conductors and the feeder being made in such a manner that the directive gain of the antenna increases as operation shifts from one band to an adjacent band of higher frequencies, and means to connect the feeder to an external circuit at a location substantially removed from the longest of the conducting elements and in the direction of the smallest of the said elements.

12. The antenna claimed in claim 11 in which the conducting elements of the zones are arranged in V-formation with the open end of the V faced toward the feeder connection.

13. The antenna claimed in claim 11 in which the conducting elements of the separate zones are parallel dipoles.

14. The antenna claimed in claim 11 in which the conducting elements of each zone are of similar form and the conducting elements of at least one zone are arranged in V-formation with the open end of the V faced toward the feeder connection and in which the conducting elements of at least one other zone are parallel dipoles.

15. A broad band unidirectional antenna covering intermediate ranges of a wide frequency spectrum comprising a multiplicity of substantially coplanar conductor elements, each conductor element forming half of a dipole, the two elements of each dipole being of substantially the same length, the several dipole elements being selectively spaced along an axis and arranged in a plurality of separate zones, the electrical length of the dipoles decreasing with distance along the axis, the electrical length of adjacent dipole elements of the separate zones differing by a selected zone scale factor which is substantially constant in each zone, the electrical length of each dipole of all zones being approximately an odd multiple of a half-wave length at a frequency within the operating spectrum over which the antenna is to provide maximum response in each zone, a pair of feeder conductors for feeding all of the dipole elements, one element of each dipole being connected to one feeder conductor and the other element of each dipole being connected to the opposite feeder conductor, adjacent elements of different dipoles being connected to opposite feeder conductors so that the directional gain of the antenna is maximum in the direction along the feeder from the end with longer dipoles toward the end with shorter dipoles and increases as the operation shifts from one frequency within the spectrum whereat the element lengths are approximately an odd integral number of half-wave lengths to the next higher frequency range where the element lengths are once more approximately an odd integral number of half-wave lengths, the ratio of the lengths of any two adjacent dipole elements within any one of the zones being determined by the zonal scale factor of substantially constant value within the zone, and means to connect the feeder conductors to an external circuit at a location which is substantially removed from the longest dipole element in the direction of the shortest dipole element.

16. The antenna claimed in claim 15 wherein the dipole elements of at least one of the zones extend in a direction substantially perpendicular to the axis of the feeder conductors.

17. The antenna claimed in claim 15 in which the dipole elements of at least one of the zones comprise V-shaped elements whose apexes lie on substantially a straight line and between which elements in the region of the open portion of the V-formation there is an angular spacing in the range from about 50° and 150°.

18. The antenna claimed in claim 15 wherein the corresponding dipole elements of each zone extend parallel to each other and wherein certain of the dipoles extend substantially perpendicular to the feeder and wherein other dipoles are V-shaped elements whose apexes lie on substantially a straight line with the angular spacing between the elements of the open portion of the V-formation being within the angular limits of 50° and 150°.

No references cited.

J. E. Foster
420 Lexington Ave.
N.Y. N.Y. 10017

RECEIVED
NOV 29 1966
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

dence of commercial success may be of value in a close or doubtful case, but it is by no means conclusive. It must also be noted that the commercial success concerning which testimony was given was the sale of the flocking material or flocking mixture devised by the applicants, for which it is understood they have an application pending. The claims involved in this case are purely process claims and are not directed to any material. To be sure, Mr. Scarlati stated that he understood that 95 percent of the trade are using his process. He did not indicate how he knew this. Very likely his testimony was, to some degree, at least, based on hearsay. But his principal sales, in any event, were those of the mixture that he devised and the commercial success that he achieved consists of sales of that mixture.

[3] Finally, it must be observed that it is the law in this Circuit, in connection with actions under 35 U.S.C. § 145, to secure the granting of a patent, that doubts must be resolved against the applicant and in favor of the Patent Office. There are numerous authorities in this jurisdiction to that effect, the latest of which is Reynolds v. Aghnides, 356 F.2d 367, 148 USPQ 245. There are two reasons for this doctrine. The first is that doubts should be resolved in favor of the correctness of administrative action, in this instance, rejection of the application. There is also a broader ground. The granting of a patent is a grant of a monopoly for a long period of time and it seems to be in the public interest that monopolies should not be lightly awarded and that doubts as to the right to such a grant in any case should be resolved against the applicant.

The Court perceives no basis for disagreeing with the conclusion reached by the Patent Office. Accordingly, judgment will be rendered on the merits dismissing the complaint.

Counsel may submit proposed findings and conclusions of law.

District Court, E. D. New York

CHANNEL MASTER CORPORATION v. JFD ELECTRONICS CORPORATION

66-C-416 Decided Nov. 3, 1966

PATENTS

1. Parties to suit — Indepensable or necessary (§ 49.5)

Title — Assignments — Assignment or license (§ 66.103)

One in position of assignee of patent has implied right to bring infringement suit without joining patentee; exclusive license to make, use, and vend is in same category as an assignment on theory that licensor holds title to patent in trust for licensee; even though exclusive license is restricted to a specified territory or covers less than full life of patent, this remains true; however, exclusive license to make, use and vend covering only a portion of field of patent monopoly is a mere license which is insufficient to enable licensee to maintain infringement suit without joining licensor; another reason why instant licensee cannot be required to defend declaratory judgment action alone is that it has no independent right to institute infringement action inasmuch as right to institute suit arises only if licensor fails to do so after a lapse of 20 days.

2. Jurisdiction of courts—Declaratory judgment — Actual controversy (§ 13.303)

Since defendant (licensee) cannot maintain infringement suit without presence of patent owner, action against defendant seeking declaratory judgment that patent is invalid is dismissed because of absence of actual controversy; even were it not clear that patent owner's presence is required, court exercises discretion to dismiss action since there is substantial doubt whether declaratory judgment would resolve controversy.

3. Notice and marking patented (§ 46.)

Complaint states cause of action under 35 U.S.C. 292 where it alleges that patent mismarkings were knowingly made by defendant with intent to mislead and deceive public.

4. Notice and marking patented (§ 46.)

Jurisdiction of courts—Joinder of causes of action and parties—Patent and other issues (§ 43.-355)

Inasmuch as pleaded misrepresentations alleged to constitute unfair competition relate to substantial and related claim under patent law for mismarking (35 U.S.C. 292), jurisdiction may rest upon 28 U.S.C. 1338(b); fact that 35 U.S.C. 292 is essentially penal in character does not eliminate it as a related claim under patent law described in 28 U.S.C. 1338(b); virtual identity of proof is not required, it being sufficient that there is a considerable overlap in factual basis of the two claims.

TRADEMARKS

5. Fraud and misrepresentation (§ 67.-37)

Notice of infringement and marking goods (§ 67.54)

Prohibition of 15 U.S.C. 1125(a) with respect to a false designation of origin or false description with respect to goods or services or containers for goods is not limited to designation and description relative to origin alone, but applies to all such false descriptions and designations with respect to such goods and services entering into interstate commerce; thus, statute confers jurisdiction as to complaint alleging unfair competition in that defendant falsely represented that its goods possess certain attributes and are covered by enumerated patents.

Action by Channel Master Corporation against JFD Electronics Corporation for declaratory judgment of patent invalidity and noninfringement, under 35 U.S.C. 292, and for unfair competition. On defendant's motion to dismiss complaint or to transfer action to another district. Motion to dismiss granted in part and denied in part; motion to transfer denied.

DARBY & DARBY (MORRIS RELSON of counsel) both of New York, N. Y., for plaintiff.

OSTROLENK, FABER, GERB & SOFFEN (SIDNEY G. FABER of counsel) both of New York, N. Y., for defendant.

DARTELS, District Judge.

This action was brought by Channel Master Corporation against JFD Electronics Corporation, University of Illinois Foundation (Foundation), and University of Illinois (University) under the patent laws of the United States for a declaratory judgment of patent invalidity, noninfringement and unenforceability. The complaint consists of two counts, in the first of which plaintiff seeks a declaratory judgment that its "CROSSFIRE" antennas do not infringe defendant's patent rights, and in the second of which plaintiff seeks damages and injunctive relief for (1) alleged patent mismarking by defendant, and (2) unfair competition by defendant in that it has falsely accused plaintiff of copying defendant's antenna. A motion made by University and Foundation to dismiss the action as against them upon the ground of improper service was granted, leaving JFD Electronics Corporation as the sole defendant.

In Count I the complaint alleges that Foundation is the record owner of the Dwight E. Isbell Patent No. 3,210,767 entitled "Frequency Independent Unidirectional Antennas", which it licensed to the defendant under an exclusive license agreement dated December 1, 1965; that defendant is engaged in making and selling antennas under said patent in competition with plaintiff, in the course of which it accused plaintiff of infringing the Isbell patent by making and selling, without a license, radio and television antennas embodying the alleged invention of that patent, and that the Isbell patent is directed to a type of antenna known as log-periodic, whereas plaintiff manufactures and sells antennas under the trademark "CROSSFIRE" (the subject of plaintiff's U.S. Patent No. 3,086,206 and the reissue thereof, No. 25,604) which it states are not log-peroidic and thereby do not infringe the Isbell patent, which it also claims is invalid.

In Count II the complaint alleges that defendant manufactures certain antennas which it represents in its advertising and sales promotion statements as log-periodic antennas operating according to a patented log-periodic formula, whereas said antennas are not log-periodic and do not operate according to any such formula or patent; that defendant has caused to be marked upon its antennas (and particularly its LPV and LPV-U lines), upon cartons therefor, and in literature accompanying the same, the word "Patent", and has represented that they were covered by certain issued or pending patents, whereas, in fact, they were not so covered and did not embody any patented inventions; and finally, that defendant has unfairly competed with plaintiff by libelling and disparaging plaintiff's "CROSSFIRE" antennas as imitations of defendant's allegedly log-periodic antennas, and also by falsely claiming that its antennas were original patented designs and that plaintiff's patent was rejected, all to plaintiff's damage.

According to the license agreement which was submitted with the motion papers, the Foundation granted to the defendant, among others, the following rights: (a) An exclusive non-transferrable right and license to make, use or sell antennas *only in the field of receiving antennas for TV and FM broad-*

casting stations and antennas for amateur and citizens band transmission and reception in the United States and in all foreign countries; (b) an option to acquire a non-exclusive license for all *other fields* than the field of the exclusive license; (c) the right to grant sublicenses upon its exclusive license; (d) the right to institute suit for infringement upon the failure of the Foundation to bring suit within thirty days after requesting the Foundation to do so; (e) the right to cancel the agreement upon ninety days' notice; and (f) upon expiration of the agreement, an option to renew the same for two additional terms (emphasis supplied).

Defendant moves under Rule 12(b)(7), Fed. Rules Civ. Proc., 28 U.S.C.A., to dismiss Count I for failure to join an indispensable party, namely, Foundation, the owner of the patent; under Rule 12(b)(6), Fed. Rules Civ. Proc., 28 U.S.C.A., to dismiss that portion of Count II alleging patent mismarking because of the absence of criminal intent to sustain the action, and under Rule 12(b)(1), Fed. Rules Civ. Proc., 28 U.S.C.A., to dismiss the remaining portion of Count II alleging unfair competition for lack of jurisdiction over the subject-matter. As an alternative to the above, defendant moves under 28 U.S.C.A. § 1404(a) for a change of venue and transfer to the Northern District of Illinois, Eastern Division.

Indispensable Party

[1] In view of the fact that the license to the defendant does not cover the entire field of the Isbell patent, the Court concludes that Count I of the complaint must be dismissed for lack of an indispensable party. The narrow question here is whether the defendant's interest in this patent is sufficient to enable it to bring the action for infringement without joining Foundation. It is clear that if defendant were in the position of an assignee of the Isbell patent, it would have the implied right to bring suit for infringement without such joinder. The leading case of Waterman v. Mackenzie, 1891, 138 U.S. 252, 11 S.Ct. 334, teaches that the monopoly granted by the patent laws cannot be divided into parts, except as authorized by those laws, and that the patentee may assign (1) the whole patent, (2) an undivided part or share of that patent, or (3) the exclusive right under the patent "to the whole or any specified part of the United States" (35 U.S.C.A. § 261). "* * * Any assignment or transfer, short of one of these, is a mere license, giving the licensee no title in the patent, and no right to sue at law in his own name for an infringement" (Waterman v. Mackenzie, supra, p. 255). In accordance with these principles an exclusive license to make, use and vend is in the same category as an assignment on the theory that the licensor holds title to the patent in trust for such licensee. Even though the exclusive license is restricted to a specified territory or covers less than the full life of the patent, this still remains true. Wilson v. Rousseau, 1846, 4 How. 646; Hartford National Bank & Trust Co. v. Henry L. Crowley & Co., 3 Cir. 1955, 219 F.2d 568, 104 USPQ 254.

While the license in this case is an exclusive one to manufacture, use and vend, it covers only the field of receiving antennas for TV and FM broadcasting stations and antennas for amateur and citizens band transmission and reception. It does not include the field of "radar antennas, antennas for military application including communication, AM broadcasting and receiving antennas", which is also covered by the Isbell and other patents upon which the license rests.[1] Plaintiff claims that this is immaterial because the defendant has exclusive rights in the exact field covered by the suit, citing in support thereof Pratt and Whitney Company v. United States, Ct. of Cls. 1957, 153 F.Supp. 409, 114 USPQ 246. While that case upholds the plaintiff's contention, its authority is contrary to the decision in Ethicrington v. Hardee, 5 Cir. 1961, 290 F.2d 28, 129 USPQ 205, and Pope Manuf'g Co. v. Gormully & Jeffery Manuf'g Co., 1892, 144 U.S. 248, 12 S.Ct. 641. In the latter case the court held that the grant of a limited use under a patent is a mere license which is insufficient to enable the licensee to maintain an infringement suit without joinder of the legal title-holder, concluding that "* * * it might lead to very great confusion to permit a patentee to split up his title within the same territory into as many different parts as there are claims. * * *" (p. 252). To the same effect is American Chemical Paint Company v. Smith, E.D.Pa. 1955, 131 F.Supp. 734, 106 USPQ 361. There is a distinction between an exclusive license under a geographical or time limitation and an exclusive license under a use limitation. The reason for permitting a licensee to sue alone in the first two cases is based upon the theory that the licensor has in substance granted an assignment to the licensee of the whole patent and the interests of the licensor and licensee in protecting the same are identical, even

[1] The exclusions are based upon representations in the defendant's brief, which plaintiff does not deny.

[illegible] is a general [illegible] limitation in the license [illegible] however [illegible] exclusive [illegible] only [illegible] of the patent [illegible] of a licensee in [illegible] of that part may [illegible] licensed [illegible] whole [illegible] absence, his [illegible] would not in [illegible] of the rights of [illegible] upon the [illegible] [illegible] upon who [illegible] [illegible] required to bring [illegible] [illegible] to the absence [illegible] [illegible] right in the licensor as [illegible] for patent infringement. Caldwell [illegible] aff'd [illegible] [illegible], S.D.N.Y. [illegible] F.R.D. 258, 108 USPQ 7. In Caldwell it was held that the licensor-patentee was an indispensable party to a suit against a licensee to manufacture and vend in one field because the licensee's right to bring suit for infringement sprung into existence only after the licensor-patentee failed to do so. The action was accordingly transferred to another district where the validity of the patent and the issue of infringement could be litigated in one suit in which all parties would be present. Relying on the presence or absence of licensee's right to bring suit to protect the patent as the true test rather than the classification of the litigants as "'licensees' or 'assignees,'" (p. 253, 108 USPQ at 10), Judge Herlands said: "* * * In the absence of an independent right to bring an action for patent infringement, defendant-licensee herein has no independent right to defend a suit seeking a declaration as to the validity of the licensed patent." (p. 254, 108 USPQ at 11). Assuming, without confirming, that an independent right[2] in a non-exclusive licensee would be sufficient to bring suit involving invalidity and infringement without joinder of the licensor-patentee, no such independent right exists here because the defendant's right to institute such a suit arises only if Foundation fails to do so after a lapse of thirty days.

[2] Since the defendant cannot maintain the suit without the presence of the patent owner, there is an additional ground for dismissal under the Declaratory Judgments Act, 28 U.S.C.A. § 400, because of the absence of an "actual controversy" as required by the Act. Contracting Division, etc. v. New York Life Ins. Co., 2 Cir. 1940, 113 F.2d 864, [illegible] 425, [illegible] were not clear that the patent owner's presence were required, the [illegible] nevertheless has the right, in its discretion, to refuse or exercise it, just [illegible] dismiss the proceeding where, as here, there is a substantial doubt whether the declaratory judgment would resolve the controversy. Aetna Casualty & Surety [illegible] 4 Cir. 1937, 92 F.2d 321; Caldwell Manufacturing Co. v. Unique Balance Co., [illegible] Industrial Tape Corp. v. Minnesota Mining & Mfg. Co., S.D. N.Y., [illegible] F.Supp. [illegible] 108 USPQ [illegible]

At great length plaintiff argues that the recent amendment of Rule 19 of the Federal Rules of Civil Procedure, 28 U.S.C.A., and its particular subdivision (b), requires a finding that Foundation is not an indispensable party and hence there should be no dismissal of Count I but "in equity and good conscience the action should proceed among the parties", asserting that Foundation will not be adversely affected by any judgment. With this the Court does not agree. Plaintiff misconstrues the effect of the present Rule 19, subdivision (b). While the new subdivision sets forth four relevant factors as the correct criteria for deciding whether the action should proceed or be dismissed and provides for avoiding or lessening prejudice by the "shaping of relief", this subdivision is not at variance with the settled authorities requiring dismissal where a party not joined may be seriously prejudiced through disposition of the action in his absence. Here any decision against the validity of the patent would adversely affect Foundation as to its remaining unlicensed patent claims and any relief granted to the plaintiff in such a case would not prevent relitigation of the same issue by Foundation. No shaping of relief or other measures would cure such an inadequacy. Furthermore, plaintiff has an adequate remedy in another jurisdiction where all parties may be served and brought before the court. The adjudicated cases earlier cited demonstrate why, under the present circumstances, Foundation is an indispensable party and Rule 19(b) does not require the action to proceed without joinder of such a party. It simply sharpens the definition of "indispensable party" in order to eliminate any technical approach to the problem, leaving the decision to proceed without joinder to the discretion of the Court, Cf., Provident Tradesmens Bank and Trust Company et al. v. Lumbermens Mutual Casualty Company, 3 Cir. August 30, 1966, —— F.2d ——,

[2] "Independent right" means a right to bring suit independent of any condition precedent or any permission or control of the licensor-patentee. If the licensee's right springs into existence only after the licensor has failed to exercise his right to bring suit, the licensee's right is not independent but conditional.

where the lack of an indispensable party was deemed to be a substantive defect.

Patent Mismarking

[3] The portion of Count II alleging patent mismarkings is predicated upon an alleged violation of 35 U.S.C.A. § 292, which permits any person to sue for a penalty of $500 for each offense under the statute involving false marking with an intent or purpose to deceive. Plaintiff alleges that the mismarkings were knowingly made by the defendant with intent to mislead and deceive the public. The complaint therefore sets forth a good cause of action. Apparently the only basis for the defendant's motion is its claim of lack of intent. This appears from the affidavit of Edward Finkel, defendant's vice-president, who asserts that he believes that the patent markings and representations were accurate and that they were placed upon the antennas in conformity with instructions received from Foundation under the license agreement and that under no circumstances was there an intent to deceive or to falsely mark the antennas. Hence, he contends that the necessary element of intent was lacking. Obviously, this motion cannot be granted under Rule 12(b)(6); at best, it can be considered only as a motion for summary judgment. In this category it must also be denied because the statements in the complaint and the affidavit of defendant's vice-president, Edward Finkel, present a genuine issue as to a material fact (Rule 56, Fed. Rules Civ. Proc., 28 U.S.C.A.). Smith Welding Equipment Corp. v. Pearl, et al., W.D. Pa. 1956, 21 F.R.D. 196.

Unfair Competition

There remains for disposition the motion to dismiss that portion of Count II alleging unfair competition upon the ground that the Court lacks jurisdiction over the subject matter.

[4] In this portion of Count II plaintiff splits its claim of unfair competition into two parts, (i) false representations by defendant to the effect that its antennas are log-periodic and are covered by a patented periodic formula and by certain enumerated patents, and (ii) false representations by defendant that plaintiff's "CROSSFIRE" antennas were not original but imitations of defendant's allegedly log-periodic antennas. There is no diversity of citizenship between the parties and subject-matter jurisdiction in this Court must therefore be founded upon some Federal statute. Both categories of misrepresentations in this case relate, in one form or another, to the claim of mismarking in Count II under the patent law, 35 U.S.C.A. § 292. Jurisdiction, therefore, may rest upon [redacted] provision of 28 U.S.C.A. § 1338([redacted] which reads as follows:

> "The district courts shall have original jurisdiction of any civil action asserting claim of unfair competition when joined with a substantial and related claim under the copyright, patent or trademark laws."

The claims of unfair competition are in accordance with the terms of the above section, joined with a substantial and related claim under the patent law. The fact that 35 U.S.C.A. § 292 is essentially penal in character does not eliminate it as a related claim under the patent law described in Section 1338 (b). In order to avoid piecemeal litigation a broader view has been taken in this circuit of the pendant jurisdiction of Federal courts over non-Federal claims which are joined with substantial Federal claims. To establish the existence of a substantial and related claim under Section 1338(b), virtual identity of proof is not required and it is sufficient if there is a considerable overlap in the factual basis of the two claims. Maternally Yours v. Your Maternity Shop, 2 Cir. 1956, 234 F.2d 538, 110 USPQ 462. For instance, the proof that plaintiff adduces to show mismarking under 35 U.S.C.A. § 292, will involve the coverage of the Isbell patent as well as the defendant's intent. Substantially the same proof will be necessary to establish that defendant falsely claimed that its antennas were log-periodic and covered by certain specifically numbered patents as set forth in the first category of misrepresentations. Likewise, part of the same proof will be necessary to establish that plaintiff's "CROSSFIRE" antennas were not log-periodic antennas and were not covered by the Isbell patent and hence not imitations of defendant's antennas as claimed in the second category of false representations.

[5] Although the complaint does not predicate jurisdiction upon 15 U.S.C.A. § 1125(a)[2] [§ 43(a), Lanham Act], jurisdiction may be rested upon that section as to the first category of misrepresentations. The prohibition with respect to a false designation of origin or false description with respect to goods or services or [illegible] for goods, is not [illegible] and description [illegible] as argued by defendant. On the contrary, the prohibition applies to all such false descriptions and designations with respect to such goods and services entering into interstate commerce. D'Aigle Apparel v. Issa Lobell, Inc., 3 Cir. 1954, 214 F.2d 649, 102 USPQ 34.

For the above reasons, the motion to dismiss Count II must be denied.

Motion to Transfer

In view of the fact that Count I will be dismissed for lack of an indispensable party, the most important reasons suggested by the defendant for change of venue to the Northern District of Illinois, Eastern Division, have disappeared. As the case now stands, the defendant has failed to show that the balance of convenience, either for the parties or witnesses, is sufficiently strong in its favor to justify a transfer of the case under 28 U.S.C.A. § 1404(a) to another jurisdiction. Hence, the plaintiff's choice of venue should not be disturbed. [illegible] Corporation v. Gilbert, 1947, 330 U.S. 501, 67 S.Ct. 839, Ford Motor Co. v. Ryan, 2 Cir. 1950, 182 F.2d 329. The interest of justice therefore requires that this application be denied.

Settle order in accordance with the above within ten (10) days on two (2) days' notice.

---

[2] This section reads as follows:

> "Any person who shall affix, apply, or annex, or use in connection with any goods or services, or any container or containers for goods, a false designation of origin, or any false description or representation, including words or other symbols tending falsely to describe or represent the same, and shall cause such goods or services to enter into commerce, and any person who shall with knowledge of the falsity of such designation of origin or description or representation cause or procure the same to be transported or used in commerce or deliver the same to any carrier to be transported or used, shall be liable to a civil action by any person doing business in the locality falsely indicated as that of origin or in the region in which said locality is situated, or by any person who believes that he is or is likely to be damaged by the use of any such false description or representation.

District Court, S. D. Ohio, W. Div.

MAXON v. MAXON CONSTRUCTION COMPANY, INC.

No. 2083. Decided [illegible], 1966

PATENTS

1. Licensee—As to infringement (§ 35.-[illegible])

Estoppel—As to validity — Licensor or licensee (§ 35.156)

Although licensee cannot attack validity of licensed patent, it may refer to prior art to limit scope of claims and to show that claims should not be construed so broadly as to read upon its device.

2. Construction of specification and claims—Broad or narrow—In general (§ 22.101)

Construction of specification and claims—By Patent Office proceedings—In general (§ 22.151)

Construction of specification and claims—By specification and drawings—In general (§ 22.251)

Patent claims must be read in light of specification, drawings, and file wrapper history and may not be given a construction broader than teachings of patent.

Particular patents—Dump Truck

2,465,899, Maxon, Dump Truck, liability for royalties fixed.

Action by Glenway Maxon, Jr., against Maxon Construction Company, Inc., for royalties under patent license. Complaint dismissed.

IRA MILTON JONES, Milwaukee, Wis., and IRVIN J. ZIPPERSTEIN and FROIKIN & ZIPPERSTEIN, both of Dayton, Ohio, for plaintiff.

LAWRENCE B. BIEBEL, JOSEPH G. NAUMAN, and MARECHAL, BIEBEL, FRENCH & BUGG, all of Dayton, Ohio, for defendant.

WEINMAN, Chief Judge.

This is an action to recover royalties claimed to be due plaintiff under a patent license agreement with defendant. Over 20 years ago, plaintiff and defendant entered into a license agreement under which defendant was licensed to make a rear dump device which was claimed in plaintiff's patent No. 2,465,899; said patent has now expired.

The only question in this case is whether the "side-dump" bodies made and sold by defendant come within the scope of claim 15 of plaintiff's patent.

CIVIL SUBPOENA TO PRODUCE DOCUMENT OR OBJECT — D. C. Form No. 48 (Rev. 2-57)

United States District Court

FOR THE

NORTHERN DISTRICT OF ILLINOIS

CIVIL ACTION FILE NO. 660-567

THE UNIVERSITY OF ILLINOIS FOUNDATION,
Plaintiff & Counterclaim Defendant,
vs.
BLONDER-TONGUE LABORATORIES, INC.,
Defendant & Counterclaimant,
v.
JFD ELECTRONICS CORPORATION,
Counterclaim Defendant.

No.

TO: Paul E. Mayes
Room 455, Electrical Engineering Bldg.
University of Illinois
Urbana, Illinois

YOU ARE HEREBY COMMANDED to ~~appear in the United States District Court for the District of at the city of on the day of 19 at o'clock M. to testify on behalf of~~ produce for inspection and copying at the offices of Merriam, Marshall, Shapiro & Klose, 30 West Monroe Street, Chicago, Illinois: ~~in the above entitled action and bring with you~~

1. Photographs of antennas developed by Mayes, Carrel, Isbell or others at the University of Illinois Antenna Laboratory relating to the disclosures of U.S. patents 3,108,280 or 3,210,767 as they existed prior to October 31, 1962, and (if any) subsequent thereto. These photographs should include all photographs of television antennas assembled by Mayes, Carrel or others using the funds granted to them by the University of Illinois Foundation.

2. A copy of the results of the survey of applications of log periodic antennas.

October 28, 1966.

Hofgren, Wegner, Allen, Stellman & McCord
Blonder-Tongue Laboratories, Inc.
Attorney for

20 North Wacker Drive
Address Chicago, Ill. 60606

Robert A. Wagner, Jr.,
Clerk.

By William E. Kelly,
Deputy Clerk.

RETURN ON SERVICE

Received this subpoena at on
and on at
served it on the within named
by delivering a copy to h and tendering to h the fee for one day's attendance and the mileage allowed by law.[1]

Dated:
....., 19.....

.....,
By.....

Service Fees
Travel .....$
Services .....
Total .....$

Subscribed and sworn to before me, a this
day of , 19 .

.....

[1] Fees and mileage need not be tendered to the witness upon service of a subpoena issued in behalf of the United States or an officer or agency thereof. 28 USC 1825.

NOTE.—Affidavit required only if service is made by a person other than a United States Marshal or his deputy.

CIVIL SUBPOENA TO PRODUCE DOCUMENT OR OBJECT — D. C. Form No. 48 (Rev. 2-57)

United States District Court

FOR THE

NORTHERN DISTRICT OF ILLINOIS

THE UNIVERSITY OF ILLINOIS FOUNDATION,
Plaintiff & Counterclaim Defendant,
- v -
BLONDER-TONGUE LABORATORIES INC.,
Defendant & Counterclaimant,
- v -
JFD ELECTRONICS CORPORATION,
Counterclaim Defendant.

CIVIL ACTION FILE NO. .....

No. 66 C 567

TO: Earl W. Porter
Secretary of the Board of Trustees
of the University of Illinois
Administration Building
University of Illinois
Urbana, Illinois

YOU ARE HEREBY COMMANDED to produce for inspection and copying at the offices of Merriam, Marshall, Shapiro & Klose, 30 West Monroe Street, Chicago, Illinois:

Employment agreements between the University of Illinois and Robert L. Carrel, Dwight E. Isbell and Paul E. Mayes.

October 28, 1966.

Hofgren, Wegner, Allen, Stellman & McCord
Attorney for Blonder-Tongue Laboratories, Inc.
20 North Wacker Drive,
Address Chicago, Ill. 60606

Albert A. Wagner Jr., Clerk.

By William E. Kelly, Deputy Clerk.

RETURN ON SERVICE

Received this subpoena at on
and on at
served it on the within named
by delivering a copy to h and tendering to h the fee for one day's attendance and the mileage allowed by law.[1]

Dated:
....., 19.....

.....,
By.....

Service Fees
Travel .....$
Services .....
Total .....$

Subscribed and sworn to before me, a this
day of , 19 .

.....

[1] Fees and mileage need not be tendered to the witness upon service of a subpoena issued in behalf of the United States or an officer or agency thereof. 28 USC 1825.

NOTE.—Affidavit required only if service is made by a person other than a United States Marshal or his deputy.

LAW OFFICES

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
A. R. OSTRAUSKAS

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE
CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

October 28, 1966

Mr. James J. Costello
Legal Counsel
University of Illinois
258 Administration Building
Urbana, Illinois

Dear Mr. Costello:

In accordance with our telephone conversation, I have prepared subpoenas identifying the material we wish and have mailed them directly to Prof. Mayes and Mr. Porter. * Copies are enclosed for your information. If there is any question regarding the identification of the material requested from Prof. Mayes, please call me.

Very truly yours,

Richard S. Phillips

RSP:iag

* Enclosures

cc: Prof. Paul E. Mayes
Mr. Earl W. Porter
Mr. Robert H. Rines
Mr. Basil P. Mann
Mr. Myron C. Cass

Copies of Drawings

MD 1551

MC 1658 C

→ Commercial dup of Sect + Arrow get numbers

BLONDER TONGUE TO GET FOR U/I FOUNDATION AND JFD

1. Dart and Arrow instructionsheets - earlier
2. Dart and Arrow instruction sheets - most recent
3. Insulator drawing - Dart and Arrow
4. Check Schenfeld notebook for data on boom spacing
5. Search for prior publication re periodic or log-periodic antennas
6. Early antennas used in tests - ship out for examination
7. Any other log antennas - ship out for examination
8. Check BT files for Wickert letter of 7/25/66

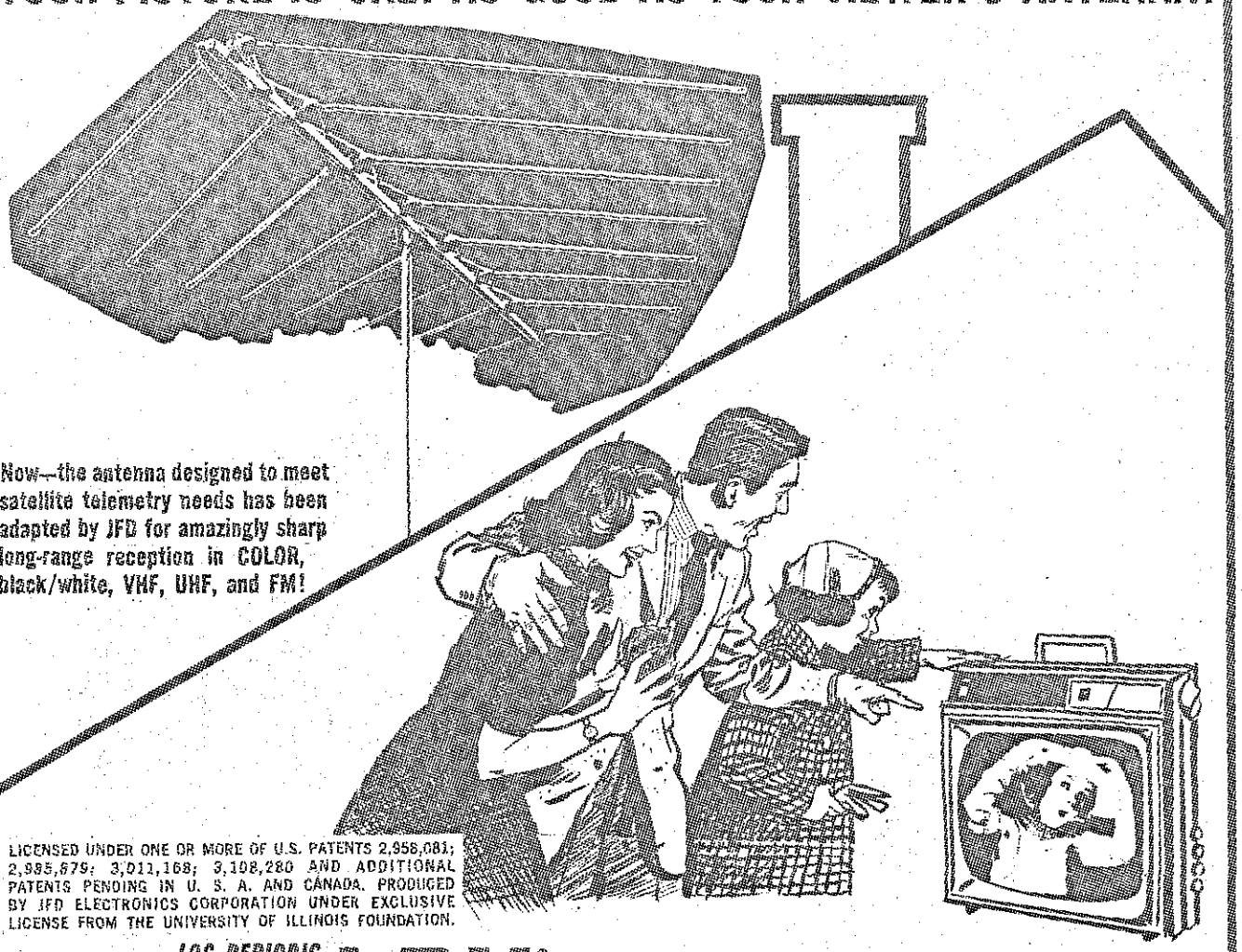
JFD

9. When did BT buy latest JFD double boom antenna - purchase order - before or after 9/1/66
10. Prosecution information re foreign patents - on BT antenna

CC 9 & 7

11. Antitrust - give Sherman and Clayton Act Sections
12. LPV-TV - Test results and reports
13. LPV-VU - Test results and reports
14. Schenfeld residence address

YOUR PICTURE IS ONLY AS GOOD AS YOUR VIEWER'S ANTENNA!



Now—the antenna designed to meet satellite telemetry needs has been adapted by JFD for amazingly sharp long-range reception in COLOR, black/white, VHF, UHF, and FM!

LICENSED UNDER ONE OR MORE OF U.S. PATENTS 2,956,081; 2,985,879; 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.

The space-age LOG-PERIODIC JFD LPV®

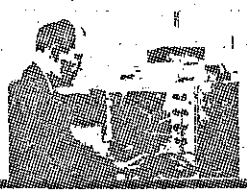
TV/FM antenna increases your share of the audience by bringing it a brighter, clearer, more enjoyable picture

The patented JFD Log Periodic LPV means more effective and complete coverage of your audience. Its unique design brings your picture in with studio-sharp brilliance in "problem" reception areas.

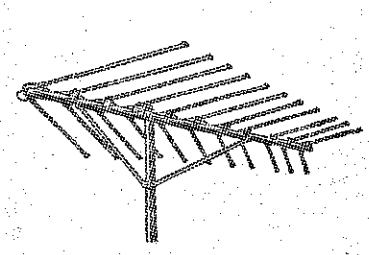
The LPV—adapted by JFD from the Log Periodic satellite antenna concept of the Antenna Research Laboratories of the University of Illinois—is available in a broad assortment of models to cover every possible VHF, UHF, VHF-UHF or FM Stereo location requirement. Write for descriptive literature or sample and see why—

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

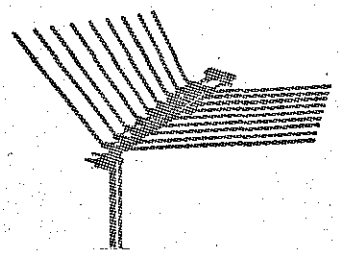
THE KNOW-HOW OF THE WORLD'S NEWEST AND FINEST ANTENNA LABORATORIES IS BUILT INTO EACH JFD LPV!



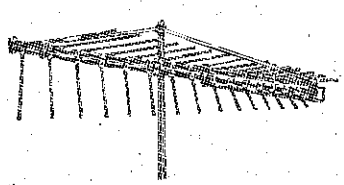
Professor Paul E. Mayes of the Antenna Research Laboratories of the University of Illinois, originator of the log periodic V-dipole antenna concept.



Model LPVII (illustrated) one of 6 gold alodized Log Periodic antennas designed for VHF channels 2 to 13 *plus FM.*



Model LPV-U9 (illustrated) one of 6 area-engineered Log Periodic LPV antennas designed for UHF channels 14 *to 83 plus VHF channels 7 to 13.*



Model LPV-VU15 (illustrated) one of 4 area-engineered Log Periodic LPV antennas for VHF channels 2 to 13, UHF channels 14 to 83, and FM with one downlead (First of its kind!)

JFD

15th Avenue at 62nd Street
Brooklyn, N. Y. 11219
Phone 212 DE 1-1000

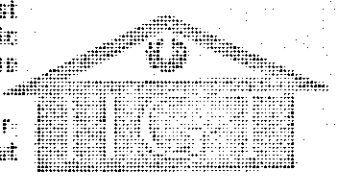
Form No. 714 Litho in U. S. A. 3-64

See us at the 1964-65 NEW YORK WORLD'S FAIR

At the 1964-65 New York World's Fair, the House of Good Taste Exhibit will feature the latest and finest advancements in home living. The board of directors of the House of Good Taste selected the JFD Log-Periodic LPV as the only television antenna to be installed on each of its three homes: the Edward Durrell Stone House, the Royal Barry Wills Associates House, and the Jack Pickens Cable House.

The House of Good Taste will create a lasting influence on consumer purchasing trends. Fifty million Fair-goers will see the JFD Log-Periodic. Millions more, everywhere in America, will see, hear, and read about the House of Good Taste and its choice of the JFD Log-Periodic antenna.

This new and unique marketing force will reflect itself in record JFD Log-Periodic sales during 1964 and 1965 for you!





SEE REVERSE SIDE FOR MORE NEWS FROM JFD!

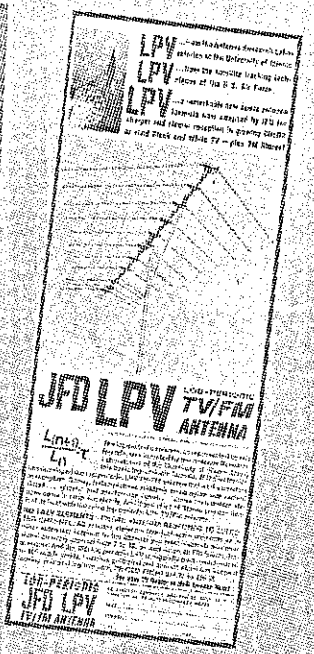
Again and Again in LOOK

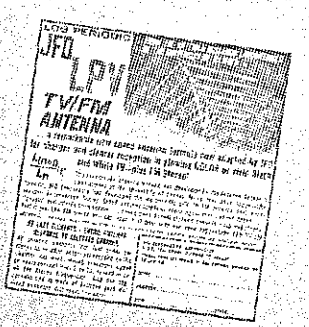
Magazine advertises the JFD Log-Periodic LPV!

Millions read about the JFD Log-Periodic this past spring. Millions more will be learning of the antenna sensation of the nation, as JFD continues the biggest antenna advertising campaign ever run in LOOK magazine.

Tie-in and cash-in with Log-Periodic LPV installations in **your** area. Promote **yourself** as JFD LPV headquarters with LPV streamers, banners, newspaper mats, mailers and TV/radio commercials.







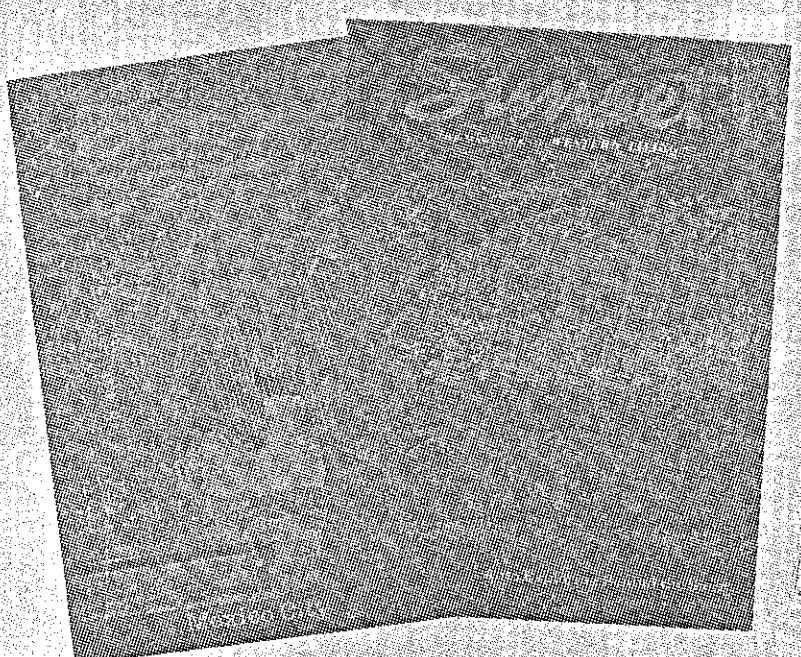
Again and Again in Sunset

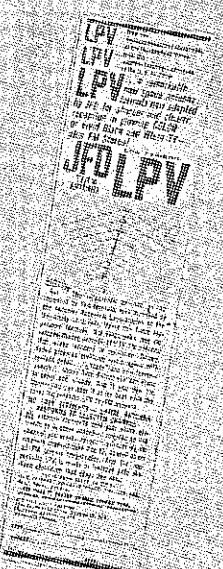
Magazine advertises the JFD Log-Periodic LPV!

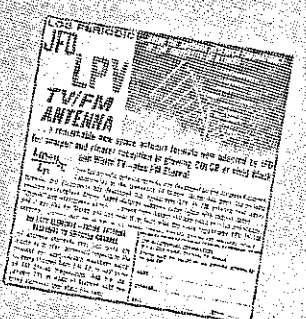
Last year, millions in the West and Far West saw the JFD Log-Periodic LPV ad in Sunset magazine.

This year, millions more TV antenna owners and prospects will be told the dramatic Log-Periodic story.

Plus—a variety of Sunset promotion aids to keep the Log-Periodic LPV the Coast's No. 1 antenna in sales!







Copyright JFD Electronics Corp. 1963

Form No. 630LP Litho in U. S. A. 9/63

no question about it—

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

"6 db BETTER THAN THE BEST!"

If you are installing JFD Log Periodic LPV's, no doubt you will agree with this report from R. L. Monroe, a leading TV antenna service-dealer of Charleston, West Virginia—a problem reception area.

"It beats all, it beats everything that I have ever seen. Not only that, but this antenna is better than 6 db better than the best that I have installed. It pulled in a consistently clear picture from Columbus, over 130 miles away.

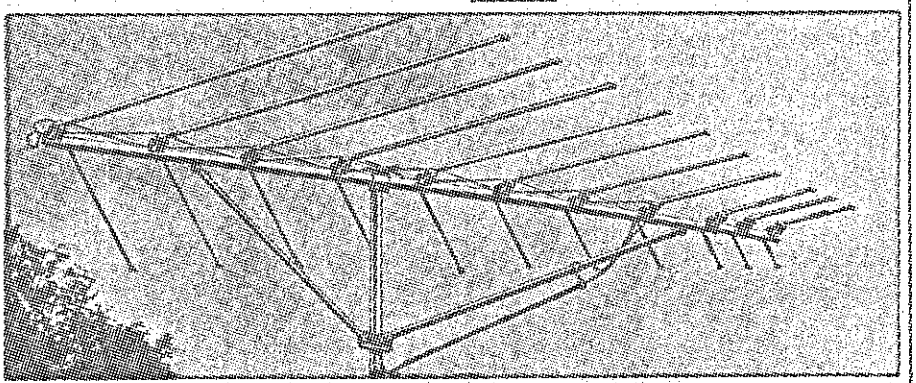
**** *** **** "It's just great on color —turns browns into real reds, faded bluish greens into brilliant greens, and completely eliminates the chronic ghost problems we have been suffering from in this area."*

****I have been in this business since 1948, which is a considerable time, particularly in the valley, and have yet to see any antenna, even near to this log periodic antenna in performance of the things I have wanted."*

Why the JFD Log Periodic LPV Outperforms Every TV Antenna Ever Made!

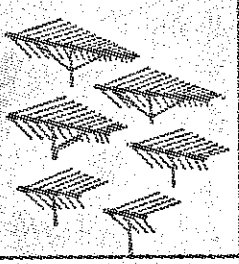
The log-periodic LPV blows the whistle on cumbersome antennas with their "Chinese puzzle" combinations of collectors, directors and reflectors. Now a single precisely-engineered antenna—the first based on a geometrically-derived *logarithmic* scale—actually *tunes* itself to the desired channel for unprecedented performance in crisp black and white or stunning color—plus FM STEREO. Is it any wonder that never before have so many installers and technicians so quickly acclaimed a TV antenna?

We would like to tell you more about the LPV, and how its *frequency independent* characteristics, have broken through distance, ghost and interference barriers to bring clear, steady pictures into previously "impossible" areas. Write today for your log periodic LPV Sales Kit. Better yet, call your JFD distributor and try one with our money-back guarantee of a better picture. You will prove it to yourself.



Developed by the University of Illinois Antenna Laboratory—Now Serving in Satellite Telemetry—Adopted to TV by JFD! THE LOG PERIODIC LPV ENDS THE ERA OF ANTENNA COMPROMISE! FOR THE FIRST TIME ONE SCIENTIFICALLY FORMULATED ANTENNA CONFIGURATION SATISFIES ANY LOCATION DEMAND: Harmonically resonant V-element operate on the Log-Periodic Cellular Principle in the Fundamental and Third Harmonic Modes for unprecedented performance —in color—in black and white—plus FM STEREO

LPV17:	16 Active Cell and Director System—up to 175 miles	$59.95, list
LPV14:	13 Active Cell and Director System—up to 150 miles	$49.95, list
LPV11:	11 Active Cell and Director System—up to 125 miles	$39.95, list
LPV8:	7 Active Cell and Director System—up to 100 miles	$29.95, list
LPV6:	4 Active Cell System—up to 75 miles	$21.95, list
LPV4:	4 Active Cell System—up to 50 miles	$14.95, list



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.

JFD AAA GOLD BOND ALODIZED LPV LOG PERIODIC ANTENNAS

DEVELOPED BY THE UNIVERSITY OF ILLINOIS* ANTENNA RESEARCH LABORATORY, PROVED-OUT IN AIR FORCE SATELLITE TELEMETRY

—THIS HISTORIC NEW PRINCIPLE ENDS THE "ERA OF COMPROMISE" IN TV ANTENNA DESIGN

- IT COULD ONLY HAVE BEEN PRODUCED by such massed resources as those of a prominent university, the military, and the country's leading antenna manufacturer.
- BECAUSE ITS GAIN IS INDEPENDENT OF FREQUENCY, the end-fired log-periodic LPV functions with total efficiency across the entire band—is **comparable on any channel to a tuned Yagi cut to that channel.**
- ON VIRTUALLY EVERY COUNT IT OUTPERFORMS PREVIOUS WIDE-BAND ARRAYS: in gain, in directivity, in bandpass, in front-to-back ratio. Develops gain as high as 7 db on low band and 10 db on high band in the 11-element model. Shows flat response across all 12 channels — with greater gain on the high band, where it's needed most. Result: An all-channel, all-purpose antenna with unprecedented power, a decisive end to snow and ghosts, and the truest color reception yet—as well as vivid sharpness in black-and-white. And the basic log-periodic LPV principle can be adapted to any future UHF antenna needs.
- NOT A "CATCH-ALL COMPROMISE"—the log-periodic LPV signals a halt to the endless piling-on of narrow-band elements and trimmers. Derived from an antenna geometry that repeats the electrical properties of the antenna periodically with the logarithm of the frequency, it is essentially **frequency-independent.** (Actually, the basic log-periodic design is capable of receiving a range as broad as 54 to 890 mcs. or broader.)
- DEVELOPED TO MEET THE AIR FORCE'S RIGOROUS STANDARDS OF RELIABILITY, RUGGEDNESS, HIGH PERFORMANCE—built to uncompromising JFD specifications—of AAA! Gold Bond Alodized aircraft aluminum for enduring good looks. 100% PREASSEMBLED FLIP-QUICK CONSTRUCTION—with new JFD "tank-turret" aluminum brackets that align and double-lock elements instantly, permanently in place.
- RECEIVES FM, TOO—delivers drift-free, distortion-free FM stereo.

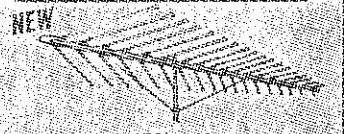
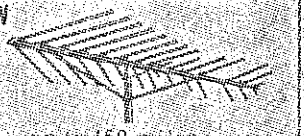
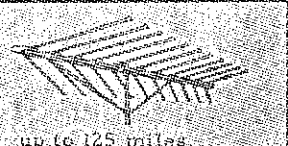
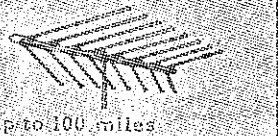
Harmonically resonant V-elements operating on the Log-Periodic Cellular Principle in the Fundamental and Third Harmonic Modes:

- antenna with unprecedented power, a decisive end to snow and ghosts, and the truest color reception yet—as well as vivid sharpness in black-and-white. And the basic log-periodic LPV principle can be adapted to any future UHF antenna needs.
- MORE, FAR MORE, THAN JUST A "FRINGE" SOLUTION, the log-periodic LPV achieves superior reception in all multi-channel areas. It is the first true "universal" antenna. And it will open key profit opportunities to you in the months ahead—not only because it puts better reception within the reach of virtually every TV set-owner, but because it enables you for the first time to **meet all antenna needs with a single antenna line.**
- U. S. PATENT NUMBERS: 2,958,081 - 2,965,879 - 3,011,168 OTHER PATENTS PENDING

*produced exclusively by JFD Electronics under license from the University of Illinois Foundation.

LOG-PERIODIC LPV $\frac{L(n+1)}{Ln} = \tau$

*Antenna Research Laboratory

FOR THE BEST PICTURE, COLOR AND BLACK & WHITE-USE THE BEST ANTENNA	MODEL	DESCRIPTION	LIST PRICE	STD. CTN.	Suggested Dealer Prices 1-4	5-11	12 & UP
NEW  up to 175 miles	LPV17	18 Active Cell and director system	59.95	1	35.97	32.37	29.98
NEW  up to 150 miles	LPV14	15 Active Cell and director system	49.95	1	29.97	26.97	24.98
NEW  up to 125 miles	LPV11	11 Active Cell and director system	39.95	1	23.97	21.57	19.98
NEW  up to 100 miles	LPV8	8 Active Cell and director system	29.95	1	17.97	16.17	14.98
NEW  up to 75 miles	LPV6	6 Active Cell system	21.95	1	13.17	11.85	10.98
NEW  up to 50 miles	LPV4	4 Active Cell system	14.95	1	8.97	8.07	7.48

JFD VHF/UHF/FM CAP ELECTRONIC® LOG PERIODIC FOR CHANNELS 2 TO 83 PLUS FM—FM STEREO

In the new LPV-VU Cap-electronic, the JFD Champaign, Illinois R & D Laboratories shatter antenna design precedent with a remarkable new electronic principle—the capacitor-coupled dipole.

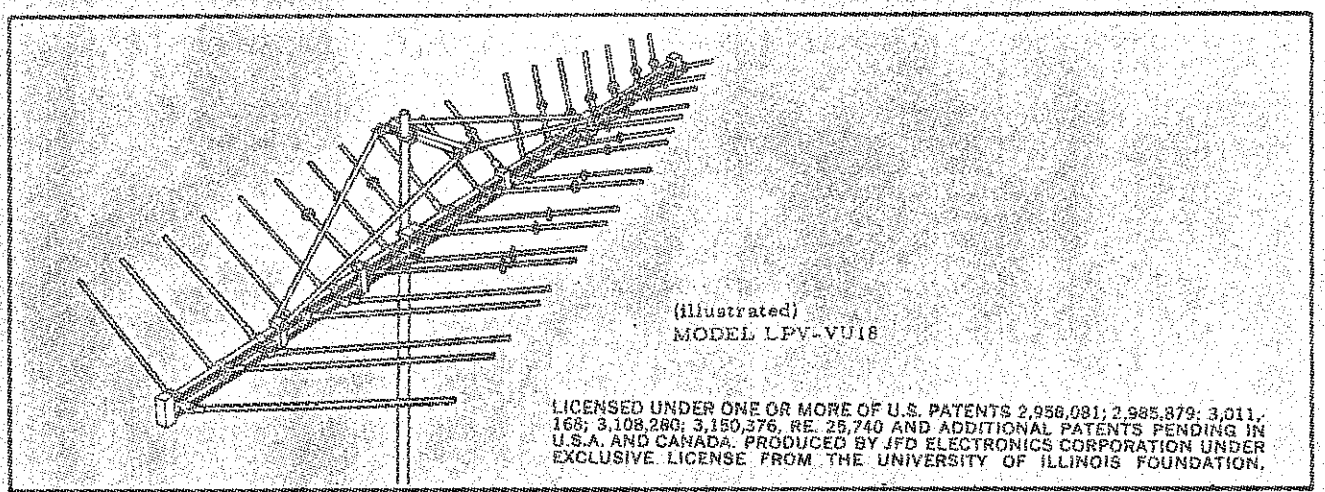
By introducing unique parallel plate capacitors into the dipoles and adjusting precisely their capacitance and location, JFD creates more driven elements than ever before possible. Result: the highest gain ever on VHF, UHF, FM/Stereo—from one antenna.

PLUS

1. Frequency independent log periodic design provides an unprecedented combination of remarkable gain . . . flat, full bandwidth response . . . sharp directivity . . . high front-to-back ratios . . . matched impedance and low VSWR on all TV and FM bands.
2. Only one downlead is required (a JFD VU/FM splitter is included so lead-ins can be run to VHF, UHF and FM set terminals).
3. Unique low-impedance twin crossarms function as crossed feeder harness to increase gain and provide maximum signal transfer on both high and low band channels.

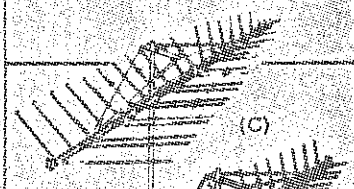
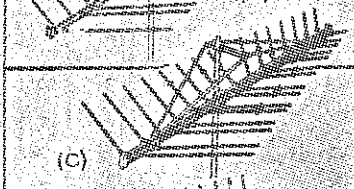
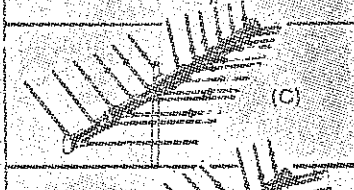
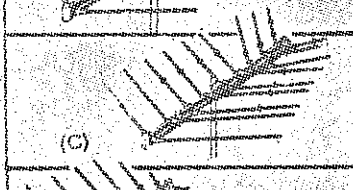
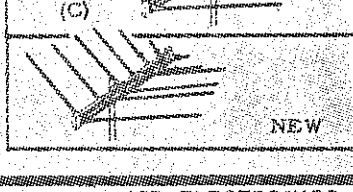
GET THE LION'S SHARE OF ANTENNA BUSINESS (FLATTEN CATV COMPETITION, TOO) BY FEATURING THE JFD LPV-VU LOG PERIODIC! THIS NEW GENERATION OF LOG PERIODIC ANTENNAS DELIVERS WHAT VIEWERS WANT—MANY MORE STATIONS...VHF CHANNELS 2 TO 13...UHF CHANNELS 14 TO 83...FM/STEREO. GIVES THE CLEAN, UNIFORM SIGNAL SETS NEED ESPECIALLY FOR VIVID COLOR RECEPTION.

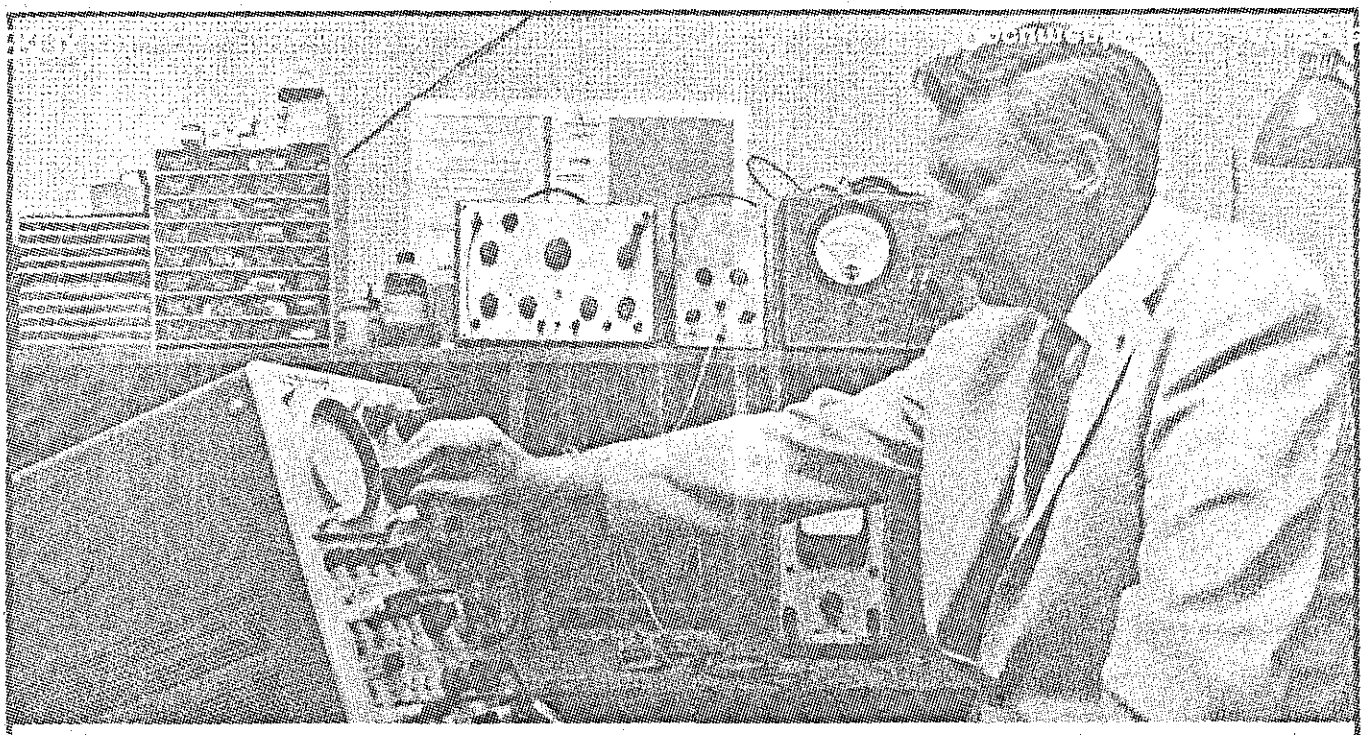
FIGHT CATV WITH THE JFD LPV! Keep CATV out of your area with JFD Log Periodics (such as the 82-channel LPV-VU) which provide viewers with more channels—sharper reception—richer color—plus FM stereo. Don't install inferior antennas that open the door to CATV. Install the best to get the best performance—the LPV!



(illustrated)
MODEL LPV-VU18

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	DESCRIPTION	LIST PRICE	STD. CTN.	Suggested Dealer Prices 1	2-9	10 & UP
 (C)	LPV-VU18	18 Active Cells VHF-up to 175 miles UHF-up to 90 miles FM-up to 75 miles	69.95	1	41.97	38.82	35.94
 (C)	LPV-VU15	15 Active Cells VHF-up to 150 miles UHF-up to 90 miles FM-up to 60 miles	59.95	1	35.97	33.27	30.80
 (C)	LPV-VU12	12 Active Cells VHF-up to 125 miles UHF-up to 65 miles FM-up to 50 miles	49.95	1	29.97	27.72	25.66
 (C)	LPV-VU9	9 Active Cells VHF-up to 100 miles UHF-up to 40 miles FM-up to 40 miles	39.95	1	23.97	22.17	20.53
 NEW	LPV-VU6	6 Active Cells VHF-up to 75 miles UHF-up to 25 miles FM-up to 30 miles	27.50	1	16.50	15.25	14.12



BOB PAASCH, Chief Engineer, WCKT Channel 7, Miami, Fla. recommends: *Good Antennas for Best Color and Black and White TV.*

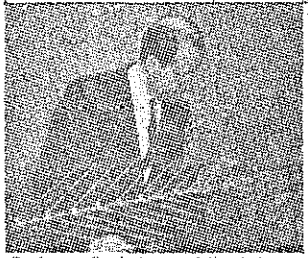
NBC Channel 7 of Miami, Florida knows that most reception troubles are caused by poor receiving antennas. To help Dade and Broward County TV service technicians solve their picture problems, Bob Paasch, Chief Engineer of WCKT tested and reported on the performance of outdoor antennas in Miami and outlying areas. JFD Log-Periodic LPV antennas were included in this complete and accurate analysis, excerpts of which are given below.

A REPORT ON OUTDOOR TV ANTENNAS TESTED FOR USE IN THE LOCAL AND FRINGE AREAS OF MIAMI

"The attached chart rates the various antennas for different characteristics. Taking all factors into consideration, there is one outstanding antenna for the Miami and outlying areas, and that is the JFD LPV-4. For problems with reflections, such as on Miami Beach and other large building areas, the JFD LPV-8 is a good antenna.

Use good (new) 300 ohm line and use a good antenna such as JFD LPV-4. By all means don't use a VHF-UHF-VEE or a conical. See chart to make selection."

TYPE OF ANTENNA	MATCH TO 300 OHMS or VSWR	DIRECTIVITY FRONT TO BACK	RELATIVE GAIN	CONSTRUCTION	PHYSICAL SIZE
LPV (4 models)					
LPV-4	Excellent (1.5 or less to 1)	Fair-Good (Hi-band over 5 to 7-1) (Lo-band over 2 to 3-1)	Medium (over 8 db on Hi-band) (over 4 db on Lo-band)	Good	Small
LPV-6	Good (1.5 to 2.5-1)	Good (Hi-band over 7-1) (Lo-band over 3-1)	Medium-High (over 8-10 db on Hi-band) (over 4-6 db on Lo-band)	Good	Medium
LPV-8	Excellent (1.5 or less to 1)	Excellent (Hi-band over 10-1) (Lo-band over 5-1)	High (over 10 db on Hi-band) (over 6 db on Lo-band)	Good	Medium-Large
LPV-11	Good (1.5 to 2.5-1)	Excellent (Hi-band over 10-1) (Lo-band over 5-1)	High (over 10 db on Hi-band) (over 6 db on Lo-band)	Good	Large



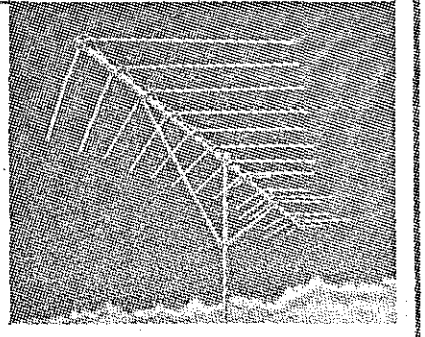
Professor Paul Mayes of the Antenna Research Laboratories of the University of Illinois, originator of the log-periodic V-dipole antenna concept.

AND—IF WE MAY ADD...

You will find our LPV14 (15 active cell) and LPV17 (16 active cell) Log-Periodic LPV's, *which were not available for testing by Bob Paasch when* report was being made, powerful performers in the deep fringe.

Your own test will prove it—because in the end result: **at the moment of truth, the picture is the proof why the JFD Log-Periodic works best.**

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



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

JFD ELECTRONICS CORPORATION

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

Copyright JFD Electronics Corp. 1963

Congress DIDN'T GO FAR ENOUGH!

PUBLIC LAW 87-529—76 STAT. 150

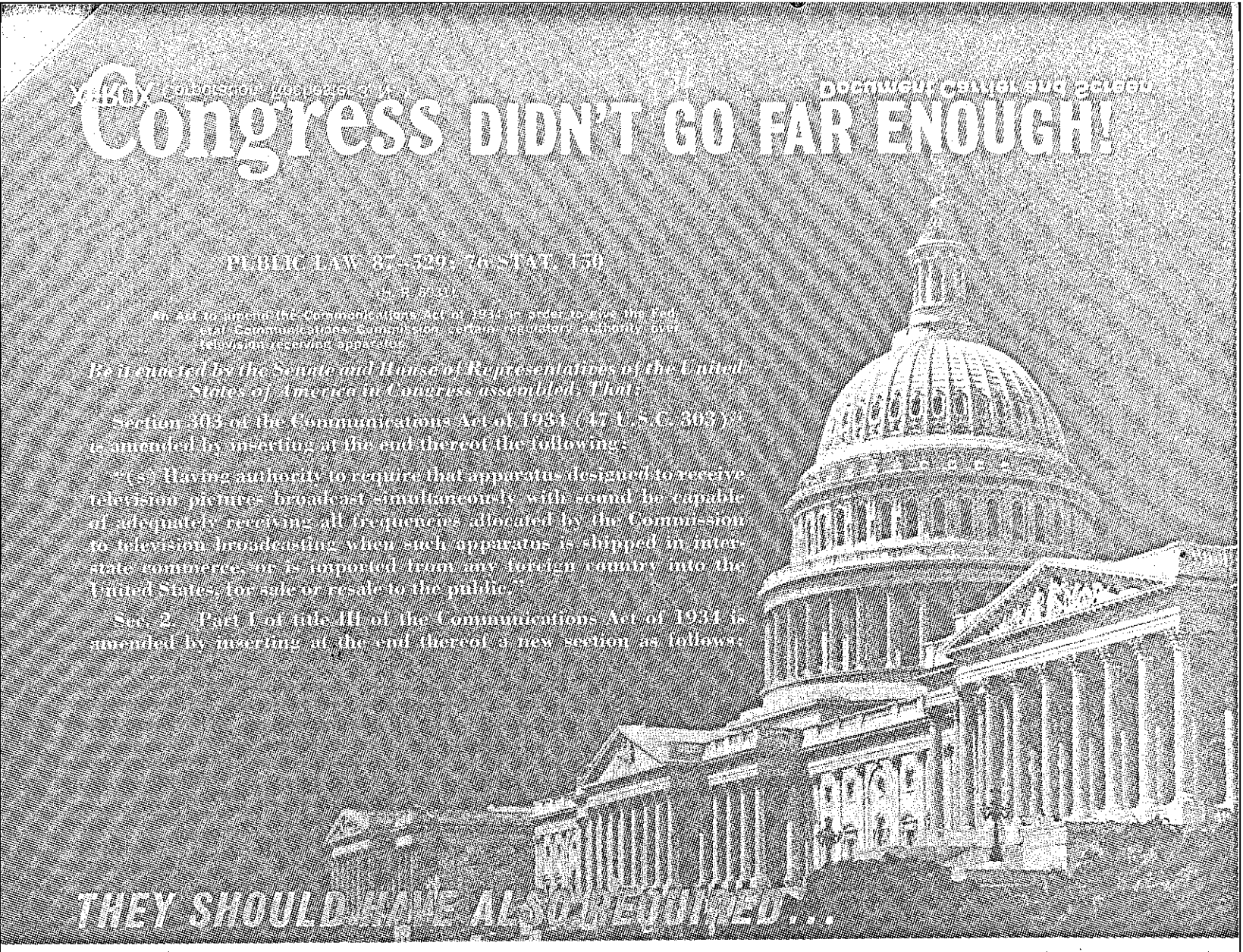
An Act to amend the Communications Act of 1934 to require that certain television broadcast receiving apparatus shall be capable of receiving all frequencies allocated by the Commission to television broadcasting.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That:

Section 303 of the Communications Act of 1934 (47 U.S.C. 303) is amended by inserting at the end thereof the following:

"(s) Have authority to require that apparatus designed to receive television pictures broadcast simultaneously with sound be capable of adequately receiving all frequencies allocated by the Commission to television broadcasting when such apparatus is shipped in interstate commerce or is imported from any foreign country into the United States, for sale or resale to the public."

Sec. 2. Part I of title III of the Communications Act of 1934 is amended by inserting at the end thereof a new section as follows:



THEY SHOULD HAVE ALSO AUTHORIZED...

"—that all 82-channel television receivers* must use an 82-channel television antenna."

Of course, you can't take the law into your own hands—but you *can* take advantage of today's ready-made opportunities to sell an 82-channel antenna with each 82-channel TV set.

Our Antenna Research Laboratories in Champaign, Illinois knew what they were doing when they teamed the acclaimed Log Periodic concept of the University of Illinois Antenna Research Laboratories with our new antenna design advance—the capacitor-coupled electronic dipole. Proof is the fact that the JFD LPV-VU is America's No. 1 82-channel TV/FM antenna!

Who says you can't have everything you want in a TV antenna—VHF?... UHF?... FM Stereo?—with a *single* down-lead to boot!

MOST EFFICIENT PERFORMANCE EVER ON VHF, UHF, FM/STEREO FROM *ONE* ANTENNA USING *ONE* DOWN-LEAD!

- *Cap-electronic* dipole design makes more elements resonate on channels 7 to 13 with a corresponding increase in gain.
- *Higher mode* operation in UHF band achieves higher gain on channels 14 to 83—and FM stereo.
- *Narrower* beamwidths . . . higher front-to-back ratios step up ghost rejection . . . intensify color.
- *Patented frequency independent* design maintains peak performance characteristics regardless of channel or band tuned.
- Includes 3-way splitter so single down-lead can be tied into individual VHF, UHF and FM system inputs.

REMEMBER — AN 82-CHANNEL TV SET IS NOT AN 82-CHANNEL TV RECEIVER UNLESS IT HAS AN 82-CHANNEL TV *ANTENNA!*

*Lest we forget—every *color* set is also an *82-channel* set requiring a color-perfect antenna. In fact, many color TV shows are broadcast on UHF channels.

JFD

SEE YOUR DISTRIBUTOR OR WRITE FOR BROCHURE 806

Model LPV-VU13 Model LPV-VU10 Model LPV-VU12 Model LPV-VU9 Model LPV-VU6

JFD LPV-VU LOG PERIODICS for channels 2 to 83 and FM/Stereo.

Patented under one or more of U.S. Patents 2,985,881; 3,068,478; 3,185,989; 3,196,446 and 3,200,401. Licensed by JFD Electronics Corporation under patents issued to the University of Illinois Foundation.

JFD ELECTRONICS CORPORATION
43th Ave. 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

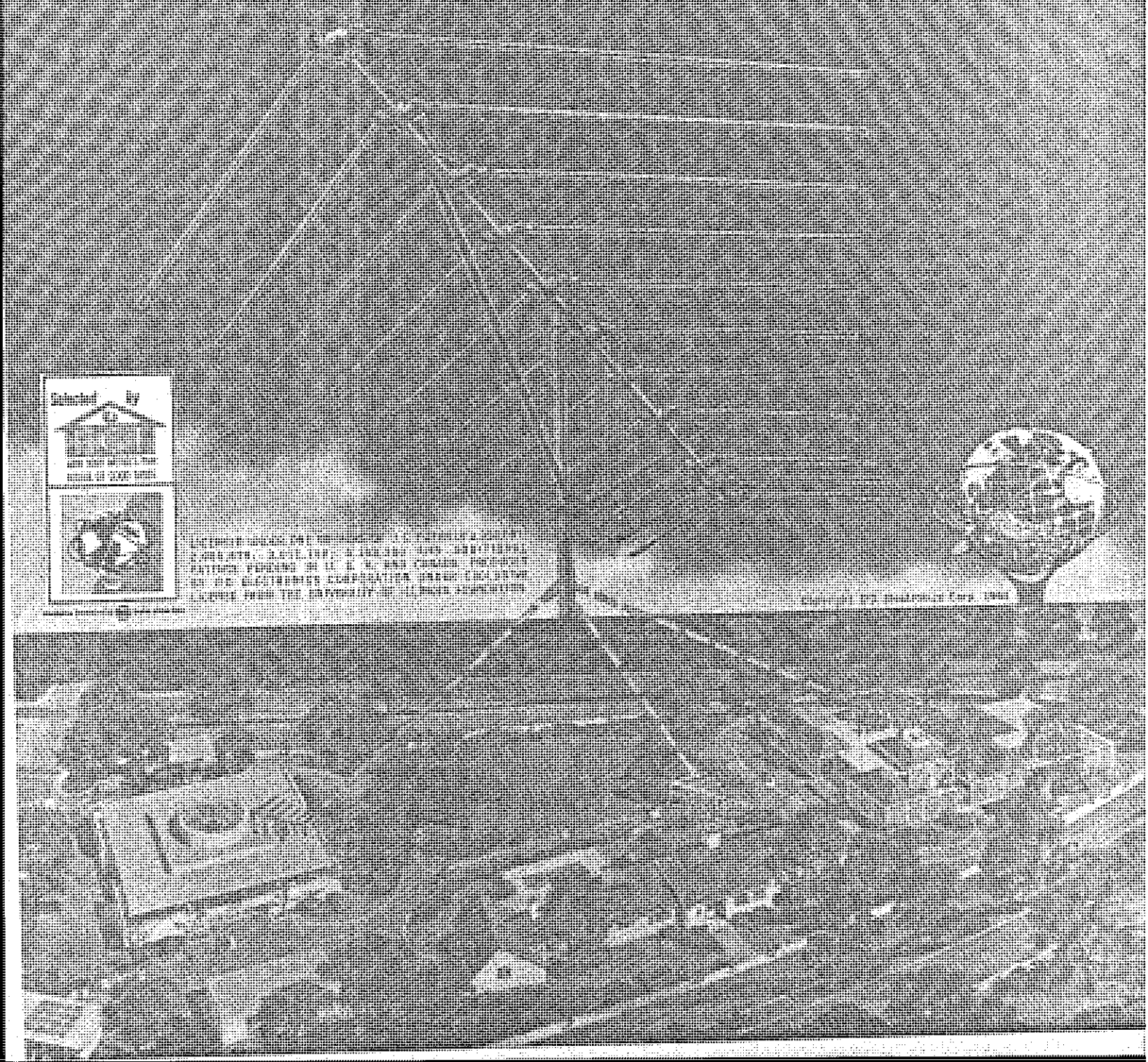
SEE THE JFD LOG-PERIODIC LPV ANTENNA AT THE 1964-65 NEW YORK WORLD'S FAIR

The New York World's Fair House of Good Taste Exhibit will showcase today's and tomorrow's finest advances in home living. Its Board of Directors selected the JFD Log-Periodic LPV as the only television antenna to be installed on each of the three homes in its exhibit.

Sixty million Fair-goers will see the JFD Log-Periodic LPV. Millions more, everywhere in America, will see, hear and read about the House of Good Taste and its choice of the JFD Log-Periodic LPV. This powerful new marketing force will be at work building record JFD Log-Periodic LPV sales and profits for you during 1964 and 1965.

Another JFD first that means more customers—more profits for Log-Periodic LPV users!

60 MILLION FAIRGOERS WILL SEE AND HEAR ABOUT THE REMARKABLE NEW JFD LOG-PERIODIC LPV THE EXCLUSIVE TV ANTENNA CHOICE OF THE NEW YORK WORLD'S FAIR HOUSE OF GOOD TASTE!



BE OUR GUEST AT THE MOST EXCITING EXTRAVAGANZA OF THE YEAR...

—the fabulous 1964-1965 New York World's Fair Festival!



HERE IS NOW

Every JFD VHF or UHF Log-Periodic LPV you buy between March 1, 1964 and August 31, 1965 earns you valuable JFD Fair Festival Certificates (see schedule below) which you can:

1. **Trade in for FREE World's Fair Adult Admission Tickets (worth 150 points) or...**
2. **Trade in for FREE 3-day, 2-night Fair WEEK-ENDER HOLIDAY (worth 3,000 points) or...**
3. **Redeem for $1.25 cash for each 150 points, from JFD.**

USE THEM FOR YOURSELF AND YOUR FAMILY... USE THEM AS INCENTIVES TO YOUR CUSTOMERS TO PROMOTE MORE JFD LPV ANTENNA SALES!

ENJOY THE GREATEST SHOW EVER ASSEMBLED

50 different nations and 50 states will be represented. You'll see the first public demonstration of nuclear fission... a moon exploration team at work... water shows, ice shows, continental circus, monorails, the Wild West, auto thrills, space capsule and hundreds of other spectacular sights.

AND TO HELP YOU SELL MORE LPV ANTENNAS, JFD OFFERS YOU A SENSATIONAL WORLD'S FAIR TIE-IN PROMOTION PROGRAM...

A stunning array of full-color official World's Fair displays, banners, streamers, brochures, folders, cards, newspaper mats, and dozens more advertising aids will power your own local sales campaign—earn you more profits **and** tickets toward **your** FREE FAIR HOLIDAY.

START NOW...MAKE SALES/POINTS WITH JFD ANTENNAS!

JFD DEALER LPV POINT VALUES

model	points	model	points
LPV17	60	LPV-U15	20
LPV14	50	LPV6, LPV6PM	15
LPV11	35	LPV4, LPV4PM, LPV-U9	10
LPV-U21	30	LPV-U5	5
LPV8, LPV8PM	25		

Obtainable from your JFD distributor when you purchase LPV Antennas.

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
401-144 W. Hastings Street, Vancouver 3, B.C.

THE LPV $\frac{L_{(n+1)}}{L_n}=\tau$ LOG-PERIODIC TV ANTENNA BY JFD IS THE BIGGEST ANTENNA STORY IN YEARS. TELL IT AND YOU'LL SELL IT. HERE'S HOW...

Virtually every TV set-owner—which means almost everybody—is interested in the better reception he can get with the log-periodic LPV. Make sure all the prospects in your area know about it. Use the promotion material pictured in this folder to plan a complete, continuing campaign.

1 Mailers to reach your customers and best prospects.

2 A newspaper ad campaign to cover your entire marketing area—bring everybody in.

3 TV slides and radio/TV scripts to convey the full excitement of the LPV story.

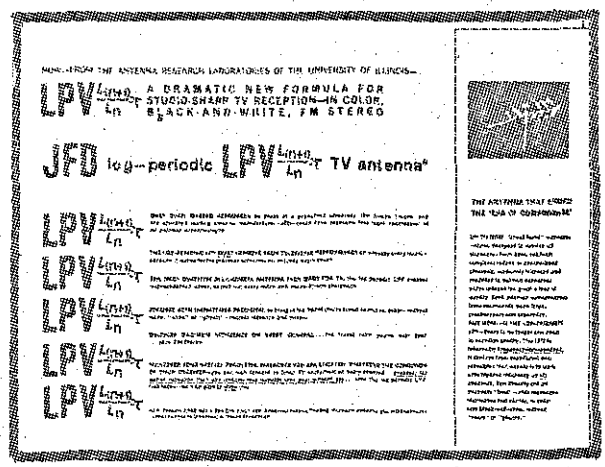
4 Doorknob hangers for "pinpoint" advertising in your immediate locality.

5 Streamer to "stop" street traffic, create impulse sales, help close the order.

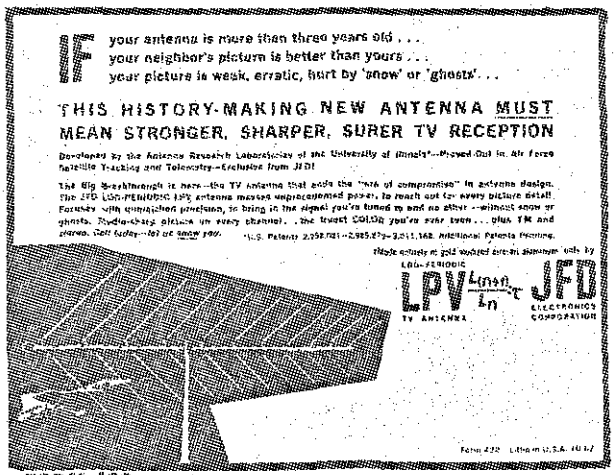
Use the enclosed postcard to order additional selling kits—conveniently packaged in a handsome file folder-portfolio—now.

LPV MAILERS TO SEEK OUT AND SELL OLD AND NEW TV VIEWERS!

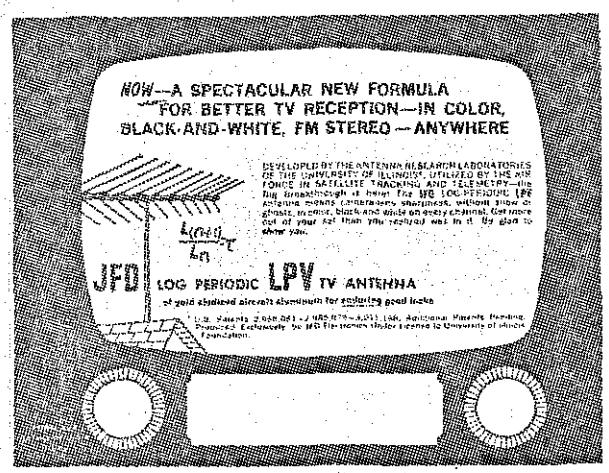
Send to your customer lists, phone book or street directory lists, association rolls, etc. (Possibly the board of elections, cleaning stores, liquor dealers, department stores or other businesses in your neighborhood have lists they may let you use.) For maximum impact, send all three—postcard, self-mailer, postcard—to fringe prospects, local prospects, all prospects.



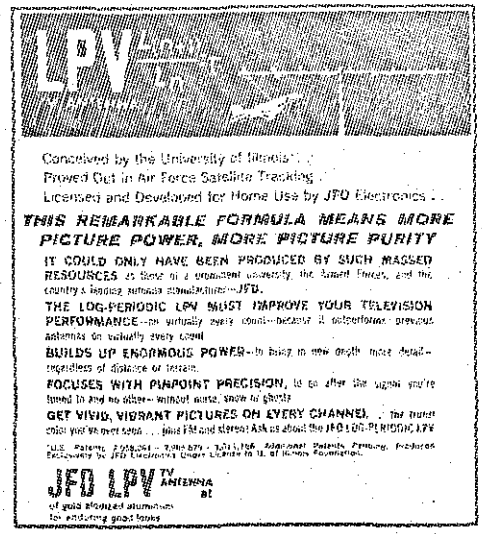
FORM 421 (folds to 5½ x 4¼")
4-page, 2-color consumer self-mailer/envelope stuffer



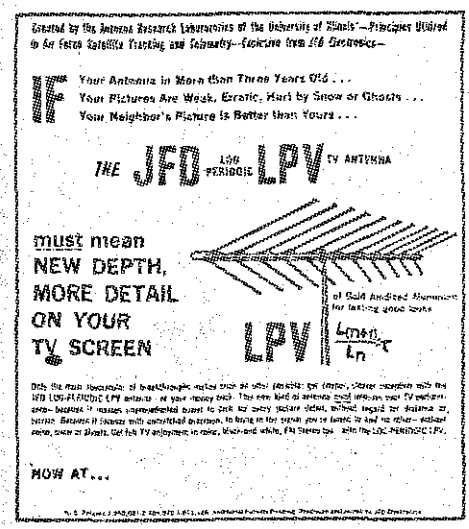
FORM 422
2-color jumbo postcard (7 x 5¼")



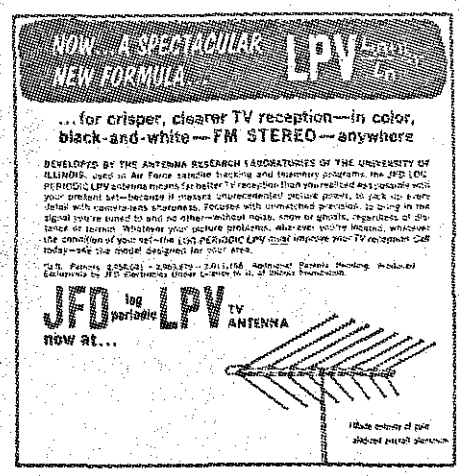
FORM 423
2-color jumbo postcard (7 x 5¼")



Mat No. 255
3 cols. x 84 lines=252 lines



Mat No. 256
3 cols. x 87 lines=261 lines

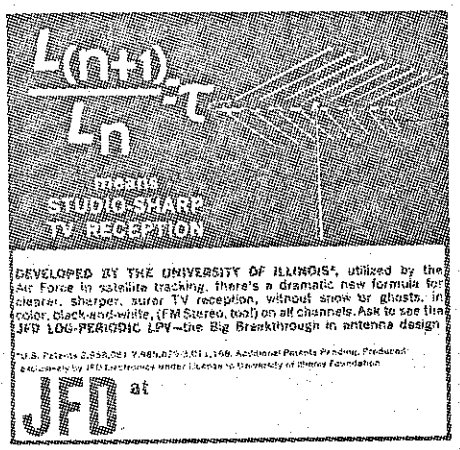


Mat No. 257
3 cols. x 74 lines=222 lines

SHOWN ⅓ ACTUAL SIZE

LPV AD MATS TO MAKE EVERY TV OWNER REALIZE THERE'S SOMETHING NEW IN THE AIR!

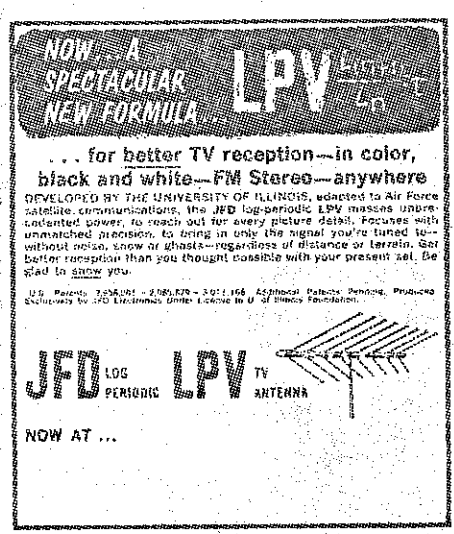
Consistency is the secret of effective advertising. Alternate these mats on a planned schedule to create a continuing campaign and a lasting impression. Your newspaper rep will be glad to help you with the details. (Mats shown one-third actual size.)



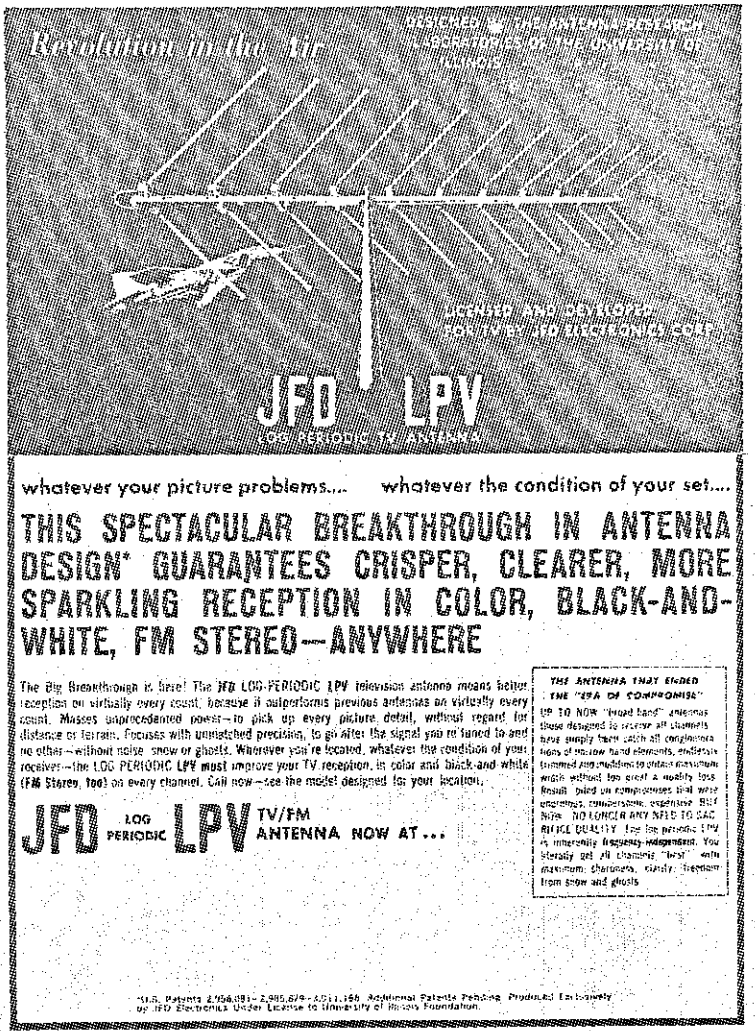
Mat No. 259
2 cols. x 50 lines=100 lines



Mat No. 260
2 cols. x 52 lines=104 lines



Mat No. 261
2 cols. x 57 lines=114 lines



Mat No. 254
4 cols. x 140 lines=560 lines



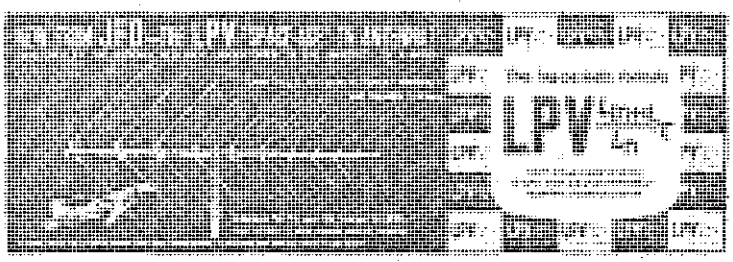
Mat No. 258
2 cols. x 85 lines=170 lines

SHOWN 1/3 ACTUAL SIZE

JFD ELECTRONICS CORPORATION 1462 62nd Street Brooklyn 19, N.Y.

STOP and SELL YOUR ANTENNA PROSPECTS with these LPV SALE-SPARKERS!

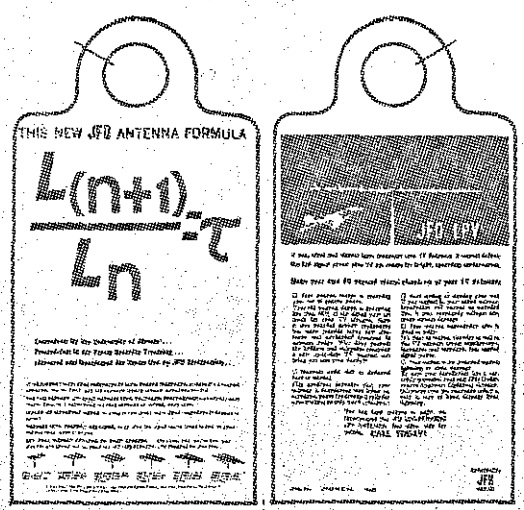
Use this exciting material to remind your customers that they get the newest advances and the complete service at your store. The LPV is a dramatic entering wedge that can help you sell other items as well as antennas.



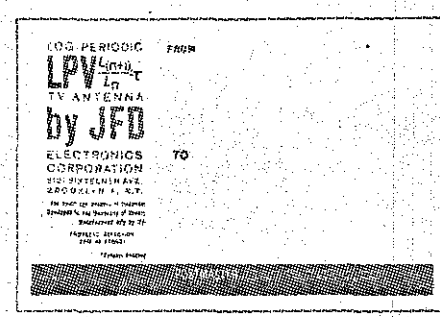
FORM 426
color streamer, 8½ x 22" for windows



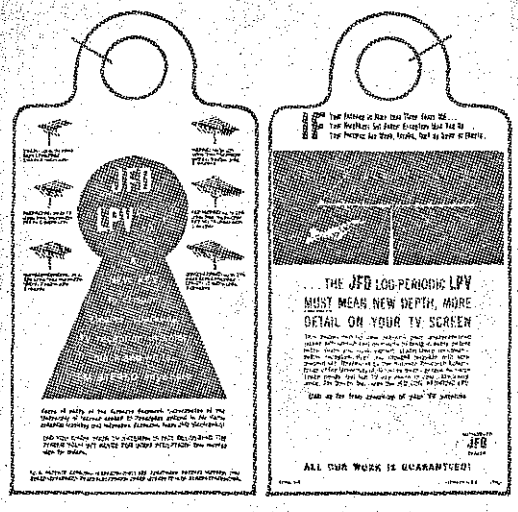
FORM 425 10-page color catalog



FORM 428
doorknob hanger for homes and autos

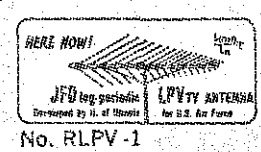


FORM 411
color shipping label



FORM 429
doorknob hanger for homes and autos

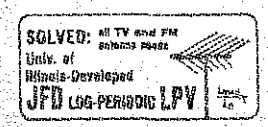
POSTAGE METER CUTS



No. RLPV-1



No. DLPV-1



No. RLPV 2



No. DLPV-2



No. RLPV 3

RADIO AND TV COMMERCIALS

FORM 460 60 second radio script
FORM 460A 60 second radio script
FORM 461 20 second radio script
FORM 461A 35 mm. TV Slide
FORM 463 35 mn. TV slide

THE LOG-PERIODIC LPV WILL BE BACKED BY THE BIGGEST PROMOTION IN ANTENNA HISTORY. It will generate new attention to TV performance—new buying excitement. Tie in with this excitement to sell not only LPV's, but installation, color TV, service.
USE ENCLOSED POSTCARD TO ORDER YOUR PROMOTION MATERIALS

FORM 430 LITHO IN U.S.A. 10/62

RETURN TO:
ISB

Developments in broadband antennas

A survey is presented for the purpose of providing the nonspecialist with a basic understanding of the remarkable advances that have taken place over the past decade in the field of broadband antennas

E. C. Jordan, G. A. Deschamps, J. D. Dyson, R. E. Mayes *University of Illinois*

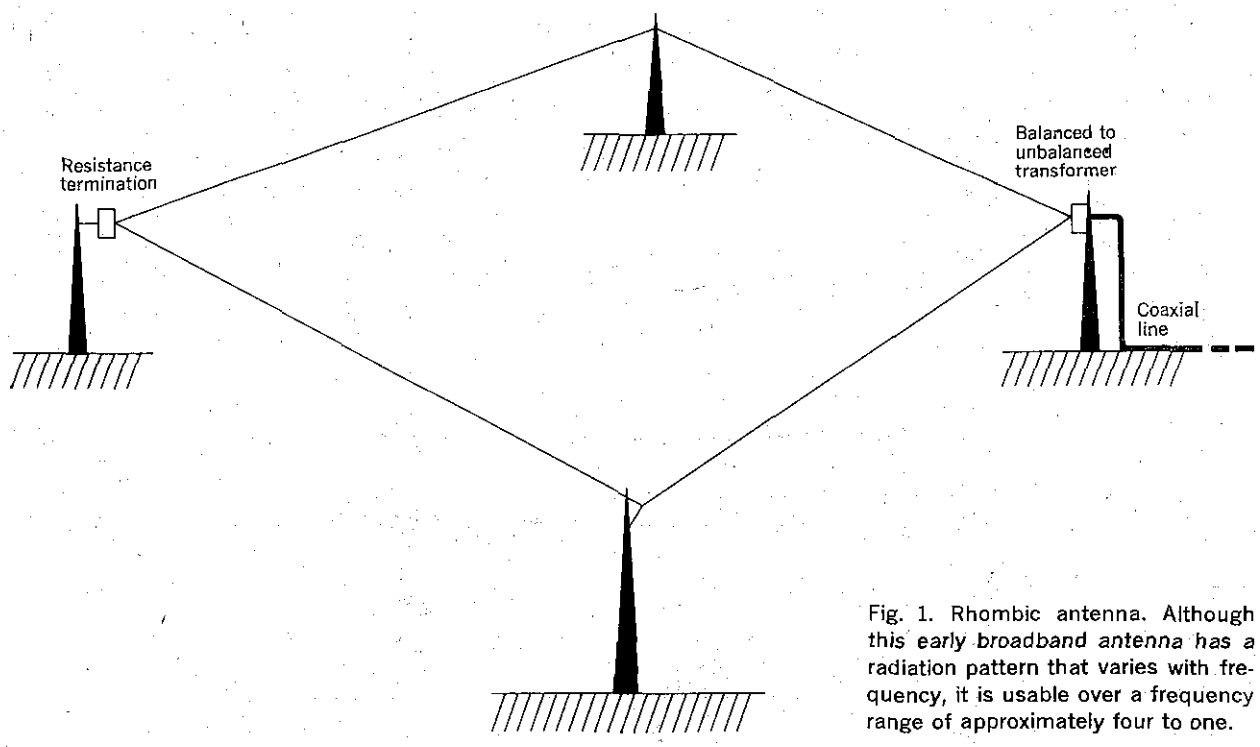


Fig. 1. Rhombic antenna. Although this early broadband antenna has a radiation pattern that varies with frequency, it is usable over a frequency range of approximately four to one.

Spectral lines

How Reduce the Damping? In the past two months I have used this space to develop a rationale for the many changes in engineering education that have occurred in the last 25 years. This month it is my intent to close out the trilogy by discussing the work remaining ahead.

It was almost trite last month to say that we were witnessing a technological explosion; explosion seems an inaccurate metaphor, since we usually assume an explosive event to end, after which we take on the job of restoring the status quo, provided that the explosion left us with any status. The technical changes of recent years are also referred to as a technological revolution, but these words also seem to carry an implication of eventual return to a steady state of merely differing characteristics. The past state or a steady state is not to be expected today.

Furthering the thought through technical language, it could be said that the changes of the last quarter century should not be looked upon as a random event, but rather as a series of forcing functions which will produce transient responses in the system to the end of time. The best title that I have yet found to describe our situation seems to be "technical evolution." Such a title implies change; it implies selection of appropriate means and devices; it suggests competition, and conveys the thought of continuing and unending progress under the control of the environment and the forces existing at the time.

If we are in an evolutionary condition, we must accept completely a philosophy of growth, expansion, and new challenge. Any return to past days of ease, to days of stable technology, is both unthinkable and contrary to the purpose of the engineer—a person who must be dedicated to change and progress if he is to improve the lot of man. We must realize that engineering education is for a changing world in which engineers will answer questions by methods now unknown.

A system under forcing can be studied by analysis of its responses. One observation to be made of our engineering manpower system is that, in its response to change, its characteristics show heavy overdamping. This should be no surprise, because it is said that of all engineers ever educated, at least 90 per cent are living today. Major changes have appeared in our curricula in only the past 15 years, and my guess is that less than 15 per cent of our estimated 850000 engineers can be assumed to have received a modern engineering education. Those of age 35 or over graduated from college before most of our new disciplines were visualized, and many years before they were regularly taught. They have not had the opportunity to acquire new skills and knowledge.

To profit from the inherent abilities and experience of these older engineers, continued education seems to be required. Formal programs embracing the new knowledge will allow them to turn the technical corners around which their fields have moved, then to progress to positions of responsibility.

For many years some colleges of engineering have conducted programs in extension or continuing education, but these are not the programs of which I write. In fact these programs all too often pointed in the other direction—toward upgrading a high school graduate to do more adequately the work of a technician. Short courses for such practitioners, review for professional examinations, or undergraduate work on the nondegree level were usual, but little was done for the engineering graduate to allow him to maintain his place in a fast-moving technology. Today we are beginning to recognize the need for both short and long courses, directed not toward graduate degrees but providing modern technology in concise and direct form to the men now in supervising or managerial positions. The Engineers Joint Council is discussing methods, and some schools are already offering seminar series and courses of varying lengths, but much greater availability is needed. Here, perhaps, using closed-circuit television, we can extend the abilities of our thin faculty ranks, and make available experts from the laboratories.

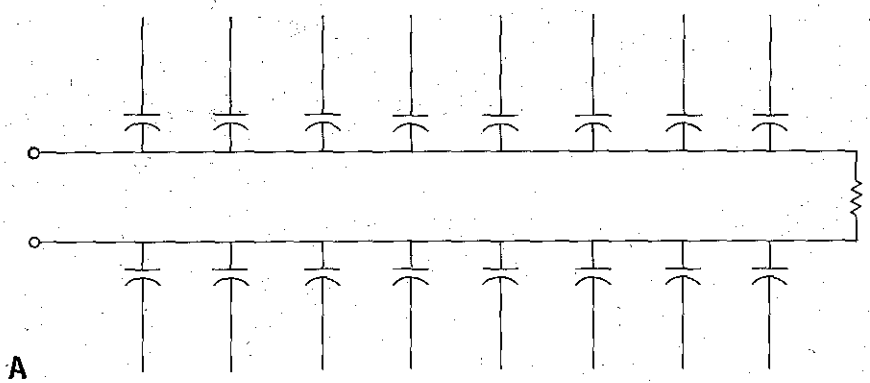
Not all industry is aware of the need for re-education—although our electrical industry is largely on board. One large corporation depending upon research for new products has stated that it must undertake such re-education; a second company oriented to production believes it inadvisable to give up the time of the men concerned. Industry must supply free time for the men to be benefited; employers must provide part of the motivation to speed the response of the system to technological needs.

Many engineers work with companies too small to undertake their own programs; others work in locations remote from our educational centers. Provision of needed educational media for such men then becomes a responsibility of their technical societies. Engineering journals must become more than technical news magazines; they must pull their members always toward increased technical competence. This is a major tenet of IEEE publications policy; we see incomplete acceptance of the view in other societies.

For the recent graduate there must be opportunity for technical advance through graduate work. Graduate credit programs are already available in our major cities, and are contributing to the employment of new graduates.

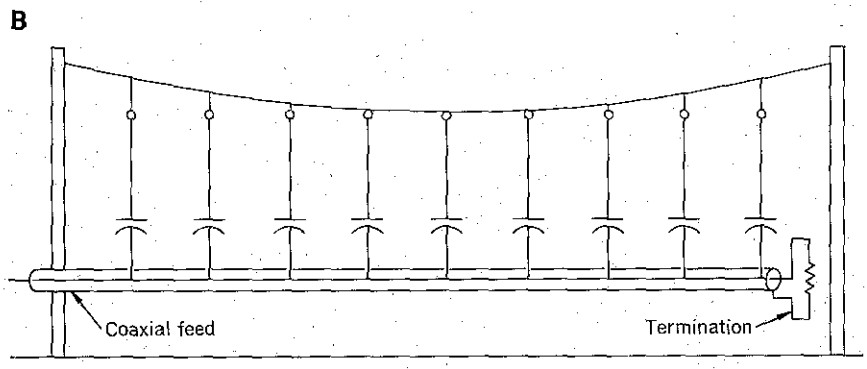
We should make good use of short annual seminars for the practicing engineer. At present our job is to reduce the backlog, and to assure that our colleges provide a solid base for today's graduates. Engineering education must drop the concept that it is teaching to earn, and adopt a new philosophy that it is educating for future learning.

J. D. Ryder



A

Fig. 2. The fishbone (A) and comb (B) antennas, which have a pattern and impedance that are relatively constant over a two-to-one frequency band.



Until a few years ago the ultimate limiting factor on the bandwidth of any communication system using radiated-wave propagation was most frequently the antenna. Since the antenna performs the dual functions of an impedance-matching device and a directional radiator, the characteristics of major importance are its impedance and its directional properties. Depending upon the application, one or the other (or both) of these characteristics may limit the useful bandwidth. The required or desired bandwidth also varies markedly with application; for example, the required bandwidth may vary from a few cycles per second for a single-channel VLF system up to about 6 Mc/s for a single television channel. For multichannel operation, the radio broadcast band covers a three-to-one bandwidth, the VHF television band covers a four-to-one bandwidth, and the high-frequency communication band covers a ten-to-one bandwidth, from 3 to 30 Mc/s. Finally, for countermeasures work it is usual to state that the desired frequency range extends from "dc to light."

Because of the wide variety of operational requirements that exist, there is no unique definition of antenna bandwidth. For our purposes, a broadband antenna will be considered to be one which retains certain desired or specified radiation pattern, polarization, or impedance characteristics over more than an octave (that is, a two-to-one frequency range).

Early broadband antennas

Some of the earliest broadband antennas were long-wire types designed to operate in the high-frequency (short-wave) band or in the low-frequency band. For the most part, they were broadband only in the sense that impedance remained relatively constant over the useful range; in general, no attempt was made to achieve a constant pattern. Among these antennas the well-known rhombic antenna has held a dominant place since the early days of radio. This antenna (Fig. 1) is essentially a resistance-terminated transmission line that has been opened out to form the four sides of a rhombus. Because of the traveling-wave current distribution along the terminated line, the main beam is in the forward direction (toward the termination) at an elevation angle that depends, in a complicated fashion, on the included angle of the rhombus and the lengths of the sides in wavelengths. Fortunately the beam is quite broad in the vertical plane and the angle above ground of the maximum increases as the frequency decreases. This change of angle with frequency is in the correct direction for transmission or reception of ionospherically reflected waves, so a rhombic antenna of fixed dimensions is usable over a wide frequency range (of the order of four to one) in the short-wave band.

The wave antenna, consisting of a long, elevated wire parallel to the ground and resistance-terminated at both ends, is another traveling-wave-type antenna. In contrast with most antennas, which operate best over a highly conducting ground, the wave antenna depends for its operation upon the finite conductivity of the earth beneath it. An incident radio wave traveling along the surface of a finitely conducting earth has a forward tilt and a horizontal component of electric field intensity. It is this horizontal component of electric field, produced by the finite earth conductivity, that induces a traveling wave of voltage in the horizontal wire and the resulting antenna action. Because the antenna has an impedance that is nearly independent of frequency, it is known as an aperiodic antenna. However, the radiation pattern

does vary with the length of the wire in wavelengths, and hence with frequency. Wave antennas are used for long-wave or low-frequency reception.

The fishbone receiving antenna consists of a long resistance-terminated transmission line loosely coupled by capacitors to an array of closely spaced (less than $\lambda/4$), untuned, horizontal dipoles; see Fig. 2(A). For vertically polarized signals, one half of a fishbone antenna is erected vertically and fed against ground to form a comb antenna; see Fig. 2(B). Tapering the coupling capacitors to larger values towards the termination equalizes the antenna currents and reduces resonance effects. Because the capacitive coupling of the elements to the transmission line is tighter at the higher frequencies, fewer of the elements are strongly excited. Hence, the effective length of the array varies inversely with frequency in such a manner as to maintain a fairly constant pattern, gain, and impedance, over the useful bandwidth of more than two to one. The fishbone and comb antennas have been described chiefly for comparison with the log-periodic dipole and log-periodic monopole types to be described later.

In contrast to the terminated wire and loaded transmission line types just described, there is a class of antennas that owes its broadband properties to broad, specially shaped surfaces. It was recognized quite early that a fat dipole had a much lower antiresonant (full-wavelength) impedance than a thin one, and that in general, fat antennas had smaller impedance variations than thin ones. The importance of broad surfaces was emphasized by Schelkunoff in the treatment of the biconical antenna, and many broad-surfaced specially shaped antennas found early application in television transmitting antennas and countermeasures antennas. A very successful broadband antenna was the discone[1] (a cone fed against a disk), which maintained good impedance and pattern characteristics over a four-to-one bandwidth (Fig. 3). For countermeasures work many antennas having surfaces of various shapes were developed,[2] some of which had remarkably wide impedance bandwidths and usable pattern bandwidths of the order of five to one. It must be admitted, however, that most of these early designs were arrived at by an intuitive or cut-and-try approach.

Another group of antennas, some of which display fairly wide bandwidths, consists of various helical and spiral shapes. When the circumference of a helical antenna is of the order of a free-space wavelength, the antenna radiates in the axial mode—that is, with the maximum radiation along the axis of the helix. In this mode, the helical antenna has desirable impedance, pattern, and circular polarization properties over nearly an octave.[3] By expanding the diameter of the helix along its length to form a conical monofilar helix fed from the base end, Springer[4] showed that the bandwidth could be increased. His observation that there appeared to be an effective aperture that moved toward the smaller end of the cone as the operating wavelength decreased was perhaps the first indication of things to come. Later, Chatterjee[5,6] also considered monofilar helical antennas formed on a conical surface and fed against a ground plane. He demonstrated that they could be excited from either end, and obtained usable bandwidths of approximately four to one. At about the same time, Turner[7] proposed a balanced antenna constructed in the form of an Archimedes spiral. This planar antenna, constructed with narrow constant-width arms and radiating a broad lobe on each side of the structure, gave promise of being usable over the then remarkable bandwidths of between seven and eight to one.

Frequency-independent antennas

In 1954, Rumsey[8] put forth the idea that a structure entirely definable by angles, without any characteristic length dimension, should have properties that are independent of the frequency of operation. However, all such angle structures extend to infinity, so the key question was which of such structures retained these frequency-independent characteristics when truncated to a finite length. It should be noted that the well-known biconical structure is an angle structure that is *not* frequency independent when it is truncated to form a practical antenna. Both impedance and pattern vary with frequency for any finite length.

Rumsey proposed that an equiangular spiral structure, which satisfies the angle requirement, might have the desired properties, and Dyson[9-11] undertook a comprehensive experimental study of an antenna based on the equiangular spiral geometry shown in Fig. 4. The equiangular or logarithmic spiral* is defined by

$$\rho = e^{a(\phi-\delta)} \quad \text{or} \quad \phi - \delta = \frac{1}{a} \ln \rho$$

where ρ and ϕ are conventional polar coordinates, and a and δ are constants. In Fig. 4 the edges of the metallic arms are defined by

$$\rho_1 = ke^{a\phi} \quad \text{and} \quad \rho_2 = ke^{a(\phi-\delta)}$$

for one arm, and by

$$\rho_3 = ke^{a(\phi-\pi)} \quad \text{and} \quad \rho_4 = ke^{a(\phi-\pi-\delta)}$$

for the other arm, where the constants a, k, and δ determine the rate of spiral, size of the terminal region, and arm width, respectively. With this particular spiral the angle between the radius vector and the spiral remains the same for all points on the curve—hence the term "equiangular spiral." Experimental investigation established that this particular geometry did indeed retain its frequency-independent properties after truncation, and this design was the basis for a large class of successful frequency-independent antennas.

When this angular structure is excited in a balanced manner at the origin, the current flows outward with small attenuation along the spiral arms until a region of given size in wavelengths is reached. In this region (the active or radiating region) essentially all of the incident energy transmitted along the spiral arms is radiated, and somewhat beyond this region the presence or absence of the arms is of no consequence. Because the radiating region is of constant size in wavelengths, it moves toward the origin as the wavelength of operation decreases. The size of effective radiating aperture thus automatically adjusts or scales with frequency of operation in such a manner that the antenna behaves the

* The logarithmic spiral was first discussed by Descartes (1638) and later (1691–1693) studied by Jacques Bernouilli, who gave it its name. Bernouilli was so delighted by the property of the spiral reproducing itself under various transformations that he requested that the spiral be engraved on his tomb with the inscription "Eadem Mutata Resurgo."

same at all frequencies. Because of the spiraling of the arms, this scaling is accompanied by a rotation of the radiated field about the axis of the antenna.

It is now known that this automatic scaling of the radiating aperture is a condition for operation in a frequency-independent manner. It is interesting to note that Springer observed this phenomenon on the expanding helix, but unfortunately the methods of construction and excitation limited the bandwidth obtainable to something over an octave, so the importance of scaling of effective aperture with frequency was not fully recognized. Chatterjee's measurements also show evidence of scaling with frequency in the near-field amplitude plots from which he calculated radiation patterns; but again, possibly because of the physical configuration and method of feed, the full significance of this scaling does not appear to have been appreciated. In a similar manner, the radiating aperture of the Archimedes spiral antenna tends to scale with frequency; however, because the width and spacing of the spiral arms in the radiating region are not constant in wavelengths, as frequency is varied, the antenna characteristics change (albeit slowly) with frequency.

At this point it is necessary to define the term "frequency independent" when it is used with a practical finite-sized structure. If the antenna is excited by a voltage applied between the two arms at the origin, it has an impedance and radiation pattern that are essentially constant* (that is, independent of frequency) for all frequencies above that for which the outer diameter of the truncated structure is approximately half a wavelength up to the frequency at which the diameter of the feed region (as determined by the transmission line feed) is comparable with a half wavelength. Since these two dimensions can be specified independently, the design bandwidth can be made arbitrarily large; actually it is limited only by practical considerations of construction—that is, how large the outer diameter is made and how finely the geometry at the feed region can be modeled.

The equiangular spiral antenna, which is bidirectional, radiates a very broad, circularly polarized beam on both sides of its surface. This bidirectional characteristic severely restricts its utility in practice, but a modified version, to be described later, provides a highly practical, extremely broadband antenna.

Log-periodic antennas

In 1955, working with Rumsey on broadband antenna development, DuHamel[12] proposed that it should be possible to force radiation from otherwise "angle structures" by the use of appropriately located discontinuities. One of the first geometries chosen to investigate the validity of this concept was that shown in Fig. 5. Here two wedge-shaped metallic angle structures have teeth cut into them along circular arcs. The radii of the arcs which define the location of successive teeth are chosen to have a constant ratio $\tau = R_{n+1}/R_n$. This same ratio τ defines the lengths and the widths of suc-

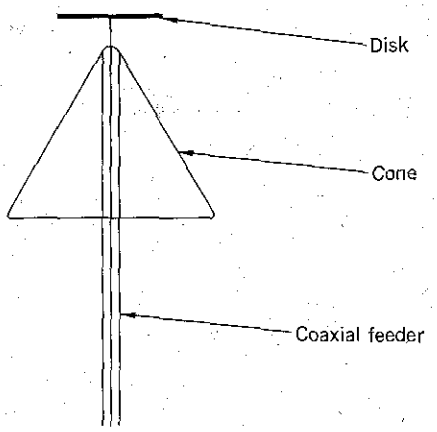


Fig. 3. The discone, a successful early broadband antenna having a useful bandwidth of approximately four to one.

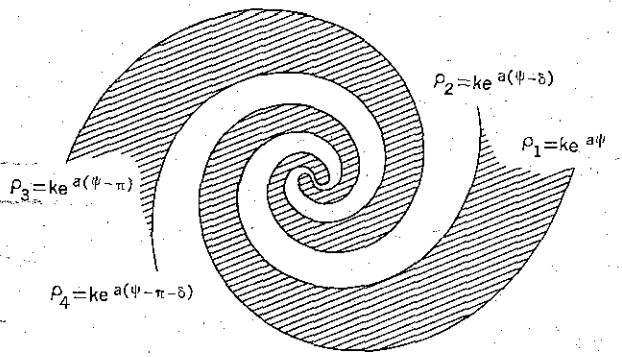
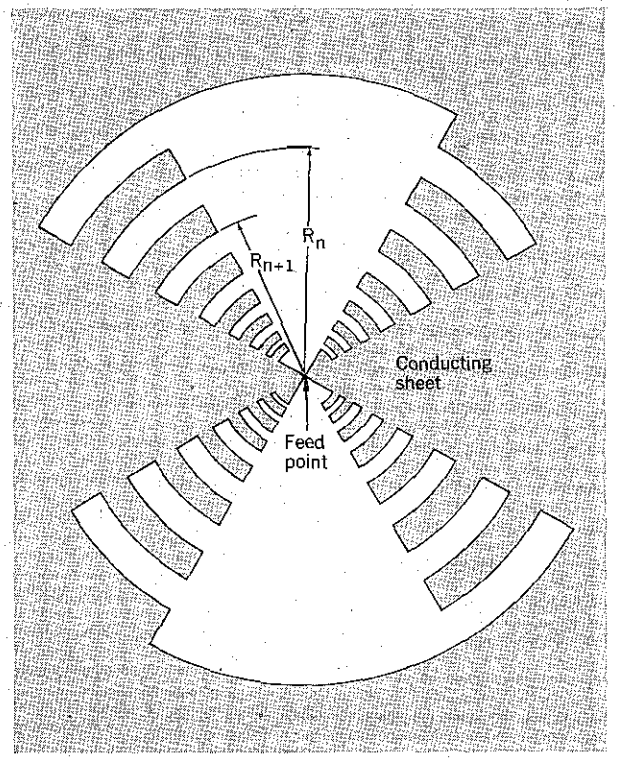


Fig. 4. Sketch showing the geometry of the equiangular (or logarithmic) spiral antenna with equations of the edges.

Fig. 5. A sheet-metal log-periodic antenna.



* The pattern actually rotates with frequency about an axis perpendicular to the plane of the spiral. If the pattern-measuring coordinate system is allowed to rotate at the same rate, the measured pattern remains constant; otherwise there will be a (generally small) periodic variation of magnitude proportional to the rotational asymmetry of the pattern.

cessive teeth. From the principle of modeling it is evident for this structure, extending from zero to infinity and energized at the vertex, that whatever properties it may have at a frequency f will be repeated at all frequencies given by $\tau^n f$, where n is an integer. When plotted on a logarithmic scale, these frequencies are equally spaced with a period equal to the logarithm of τ; hence the name "log-periodic" structure. Log-periodicity guarantees only periodically repeating radiation pattern and impedance. However, for certain types of such structures and for values of τ not too far from unity, variation of characteristics over a period can be quite small, and an essentially frequency-independent structure results. It is important to note that only a relatively few of the nearly infinite variety of log-periodic structures will make successful broadband antennas in the sense that the impedance and pattern characteristics will remain constant when the structure is truncated to a finite length. It happens that the geometry of Fig. 5 did result in a successful log-periodic antenna.

The antenna of Fig. 5 was designed to have one other rather special property; namely, that the metal cut away from the plane sheet to form the antenna arms has identical shape with the metal that remains. In other words, the complementary slot antenna has the same size and shape as the metallic dipole antenna. Now by an extension of Babinet's principle it is known that complementary-dipole and slot antennas have impedances Z_d and Z_s, respectively, related by $Z_d Z_s = (60\pi)^2$. Because the slot antenna and dipole antenna are the *same* (for the geometries chosen) it follows that $Z_d = Z_s = 60\pi \approx 189$ ohms, a result that is independent of frequency. Hence this particular geometry assured constant impedance, although not constant radiation pattern, independently of the other consideration of log-periodic geometry. In view of this use of Babinet's principle in the design of these planar structures, the next step to be taken was a bigger one than might at first appear.

Unidirectional frequency-independent and log-periodic antennas. Both the equiangular spiral antenna (Fig. 4) and the log-periodic antenna (Fig. 5) radiate equally on both sides of the plane of the antennas, a result that severely limits their usefulness. A major step forward was made in extending the range of practical application when Isbell[13] bent the two arms of the planar log-periodic structure toward each other (out of the plane) to form the nonplanar V-shaped antenna of Fig. 6. Two rather surprising results were observed. As the angle between the two arms of the antenna was decreased from 180° the radiation pattern changed from bidirectional to undirectional, with the major radiation off the apex of the antenna—that is, in the backward direction. Moreover, although one of the necessary conditions for Babinet's principle (that of a plane surface) was now violated, the impedance continued to remain nearly constant with frequency, but at a different value, which depended upon the angle between the arms. This nonplanar version of the log-periodic structure, radiating a plane-polarized unidirectional beam, greatly increased the utility of the log-periodic structures.

The frequency-independent logarithmic spiral structure also found wider use when Dyson developed a unidirectional version by wrapping the balanced spiral arms on the surface of a cone, as shown in the antenna of Fig.

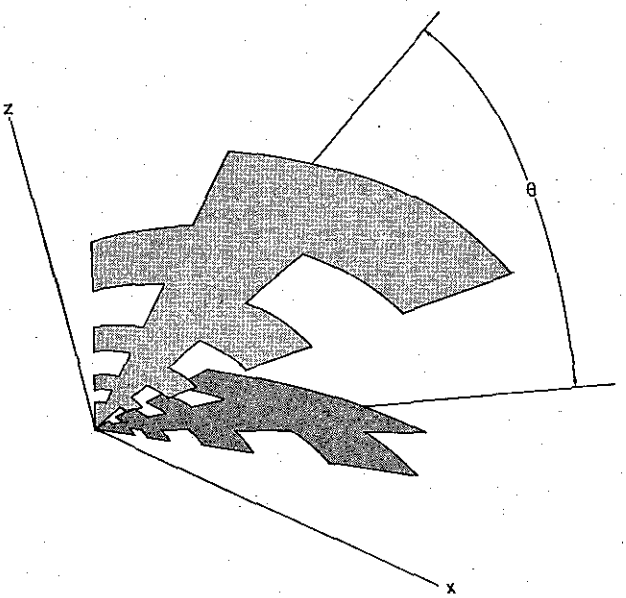
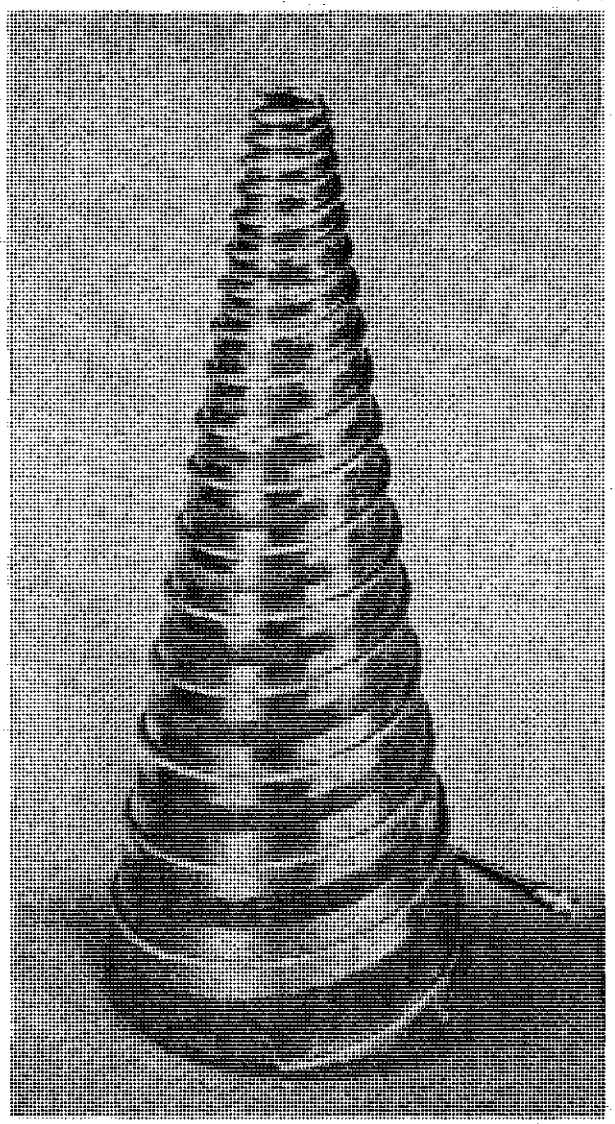


Fig. 6. Nonplanar, unidirectional log-periodic antenna.

Fig. 7. Unidirectional conical spiral antenna.



7. For appropriately chosen rates of spiral this modified version continued to yield essentially frequency-independent performance. For cone angles of less than about 45° the pattern became unidirectional with a broad-lobed beam, again in the backward direction off the apex of the cone.

The conical equiangular spiral antenna is a balanced structure, which may be fed (at the apex) by means of a balanced transmission carried up inside and along the axis of the cone. Alternatively, it may be fed as illustrated in Fig. 7 by a coaxial cable carried along and soldered in contact with one of the arms. Because the amplitude of antenna current on the arms, and also on the outside of the coaxial cable, falls off quite rapidly with distance from the apex, the ends of the arms where the cable enters is essentially a field-free region. This type of feed automatically provides a frequency-independent balun (balanced converter), permitting the balanced antenna to be fed by means of an unbalanced coaxial line. To maintain physical symmetry a dummy cable is usually soldered to the other arm. Conical equiangular or log-spiral antennas have been constructed to operate over bandwidths of higher than 40 to 1. The bandwidth obtained is at the discretion of the designer. The upper usable frequency is determined by the truncated region at the apex, which must remain small in terms of wavelengths, and the lowest usable frequency is set by the base diameter of the cone, which must be at least $\frac{3}{8}$ wavelength at the lowest frequency of operation for spirals that are wrapped fairly tightly.

A further modification of the conical equiangular spiral results in a very practical, easily constructed antenna. If the width of the expanding arms is narrowed and they are allowed to degenerate to constant-width structures, the cables alone can form the arms. For fairly tightly spiraled antennas there is little change in the characteristics from those of an antenna with narrow expanding arms.

Other types of log-periodic antennas. The practical value of the log-periodic approach was enhanced even further when DuHamel[14] and co-workers demonstrated that successful log-periodic antennas could be made with wire structures as well as sheet structures. This development extended the range of application down from microwaves through the high-frequency band. A typical wire version of a log-periodic antenna is shown in Fig. 8. It was also demonstrated that for higher gain a frequency-independent array of log-periodic antennas could be constructed by arranging the antennas like the spokes of a wheel with the origins of the individual antennas at the hub.

Still another application of the log-periodic principle is the log-periodic dipole array[15] of Fig. 9. As with all log-periodic geometries, all dimensions are increased by a constant ratio in moving outward from the origin. Thus the lengths and spacings of adjacent elements must be related by a constant scale factor τ, as follows:

$$\frac{l_n}{l_{n-1}} = \frac{d_n}{d_{n-1}} = \tau$$

Although at first glance this antenna might appear similar to the early fishbone antenna with $\tau = 1$, there are several essential differences. For successful operation, the log-periodic dipole array must be fed with a transposition of the transmission line between adjacent dipole elements. The antenna is then caused to radiate in the backfire direction (that is, toward the source), a condition which appears to be necessary for successful unidirectional frequency-independent or log-periodic operation. The

Fig. 8. Log-periodic wire antenna for frequencies of 11 to 60 Mc/s. (Photo courtesy Collins Radio Company.)

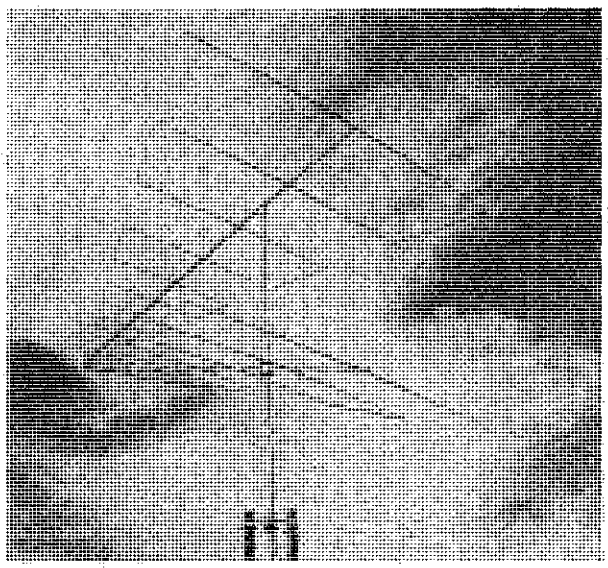
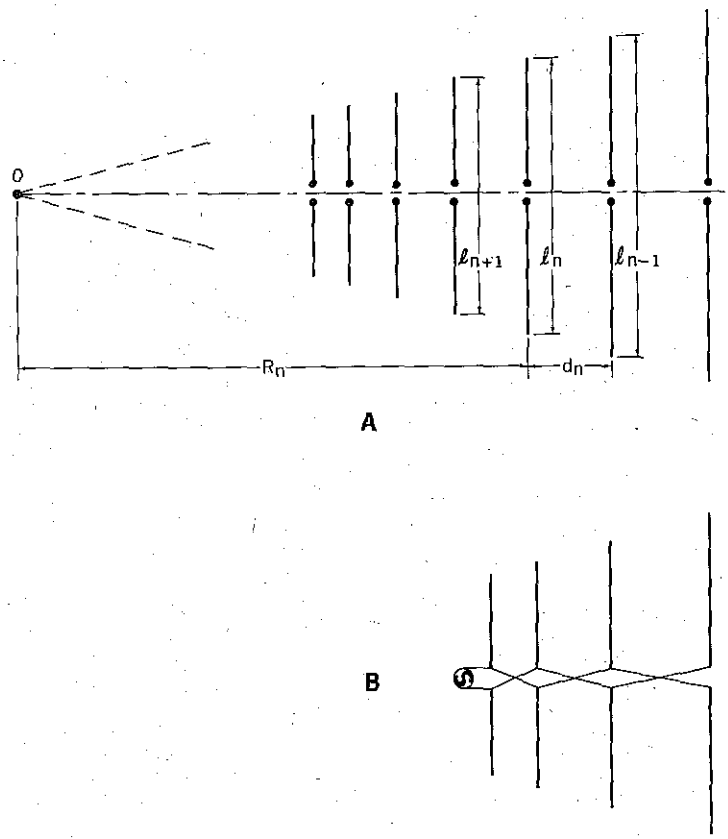


Fig. 9. Log-periodic dipole antenna array. A—Lengths and spacings of elements. B—Method of feeding.



active portion of the array from which most radiation occurs is centered around those elements near resonance (for which l_n is somewhat less than $\lambda/2$). As the frequency is changed the active region moves back or forth along the array. Because practically all of the input power is absorbed in and radiated by the active portion, the larger elements to the right of the active region are not excited. Moreover, because the beam is directed toward the feed point at the left, these larger elements are in an essentially field-free region, and so do not adversely affect the operation. The shorter elements to the left of the active region are in the beam but, because of their short lengths, close spacings, and alternate phasings, have small influence on the pattern.

Basic principles of operation of log-periodic and frequency-independent antennas. Of the almost unlimited variety of log-periodic structures that can be devised, only a small fraction will produce successful antennas when truncated. It is interesting to search out the essential requirements for successful design. The operation of the log-periodic dipole array of Fig. 9, being simple and easily understood, will be analyzed in some detail. From the understanding so gained it should be possible to extend the analysis to less familiar geometries, and then to frequency-independent antennas in general.

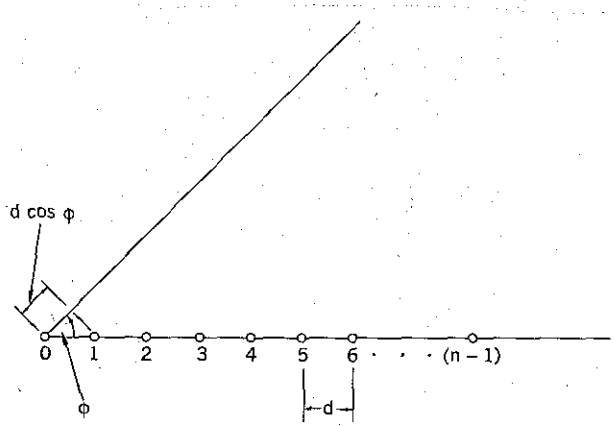


Fig. 10. Array of equispaced isotropic radiators.

At this point it will be advantageous to recall some of the basic notions of antenna array theory. Consider an n-element array of equispaced isotropic radiators (Fig. 10) having equal current amplitudes and a spacing d less than one-half wavelength. (An isotropic radiator is one that radiates uniformly in all directions; a simple dipole antenna is an isotropic radiator in the H plane perpendicular to its axis.) At a distant point the electric fields from these radiators will add with a phase angle between them which is dependent upon the relative phasings of the radiator currents and the relative phase delays produced by the difference in path lengths to the distant point. For the array shown the phase difference due to path length difference between adjacent elements is $(2\pi/\lambda)d \cos \phi$ radians. If the elements of the array are fed with a progressive phasing of currents equal to α, where α represents the angle by which the current in a given element *leads* the current in the preceding element, then at the distant receiving point the phase difference of the fields produced by adjacent elements will be

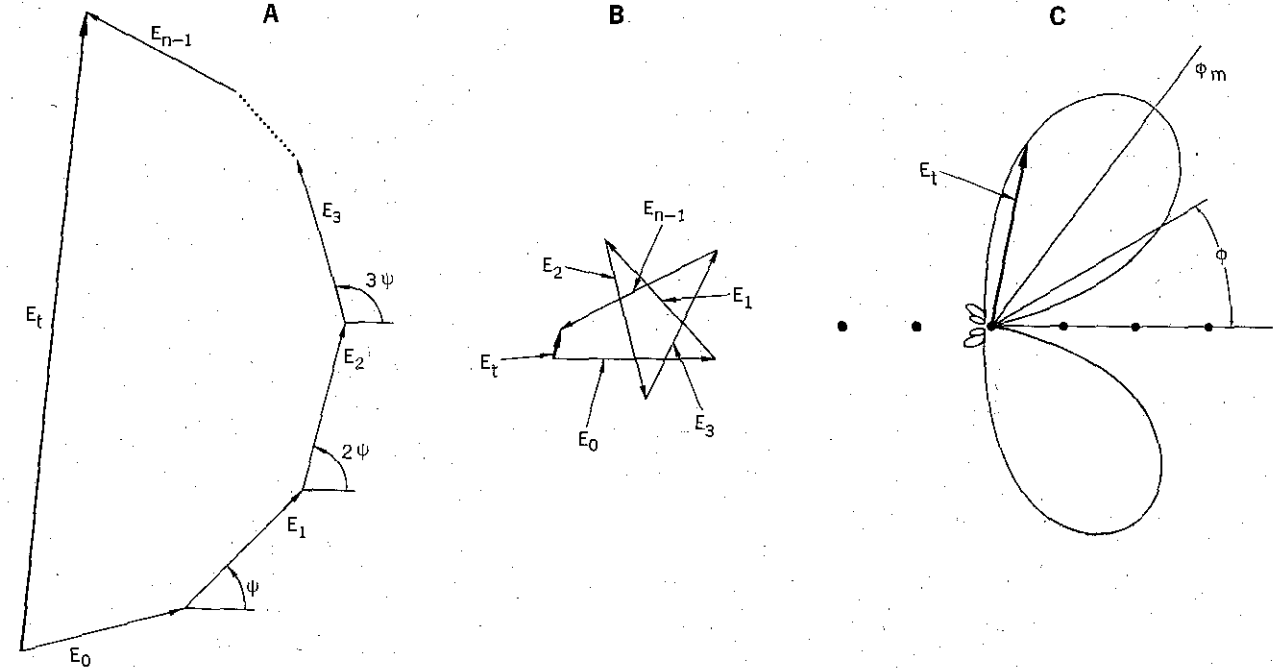
$$\psi = \alpha + \frac{2\pi}{\lambda} d \cos \phi = \alpha + kd \cos \phi \qquad (1)$$

where $k = 2\pi/\lambda$ is the free-space phase-shift constant. The total electric field at any distant point will be given by the phasor sum

$$E_t = E_0 \left| 1 + e^{j\psi} + e^{j2\psi} + \ldots + e^{j(n-1)\psi} \right| \qquad (2)$$

where E_0 is the field intensity at the reception point produced by current I_0. E_t can be obtained graphically

Fig. 11. A and B—Graphical construction for E_t. C—Calculated radiation pattern, E_t vs. ϕ.



from the construction of Fig. 11(A). Using the particular value of α, and computing ψ from (1) for various values of ϕ, the construction of Fig. 11(A) can be used to determine a radiation pattern of the array; see Fig. 11(C). It is evident that the total field intensity will be maximum when $\psi = 0$, so that all fields add in phase.

Therefore, for a maximum, $\psi = \alpha + kd \cos \phi = 0$. The angle ϕ_m for maximum radiation is given by

$$\cos \phi_m = -\frac{\alpha}{kd} \quad \text{or} \quad \phi_m = \cos^{-1} \frac{-\alpha}{kd} \tag{3}$$

If the elements are fed in phase, $\alpha = 0$, and $\phi_m = 90°$, so the maximum radiation is broadside. If successive elements are fed with a lagging phase of value, $\alpha = -kd$, than $\phi_m = 0$, so the maximum radiation is endfire in the forward direction. If successive elements are fed with a leading phase of value, $\alpha = +kd$, than ϕ_m will equal 180°, and the maximum radiation will be endfire in the backward direction. For values of α between $-kd$ and $+kd$, the angle of maximum radiation is at an angle between 0 and 180° as given by Eq. (3). By symmetry about the axis of the array, there is another maximum at an angle between 0 and −180°, which is also given by (3). When $|\alpha| > kd$, Eq. (3) cannot be satisfied for any real value of ϕ; that is, there is no value of ϕ in the "visible" range between 0 and 180° (hence, also between 180° and 360°) that will produce a maximum—in the sense that all the radiations add in phase. However, if $|\alpha|$ is only slightly greater than kd, so that ψ is not much larger than zero, the total field can still be quite strong in the forward direction ($\phi = 0$) for negative α, or in the backfire direction ($\phi = 180°$) for positive α. This case is illustrated by the sketch of Fig. 11(A). On the other hand, if $|\alpha|$ is considerably greater than kd (that is, the phase shift between elements is large), the phase diagram might be as illustrated in Fig. 11(B), with a resulting small total E_t for all values of ϕ.

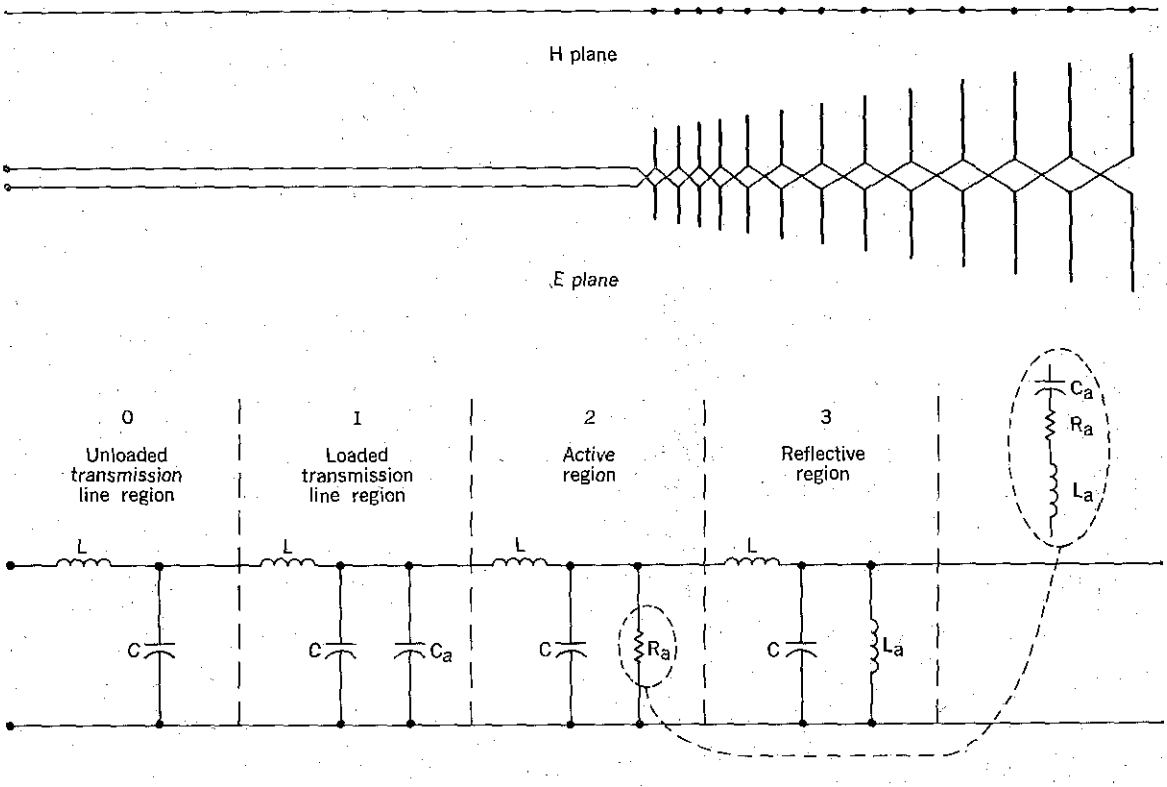
For these cases of large phase shift, as shown in Fig. 11(B), there is no major lobe anywhere, and the array radiates only feebly, scattering its small radiated energy in various directions.

The elementary notions just discussed can be applied with some slight modification to an analysis of the log-periodic dipole array sketched in Fig. 12. For this purpose, it is helpful to consider separately three main regions of the array.

1. *Transmission-line region.* The antenna elements in the transmission-line region are short compared with the resonant length (that is, $l \ll \lambda/2$), so the element presents a relatively high capacitive impedance. The element current is small and leads the base voltage supplied by the transmission line by approximately 90°. The element spacing is small in wavelengths and the phase reversal introduced by transposition of the transmission line means that adjacent elements are nearly 180° out of phase. More precisely, each element current leads the preceding element current approximately by $\alpha = \pi - \beta d$, where d is the element separation and $\beta = 2\pi/\lambda = \omega/v$ is the phase-shift constant along the line. In general β, λ, and v will differ from their free-space values owing to the loading effect of the elements on the transmission lines. Because of the phasing and close spacing of the elements, radiation from this region will be very small and in the backfire direction.

2. *Active region.* In the active region the element lengths approach the resonant length (l slightly less than

Fig. 12. Transmission-line representation of log-periodic dipole array.



$\lambda/2$), so the element impedance has an appreciable resistive component. The element current is large and more nearly in phase with the base voltage; the current is slightly leading just below resonance and slightly lagging just above resonance. The element spacing is now sufficiently large to allow the phase of current in a given element to lead that in the preceding element by an angle $\alpha = \pi - \beta d$, which may approximate $\pi/2$ radians. This combination of conditions will produce a strong radiation in the backfire direction.

3. *Reflection region.* The element lengths in the reflection region are greater than the resonant length ($l \geq \lambda/2$), so the element impedance becomes inductive and the element current lags the base voltage. The base voltage provided by the transmission line is now quite small, because in a properly designed array nearly all of the energy transmitted down the line has been abstracted and radiated by the active region. The element spacing may now be larger than $\lambda/4$. However, as will be shown later, the phase shift per unit length along the line in this region is small, so the resulting phasing between elements (including the phase reversal introduced by the transposition) is such that any small amount of radiation is still in the backfire direction. In addition, it will be demonstrated later that the characteristic impedance of the transmission-line becomes reactive in this region. Thus, any small amount of incident energy transmitted through the active region is not accepted in the reflection region but is reflected back toward the source.

The array as a loaded transmission line. Some of the remarkable properties of log-periodic and frequency-independent antennas are attributable to the propagation characteristics of the equivalent loaded transmission line that conveys energy from the source to the radiating portion of the antenna. These effects are particularly easy to see in the case of the log-periodic dipole array, shown in Fig. 12. On the feed line to the antenna, region 0, the series inductance and shunt capacitance per unit length are shown as L and C, respectively. In the transmission region of the antenna, region 1, the transmission line is loaded by a capacitance per unit length C_a that represents the loading effect of the short dipoles, which have a capacitance reactance. It is noted that to the first approximation C_a is nearly constant throughout this region because at the beginning of the region the capacitance per element is small, but the elements are closely spaced, whereas near the end of the region the capacitance per element is larger, but so is the spacing. The effect of the augmented shunt capacitance of the line ($C + C_a$) is to increase the phase delay per unit length, and since $\beta = 2\pi/\lambda = \omega/v$, this means a decrease of wavelength λ and a decrease of phase velocity v along the line below the free-space values. This is said to be a "slow wave" region of the transmission line. Note, however, that because of the transposition of the feed line between elements, successive elements are fed with a leading phase shift of $\pi - \alpha$ per section. This rapid phase shift in the reverse direction corresponds to a slow wave in the backward direction along the antenna elements.

In region 2, the element lengths approach the resonant length and the transmission line loading becomes resistive, designated by the shunt resistance R_a in series with the antenna capacitance C_a and antenna inductance L_a. The phase shift per unit length, the wavelength, and the phase velocity all approach their free-space values. Because of the transposition between elements, and accounting for the fact that the element current leads the base voltage by lesser amounts in successive elements as the resonant length is approached, it turns out that phasing of currents in the elements corresponds to a backward traveling wave having a velocity v somewhat less than c, the velocity of light.

In region 3 the element lengths become longer than the resonant length, the antenna inductive reactance pre-

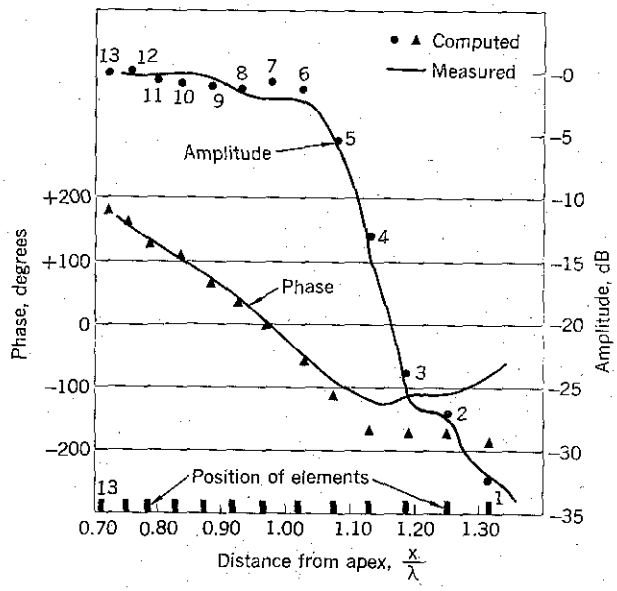
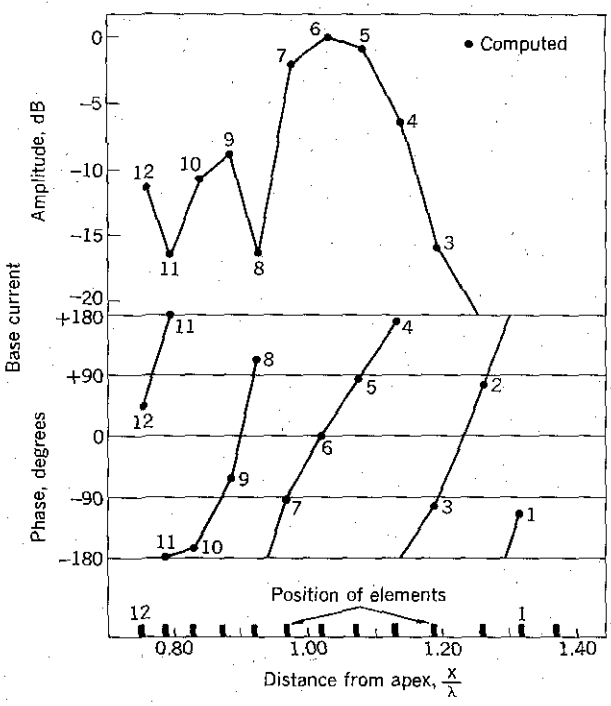


Fig. 13. Base voltages along a typical 13-element log-periodic dipole array at a frequency for which element 4 is half of a wavelength.

Fig. 14. Element currents corresponding to Fig. 13.



dominates, and the loading effect on the line is represented by the shunt inductance L_a. If the parallel combination of L_a and C is inductive, we have the equivalent of the attenuation region of a filter. The phase shift per unit length is then zero (for the lossless case) and the phase velocity is infinite; that is, there is no wave motion. The incident energy propagating down the line is no longer accepted but is reflected back toward the source. These results are strictly true only in the case of a lossless filter, but they form the first approximation in the case of a lossy filter.

The general features outlined in the foregoing discussion will be illustrated for a particular log-periodic dipole array, which has been analyzed in considerable detail.[16] Fig. 13 shows the amplitude and phase of the transmission line voltage along a particular 13-element log-periodic dipole array. Distance is shown measured from the apex of the array, and the elements are numbered starting with the largest element as number 1. This set of data is for a frequency f for which element number 4 is $\lambda/2$ long. Several interesting aspects of the data are immediately apparent: In the transmission region (elements 13 to 7), the amplitude of voltage along the line is approximately constant and the phase shift between element positions increases gradually from about 20° to 30°. (Because of the transposition between elements, this means that adjacent elements are fed with a progressive phase lead 160° to 150°.) In the active region (elements 7 to 4) the amplitude drops sharply because of power absorbed by the strongly radiating elements, and the phase shift averages about 90° between adjacent elements. Finally, in the unexcited or reflection region (elements 3 to 1), the amplitude drops to very low values and the phase shift between element positions is nearly zero (corresponding to the zero phase shift or infinite phase velocity in the attenuation region of a low-pass filter).

The resulting element currents for the log-periodic dipole array of Fig. 13 are shown in Fig. 14, both in amplitude and phase. From the current amplitudes (noting that small contributions from elements 12 through 8 tend to cancel one another because of the nearly 180° phase shift between them), it is evident that the only elements that will contribute appreciably to the radiation are elements 7, 6, 5, and 4. For these elements, the phase difference between adjacent members is approximately 90° leading, so a backfire radiation will be expected. The phasor diagrams for $\phi = 0°$, 90°, and 180° are shown in Fig. 15 and the resulting radiation patterns are shown in Fig. 16. (The E-plane pattern is the H-plane pattern modified by the directivity of the individual elements in this plane.)

As operating frequency is decreased or increased the active region moves up or down the array, but radiation pattern and input impedance remain almost constant.

General properties of log-periodic and frequency-independent antennas. The manner of operation of the log-periodic dipole array has been described in some detail because of the insight it gives into what are believed to be general requirements for successful frequency-independent operation. These appear to be as follows:

1. An excitation of the antenna or array from the high-frequency or small end of the antenna.

2. A backfire radiation (in the case of unidirectional radiators), so that the antenna fires through the small

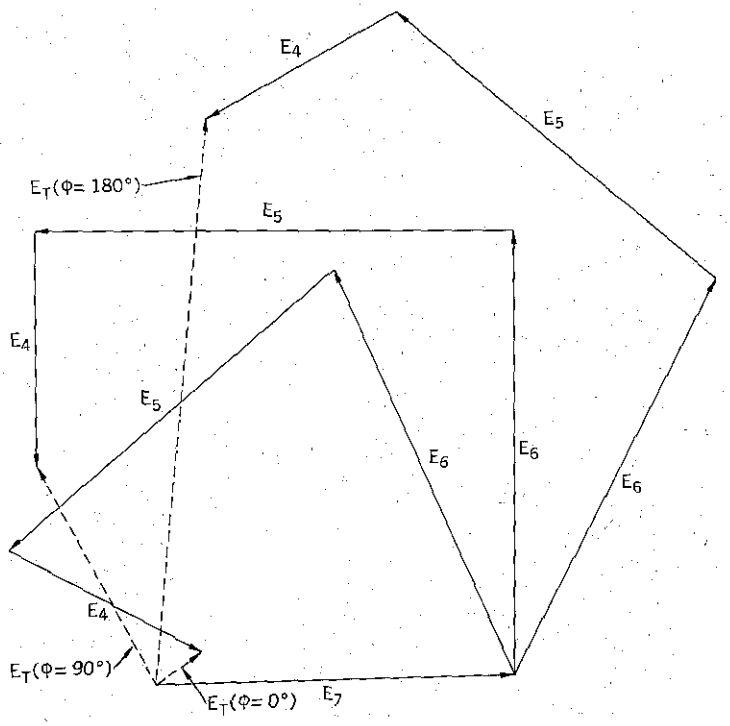
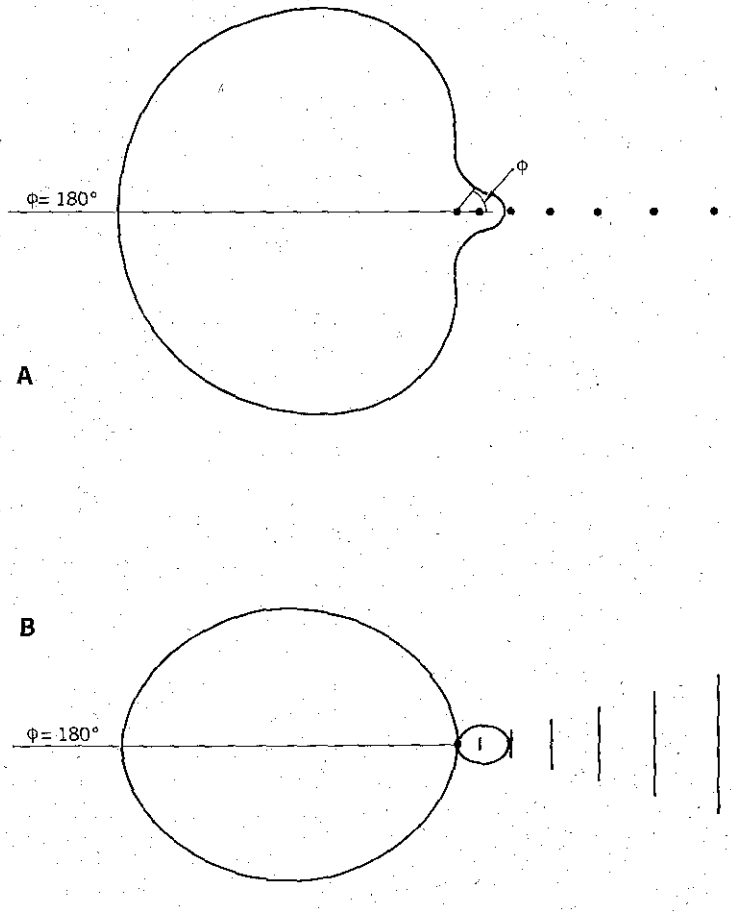


Fig. 15. Phasor sum of radiated fields from currents shown in Fig. 14, for ϕ values of 0°, 90°, and 180°.

Fig. 16. Radiation patterns resulting from fields shown in Fig. 15. A—H-plane pattern. B—E-plane pattern.



part of the antenna, with the radiation in the forward direction being zero or at least very small. For bidirectional antennas the backfire requirement is replaced by a requirement for broadside radiation. In any case, the radiation in the forward direction along the surface of the antenna (which theoretically extends to infinity) must be zero or very small.

3. A transmission region formed by the inactive portion of the antenna between the feed point and the active region. This transmission line region should have the proper characteristic impedance and negligible radiation.

4. An active region from which the antenna radiates strongly because of a proper combination of current magnitudes and phasings. The position and phasing of these radiating currents are such as to produce a very small radiation field along the surface of the antenna or array in the forward direction, and a maximum radiation field in the backward direction (broadside for bidirectional antennas). For successful backfire antennas these requirements are frequently met with separations less than a quarter wavelength and phasings near 90° leading, for adjacent elements in the active region. For broadside radiation the phasings must, of course, be zero.

5. An inactive or reflection region beyond the active region. All successful frequency-independent antennas must exhibit a rapid decay of current within and beyond the active region, so that operation will not be affected by truncation of the structure. A major cause of the rapid current decay is, of course, the large radiation of energy from the active region. An additional cause, in at least some types of frequency-independent and log-periodic antennas, is the attenuation resulting from the rejection of incident energy by the reflection region (the filter stop-band effect mentioned previously). The prevalence and importance of this latter filter action are still uncertain.

Finally, two other observations may be made. Although we have tended to think of the structures of Figs. 4, 5, 7, and 8 as single antennas and the structure of Fig. 9 as an antenna array, it appears that most frequency-independent and log-periodic antennas may be thought of as antenna arrays, with the array factor playing an important role in the formation of a proper endfire or broadside pattern. The localization of the individual radiating elements may be easier to see for the case of the log-periodic dipole array of Fig. 9, but the array action can also be observed in the other cases; it is particularly evident in the case of the fairly tightly wrapped conical log-spiral.

The second observation relates to the similarity between antennas derived from the angle concept and log-periodic concept.[17] Both lead to a solution of the unlimited-bandwidth problem and for this reason both have come to be known as frequency independent.

An example of the similarity between these two antenna types can be demonstrated in the case of the log-periodic wire antenna of Fig. 8, which produces a linearly polarized beam off the apex with the electric vector parallel to the transverse elements. If two such antennas are arranged in space quadrature along a common axis, and with a common origin but with one structure scaled a quarter period from the other, the resultant combination produces a circularly polarized beam with a pattern that rotates about the axis with frequency, exactly as in the case of the conical equiangular spiral antenna. Conversely, of course, if the pattern of a conical equiangular spiral is probed with a linear receiving antenna of fixed plane of polarization, the measured pattern will vary log-periodically with frequency, as does the pattern of the antenna of Fig. 8.

In addition, it is pertinent to note that if a narrow-armed conical equiangular spiral (an angle structure) is flattened sideways (along the axis), it becomes a log-periodic zigzag antenna.

Recent developments

The log-periodic and angle concepts have been used to generate many highly useful antennas of large bandwidth. Fig. 17 shows a very practical two-element array of log-periodic dipole arrays capable of maintaining a nearly constant radiation pattern and a 50-ohm input impedance over the frequency range from 450 to 2000 Mc/s. The 50-ohm input impedance results from feeding two 100-ohm arrays in parallel. Although the dipole array is a balanced structure, it can be fed as shown with a coaxial cable running up the inside of one of the hollow transmission lines, utilizing the frequency-independent balun effect previously noted in connection with the conical log-spiral antenna.

Fig. 17. Two-element array of log-periodic dipole arrays.

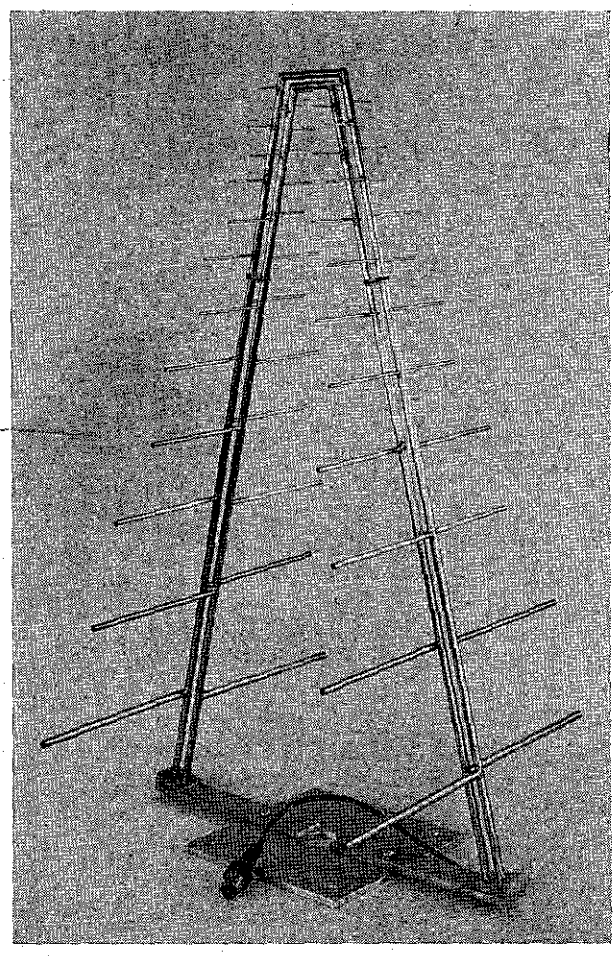


Fig. 18 shows one version of the log-periodic resonant-V developed by Mayes and Carrel.[18,19] This antenna was designed to overcome one of the major shortcomings of the ordinary log-periodic dipole array—namely, the long physical length of array required to cover a very wide band of frequencies. The antenna of Fig. 18 is designed to operate in several modes. In the lowest order $\lambda/2$ mode, the operation is similar to that of the log-periodic dipole array because the forward tilt of the elements has small effect for this mode. However, as the frequency of operation is increased beyond that at which the shortest elements are resonant—that is, when the active region runs off the front end of the array—the largest elements at the rear become active in the $3\lambda/2$ resonance mode. In this mode the forward tilting of the elements ensures a good unidirectional pattern of high directivity. As the frequency is further increased, the active region moves forward through the array in the $3\lambda/2$ mode until once again it runs off the front end, to return to the rear in the $5\lambda/2$ mode. This scheme makes it possible to obtain large bandwidths of the order of 20 to 1 with a relatively compact array. The pattern and impedance characteristics remain good over the entire frequency spectrum except for intervals about the mode-transition frequencies. Based on these principles, arrays have been designed to cover all of the television channels from 2 through 83, corresponding to a frequency range from 54 to 890 Mc/s.

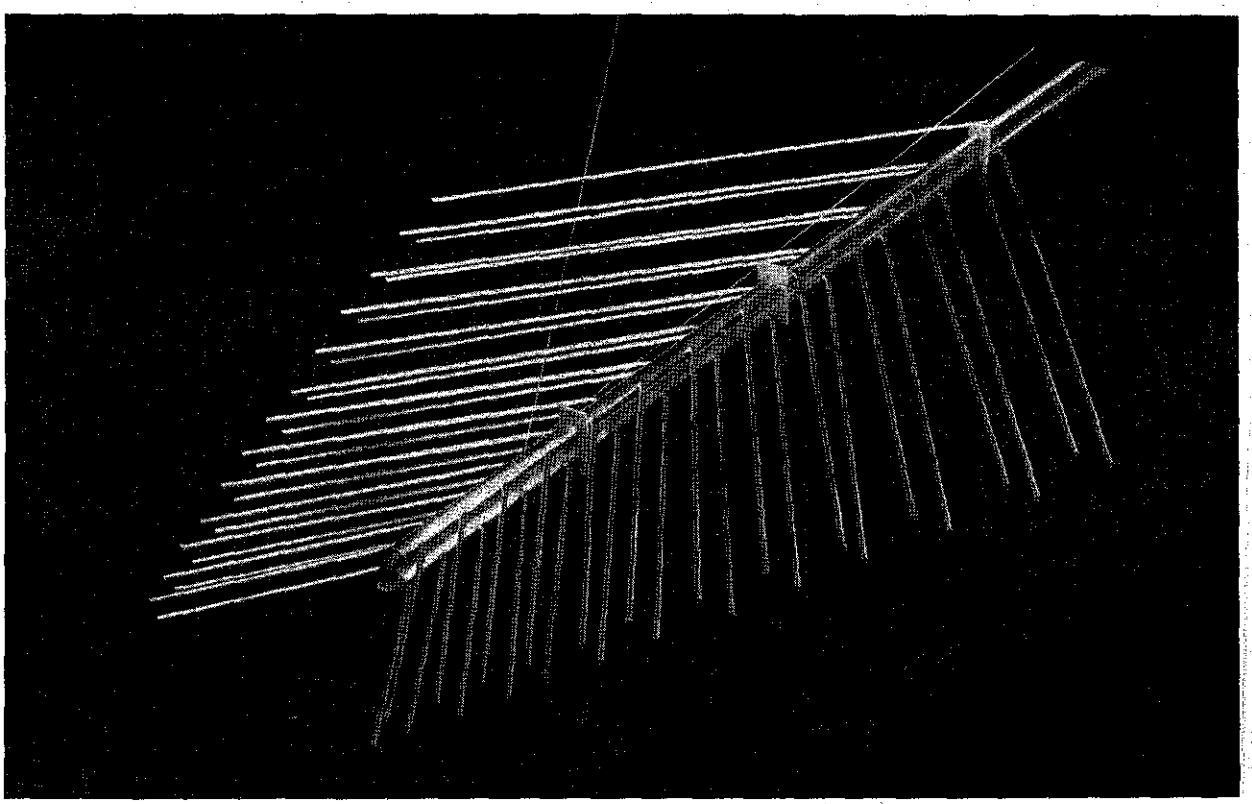
Another interesting development is that of a log-periodic folded-dipole array. At first thought it would appear that such an array could not work because the short elements at the front of the array present a very low impedance, thus short-circuiting the transmission region leading to the active region. This difficulty is circumvented[20] by connecting the folded dipoles in series with the transmission line, rather than in shunt, and recognizing that the active region will occur near first resonance, that is near the element length ($\lambda/4 < l < \lambda/2$) where the capacitive reactance of the short antenna resonates with the inductive reactance of the folded dipole viewed as a short-circuited transmission line. This unusual operating mode for the folded dipole results in a shorter element length for resonance, and consequently a narrow width for the resulting folded-dipole array.

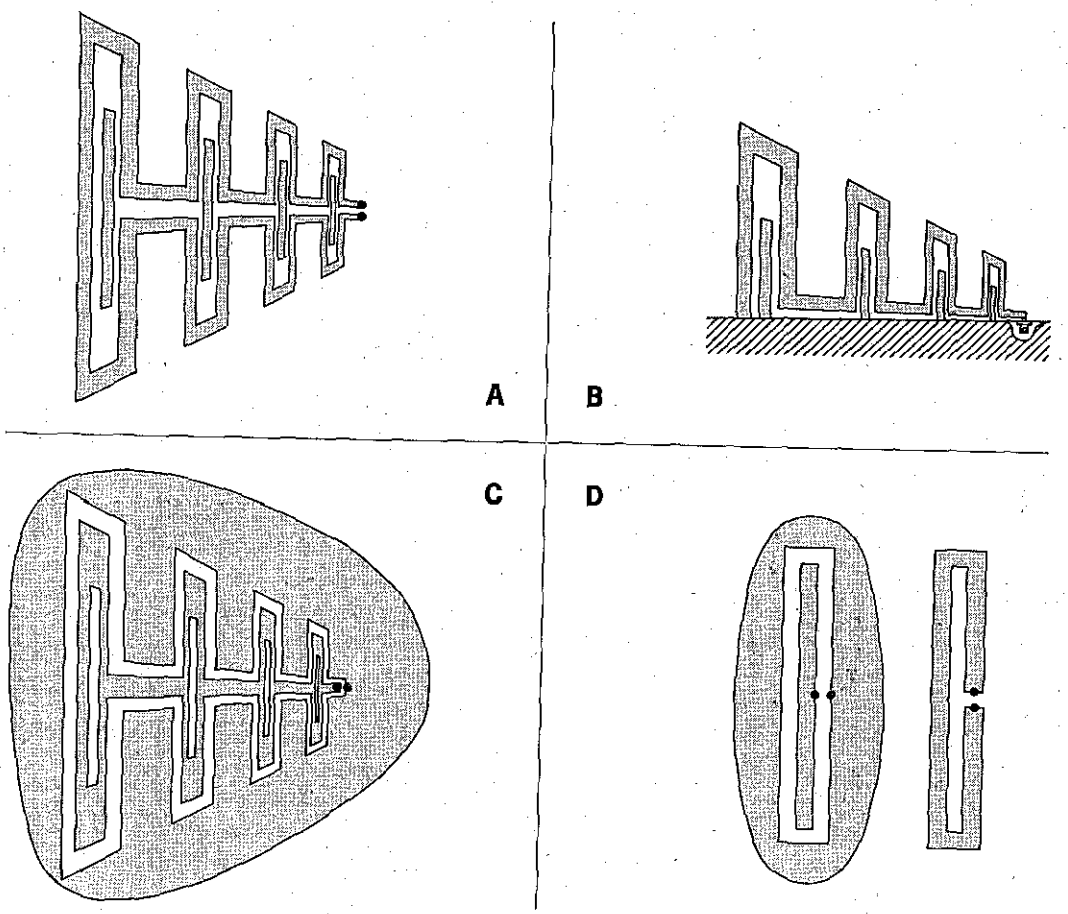
A major problem with log-periodic structures has been the design of an antenna that will operate successfully when fed against a ground plane to produce vertical polarization. One half of the antenna of Fig. 8 can be operated over ground to produce horizontal polarization, as can an inclined horizontal log-periodic dipole array. For vertical polarization, particularly in the high-frequency band (3–30 Mc/s), it is desirable to use the equivalent of a log-periodic monopole array that has a height of only approximately $\lambda/4$ at the lowest operating frequency, rather than $\lambda/2$. Because of the necessity for introducing a transposition between elements (or otherwise producing the required phase difference between elements) it is not possible simply to use one half of a log-periodic dipole array fed against ground.

Several solutions to this problem, having varying degrees of success for different applications, have been developed by a number of workers in the field.[21–23] A quite recent development[24] using folded monopoles with added phasing elements promises to be very useful.

Three versions of this antenna are shown in Fig. 19.

Fig. 18. Log-periodic resonant-V array, for operation in several modes.




A
B
C
D

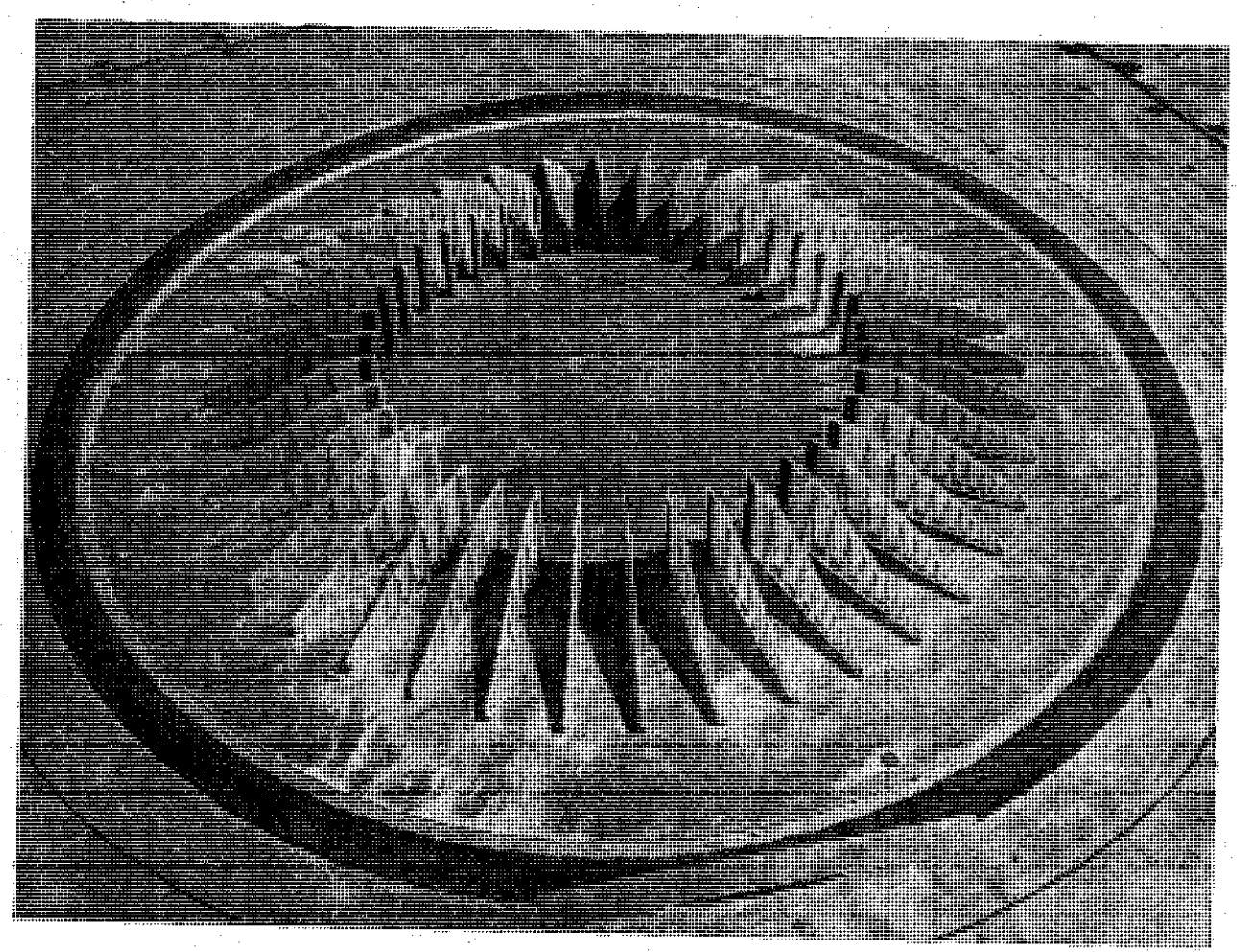


Fig. 19. Log-periodic arrays of folded elements. A—Log-periodic folded-dipole array. B—Log-periodic folded-monopole array. C—Log-periodic folded-slot array. D—Duals: folded slot and folded dipole.

Fig. 20. Model of wide-aperture log-periodic array for high-frequency radio direction finding (3–30 Mc/s).

The log-periodic folded-slot array (A) was conceived first, but by duality, the log-periodic folded-dipole array (B) is obtained automatically. Because this array possesses the proper image symmetry about the horizontal axis (horizontal currents in opposite directions, vertical currents in the same direction), one half of the array can be fed against a ground plane to produce the folded monopole array of (C). The duals, folded slot and folded dipole, are illustrated in (D). The dimensions of the phasing slots in (A), or phasing strips in (B) and (C), are adjusted experimentally to provide the required phasing between successive dipoles or monopoles to produce a good backfire beam.

For greater directivity than can be achieved with a single frequency-independent antenna (or array) it is possible to use the frequency-independent structure as the broadband feed of a large paraboloid. Although the resultant combination is no longer frequency independent, high-gain antennas having a usable bandwidth as high as ten to one have been built by use of this approach.

Some of the high-gain paraboloid tracking antennas for the Atlantic Missile Range have been modified to use two conical log-spiral antennas as a circularly polarized broadband feed in a conical scan system. This application covers a frequency band of 215 to 1000 Mc/s, but the feed elements themselves are capable of operating continuously to 2300 Mc/s.

An alternative approach to the high-gain broadband problem is illustrated in the model of a broadband (3–30 Mc/s) wide-aperture radio-direction-finding array shown in Fig. 20. For frequency-independent arraying, the individual elements should lie along radials and be arranged to fire inward toward the common origin (toward the hub of the wheel). Unfortunately this arrangement requires opposite elements to fire through each other, and severe pattern deterioration results. In the array of Fig. 20 the log-periodic antennas fire outward. A 100° sector of elements is connected together through an appropriate phasing network and rotating switch or goniometer to form a narrow beam, which rotates with the goniometer as the latter connects in elements on one side of the sector and disconnects them on the other side. Again, this arrangement is far from being frequency independent, but the use of broad-band log-periodic structures as array elements is an improvement over the earlier use of frequency-sensitive elements.

This last example indicates that although truly remarkable progress has been made in the past decade in achieving broadband antenna operation there still remain some challenging problems for the future. Among these challenges are the design of broadband antennas having very high gain, and the design of frequency-independent antennas to produce specified radiation patterns.

REFERENCES

1. Kandoian, A. G., "Three New Antenna Types and Their Applications," *Proc. IRE*, vol. 34, Feb. 1946, pp. 70W–77W.

2. Nash, C. C., and Martin Chase, "Antennas for High Speed Aircraft," Rept. TR-5, Univ. of Illinois Antenna Lab., Urbana, USAF Contract W33-038-AC20778, Feb. 1949.

3. Kraus, J. D., "Helical Beam Antenna for Wide-Band Applications," *Proc. IRE*, vol. 36, Oct. 1948, pp. 1236–1242.

4. Springer, P. S., "End-Loaded and Expanding Helices as Broadband Circularly Polarized Radiators," *Proc. Nat'l Electronics Conf.*, vol. 5, 1949, pp. 161–171.

5. Chatterjee, J. S., "Radiation Field of a Conical Helix," *J. Appl. Phys.*, vol. 24, May 1953, p. 550.

6. Chatterjee, J. S., "Radiation Characteristics of a Conical Helix of Low Pitch Angles," *Ibid.*, vol. 26, Mar. 1955, pp. 331–335.

7. Turner, E. M., "Spiral Slot Antenna," Tech. Note WCLR 55-8, Wright Air Development Center, Dayton, Ohio, June 1955.

8. Rumsey, V. H., "Frequency Independent Antennas," *IRE Nat'l Convention Record*, pt. I, 1957, pp. 114–118; also Rept. TR-20, Univ. of Illinois Antenna Lab., Contract AF33(616)-3220, Oct. 1957.

9. Dyson, J. D., "The Equiangular Spiral Antenna," *Proc. Fifth Symp. on USAF Antenna Res. and Dev. Program*, Allerton Park, Monticello, Ill., Oct. 1955 (classified).

10. Dyson, J. D., "The Equiangular Spiral Antenna," Rept. TR-21, Dept. of Elec. Eng., Univ. of Illinois, Contract AF33 (616)-3220, Sept. 15, 1957.

11. Dyson, J. D., "The Equiangular Spiral Antenna," *IRE Trans. on Antennas and Propagation*, vol. AP-7, Apr. 1959, pp. 181–187.

12. DuHamel, R. H., and D. E. Isbell, "Broadband Logarithmically Periodic Antenna Structures," *IRE 1957 Nat'l Convention Record*, pt. I, pp. 119–128.

13. Isbell, D. E., "Non-planar Logarithmically Periodic Antenna Structure," Rept. No. 30, Univ. of Illinois Antenna Lab., Feb. 1958.

14. DuHamel, R. H., and F. R. Ore, "Logarithmically Periodic Antenna Designs," *IRE 1958 Nat'l Convention Record*, pt. I, pp. 139–151.

15. Isbell, D. E., "Log-Periodic Dipole Arrays," *IRE Trans. on Antennas and Propagation*, vol. AP-8, May 1960, pp. 260–267.

16. Carrel, R. L., "Analysis and Design of the Log-Periodic Dipole Antenna," Rept. No. 52, Univ. of Illinois Antenna Lab., Contract AF33(616)-6079.

17. Deschamps, G. A., and R. H. DuHamel, "Frequency Independent Antennas," Chap. 18 in *Antenna Engineering Handbook*, Henry Jasik, ed. New York: McGraw-Hill Book Co., Inc., 1960.

18. Mayes, P. E., and R. L. Carrel, "Log-Periodic Resonant-V Arrays," presented at Wescon, San Francisco, Calif., Aug. 22–25, 1961.

19. Mayes, P. E., "Broadband Backward Wave Antennas," *Microwave J.*, vol. 6, no. 1, Jan. 1963, p. 2.

20. Balmain, K. G., and J. D. Dyson, "The Series-Fed, Log-Periodic Folded Dipole Array," *Digest IEEE PTG-AP Internat'l Symp.*, Boulder, Colo., 1963, pp. 143–148.

21. Ore, F. R., "Investigation of the Log-Periodic Coaxial Fed Monopole Array," Tech. Note No. 1, Univ. of Illinois Radiolocation Research Lab., Contract NOBSR 85243, Oct. 1963.

22. Berry, D. G., and F. R. Ore, "Log-Periodic Monopole Array," *IRE 1961 Internat'l Convention Record*, pt. I, pp. 76–85.

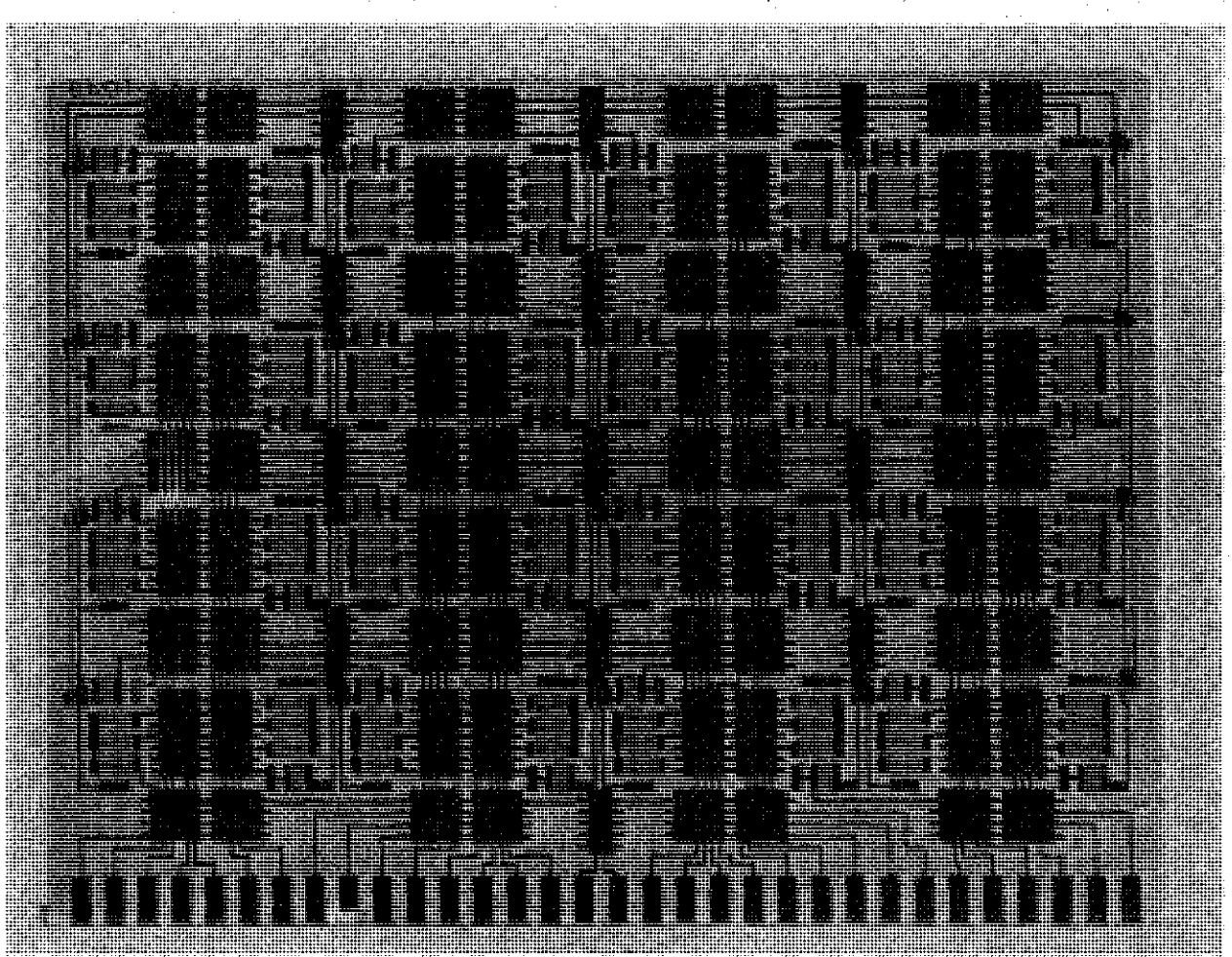
23. Wickersham, A. F., R. F. Franks, and R. L. Bell, "Further Developments in Tapered Ladder Antennas," *Proc. IRE*, vol. 49, Jan. 1961, p. 378.

24. Greiser, John, "Research on Log-Periodic Arrays of Slots," Tech. Rept. No. 3, Univ. of Illinois Antenna Lab., Contract NOBSR 85243, Feb. 1964.

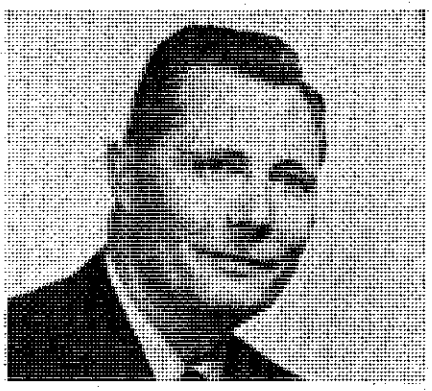
The original work on the logarithmic spiral and logarithmic periodic antennas at the University of Illinois was made possible by the sponsorship of the Aeronautical Systems Division, Wright Air Development Division, U.S. Air Force. Current work is being supported by Wright Air Development Division, Wright-Patterson Air Force Base, The Naval Electronics Laboratory, and the U.S. Army Signal Supply Agency.

Thin-film circuit technology

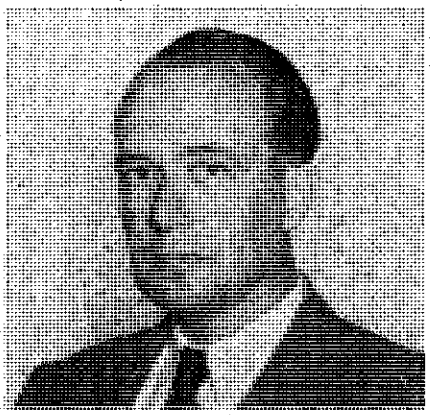
Miniaturization requirements have brought about the integral fabrication of many components. The thin-film approach permits the integration of numerous precision circuit elements and their interconnections. Part I of this three-part series deals mainly with the two deposition techniques of cathode sputtering and vacuum evaporation, and with their use in the fabrication of film resistors, capacitors, and R-C networks. Subsequent articles will discuss thin-film transistors and cryogenic thin films



Authors



E. C. Jordan (F) received the B.Sc. and M.Sc. degrees in electrical engineering from the University of Alberta in 1934 and 1936, respectively, and the Ph.D. degree from Ohio State University in 1940. He was control operator at radio station CKUA for seven years, electrical engineer for International Nickel Company for two years, and since 1940 has taught electrical engineering at Worcester Polytechnic Institute, Ohio State University, and the University of Illinois. At the latter two universities he supervised research on antennas and radio direction finding. At present he is a professor and head of the Department of Electrical Engineering at the University of Illinois. Dr. Jordan is author, coauthor, or editor of several books on antennas, electromagnetic theory, and radio and electronics. He is a member of the U.S. National Committee of URSI and past chairman of U.S. Commission VI on Radio Waves and Circuits.

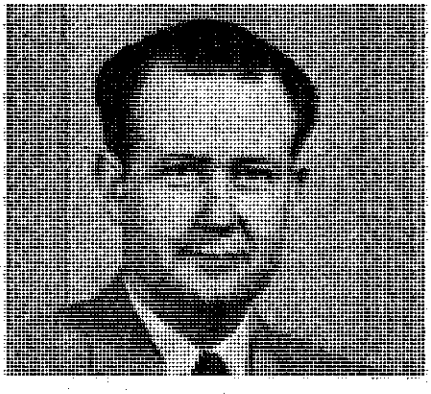


G. A. Deschamps (F) was born and educated in France. He was graduated from the Ecole Normale Supérieure, Paris, in 1934, and received advanced degrees in mathematics and physics from the Sorbonne. He taught mathematics and physics for about ten years at the Lycée Francais de New York. In 1947 he joined the Federal Telecommunication Laboratories, where he worked as a project engineer on direction-finding systems, design of high-frequency and microwave antennas, microstrip development, and radio and inertial navigation. In 1956 he was appointed a senior scientist of the ITT Laboratories. He joined the University of Illinois in 1958 as professor of electrical engineering and director of the Antenna Laboratory.

Prof. Deschamps is a member of the American Physical Society and the International Scientific Radio Union (URSI). He was chairman of the IRE Committee on Antennas and Waveguides from 1957 to 1958 and editor of the IRE TRANSACTIONS ON INFORMATION THEORY from 1958 to 1960.



J. D. Dyson (SM) received the B.S. degree in economics from South Dakota State College in 1940, was employed for one year as a statistician, and then served on active duty with the U.S. Army from 1941 to 1946. He received the B.S. degree in electrical engineering from South Dakota State College, where he also was a part-time instructor, in 1949, and the M.S. and Ph.D. degrees in electrical engineering from the University of Illinois in 1950 and 1957, respectively. He was on the research staff of the Sandia Corporation, Albuquerque, N. Mex., from 1951 to 1952. Since October 1952 he has been on the faculty of the Electrical Engineering Department of the University of Illinois, where he is now a research associate professor, devoting half time to research work in the Antenna Laboratory and half time to teaching courses in electromagnetic theory and microwave measurements. He is a member of Sigma Xi, Eta Kappa Nu, Sigma Tau, and Pi Mu Epsilon.



P. E. Mayes (M) joined the electrical engineering faculty at the University of Illinois in 1954 and is now a professor, teaching graduate courses in electromagnetic theory and supervising research in the Antenna Laboratory. He received the B.S.E.E. degree from the University of Oklahoma in 1950. He was employed as a graduate assistant and research associate in the Microwave Laboratory at Northwestern University while a graduate student there from 1950 to 1954. He received the M.S. degree in 1952 and the Ph.D. degree in 1955, both from Northwestern. His graduate research work was related to electromagnetic wave propagation along open waveguides and reflection from curved surfaces. At the University of Illinois he has worked on slot antennas, pattern synthesis, and several kinds of frequency-independent antennas. Dr. Mayes has served as consultant to a number of antenna firms and holds several patents in the antenna field.



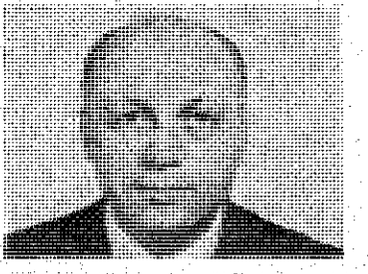
A. E. Lessor received the B.S. degree in chemistry from Union College in 1949 and the Ph.D. degree in chemistry from Indiana University in 1955. After working as a consultant on analytical and physical chemical problems at General Electric Co., he joined IBM in 1959 as manager of crystallographic services. He conducted X-ray diffraction and optical measurements and also directed independent studies of tin and indium films. He was later appointed manager of thin-film materials development, and subsequently of evaporated film development. As manager of film electronics development he is responsible for thin-film network materials and processes.



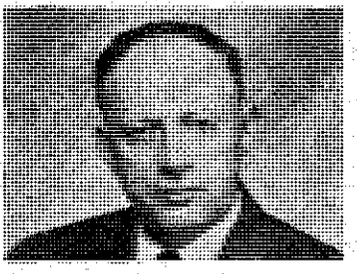
L. I. Maissel (M) was born in Cape Town, South Africa, in 1930. He received the B.Sc. degree in physics and chemistry and the M.Sc. degree in physics in 1949 and 1951, respectively, from the University of Cape Town. In 1955 he received the Ph.D. degree from the Imperial College of Science and Technology, London, for work in optical spectroscopy. During 1956–1960, he was a project physicist with the Philco Corporation, where he worked on semiconductor materials and microminiaturization. He joined IBM in 1960, and is now a senior physicist, directing work on tantalum integrated circuits and exploring new types of sputtered films and techniques.



R. E. Thun (SM), manager of components development at the IBM Space Guidance Center, Owego, N.Y., is responsible for the development of thin-film technologies, magnetic-film storage devices, and integrated circuits. Since joining IBM in 1959, he has worked on problems related to physics of thin films, vacuum technology, electron optics, and computers. He received the Ph.D. in physics from the University of Frankfort-on-the-Main, Germany, and was subsequently engaged in research in metal physics and electron diffraction in Germany. He later worked as a research physicist at the U.S. Army Research and Development Laboratories.



S. M. Fine (M) is an associate professor of electrical engineering at Northeastern University. He received the B.A.Sc. degree from the University of Toronto in 1946 and the S.M. degree from the Massachusetts Institute of Technology in 1953, both in electrical engineering, and the M.D. degree from the University of Toronto in 1957. He interned at the Edward J. Meyer Memorial Hospital, Buffalo, N.Y. He has been associated with MIT's Research Laboratory of Electronics, the National Institutes of Health, and Brookhaven National Laboratory. His interests are in biomedical engineering and effects of radiation on biological systems. He is a member of Sigma Xi, Tau Beta Pi, Eta Kappa Nu, and the Society of Nuclear Medicine.



E. Klein received the B.A. degree in physiology and biochemistry from University College, Toronto, in 1947 and the M.D. degree from the University of Toronto in 1951. He was awarded a two-year National Research Council fellowship at the Laboratories for Physical Chemistry at Harvard University and the Cilhdrens' Cancer Research Foundation, Boston. He was a research associate at that institution from 1953 to 1961 and has been a consultant since then. He has been associated with Harvard Medical School, Massachusetts General Hospital, and Tufts University. He is now chief of dermatology, Roswell Park Memorial Institute, and associate professor of experimental pathology at the N.Y. State University at Buffalo.



R. E. Scott (M) received the B.A.Sc. degree in 1943 and the M.A.Sc. degree in 1946, both from the University of Toronto, and the Sc.D. degree from MIT in 1950. From 1943 to 1945 he served as a radar officer in the Royal Canadian Navy. He has held the positions of instructor at the University of Toronto, and research assistant, research associate, and assistant professor at MIT. From 1954 to 1955 he was employed at Trans-Sonics, Inc., and then returned to the field of education to become an associate professor, later a professor, at Northeastern University. At present he is dean of the College of Engineering at Northeastern. Dr. Scott is a member of Beta Gamma Epsilon, Eta Kappa Nu, Tau Beta Pi, and Sigma Xi.

LAW OFFICES

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE

CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

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

November 23, 1966

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

RE: IUF v. BT v. JFD

Dear Bob:

I have had an opportunity to read the transcript * of Mr. Finkel's deposition. I enclose a copy of a list of material to be produced by JFD.

Very truly yours,

Dick

Richard S. Phillips

RSP:iag

* Enclosure

cc: Mr. I. S. Blonder
Mr. Basil P. Mann
Mr. Myron C. Cass

RECEIVED
NOV 28 1966
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

RECEIVED
NOV 28 1966
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

MATERIAL TO BE PRODUCED BY JFD
(Requested at Finkel Deposition)

1. Date of purchase of Blonder-Tongue ARROW or DART antenna. (Page 48)

2. Results of comparison tests of Blonder-Tongue antenna. (Page 49)

3. Tests or other evidence of infringement supplied to the Foundation with regard to Blonder-Tongue DART and ARROW antennas and correspondence between Mayes and JFD or any other writings bearing on the relationship between the Blonder-Tongue antennas and the Isbell work. (Page 51)

4. All drawings, notebooks or other writings showing dual boom construction and the earliest dates of dual boom construction at JFD. (Page 54)

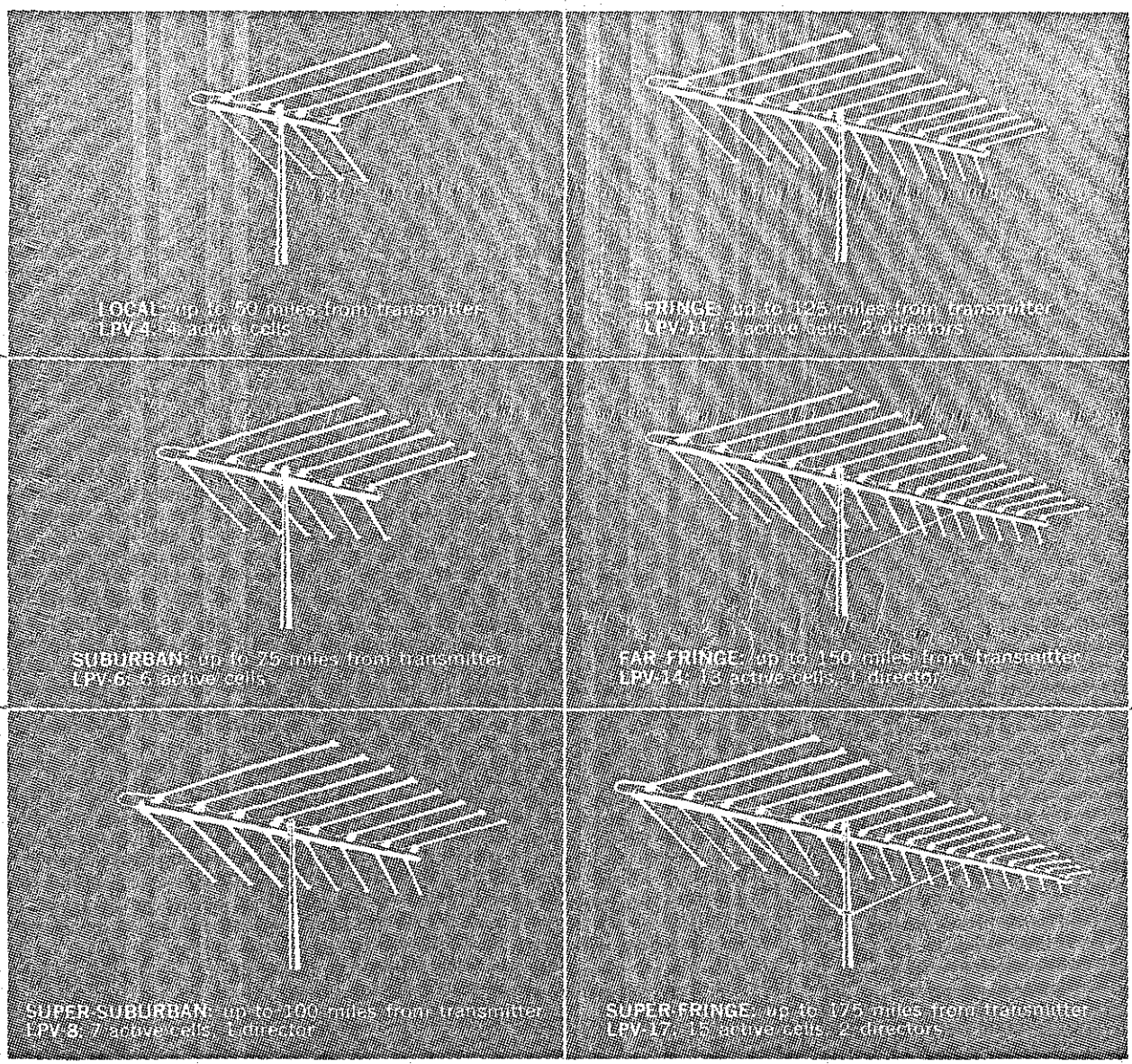
5. The names of all people who worked with Mr. Grant on any dual boom construction at JFD Laboratories in the spring of 1963. (Page 56)

6. Any documents bearing on the request to JFD from Sears for a VHF-UHF antenna or relating to the initiation of the development project in response to the Sears request. (Page 59)

6 JFD log-periodic LPV $\frac{L_{(n+1)}}{L_n}=\tau$ TV antennas

FOR CAMERA-LENS SHARPNESS IN EVERY LOCATION

harmonically-resonant V-elements operating on the log-periodic cellular principle in the fundamental and third harmonic modes—best for color, best for black and white.



AAA* GOLD BOND ALODIZED satin gold finish protects against atmospheric corrosion, assures enduring good looks **EXTRA-RUGGED IN EVERY DETAIL** with new "tank-turret" aluminum brackets that align and double-lock elements permanently in place . . . 1" square aluminum crossarm . . . solid aluminum rod harness . . . sleeve-reinforced elements that prevent accidental bending, keep alignment true **LIGHTEST IN WEIGHT PER DB. GAIN** . . . least wind resistance of any antenna **BEST FOR COLOR, BEST FOR BLACK-AND-WHITE**—FM and stereo, too!

*Attractive, Anti-corrosive Armor

JFD

JFD ELECTRONICS CORPORATION
1462 62nd Street, Brooklyn 19, New York

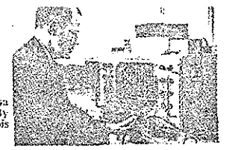
JFD Electronics-Southern Inc., Oxford, North Carolina
JFD International, 15 Moore Street, New York, N.Y.
JFD Canada, Ltd., 51 McCormack Street, Toronto, Ontario, Canada
401-144 West Hastings Street, Vancouver 3, B.C., Canada

SEE IT NOW

Form 425 Litho in U.S.A. 10-62

DEVELOPED BY THE UNIVERSITY OF ILLINOIS* —PROVED-OUT IN AIR FORCE SATELLITE TELEMETRY—

EXCLUSIVE FROM JFD THE LOG-PERIODIC LPV $\frac{L_{(n+1)}}{L_n}=\tau$ ENDS THE 'ERA OF COMPROMISE' IN TV ANTENNA DESIGN



*Professor Paul Mayes of the Antenna Research Laboratories of the University of Illinois



U.S. PATENTS 2,985,881 — 2,985,879 — 3,011,168. ADDITIONAL PATENTS PENDING. PRODUCED EXCLUSIVELY BY JFD ELECTRONICS UNDER LICENSE TO UNIVERSITY OF ILLINOIS FOUNDATION

IT COULD ONLY HAVE BEEN CREATED by such massed resources as those of a prominent university, the military, and the country's leading antenna manufacturer.

BECAUSE ITS GAIN IS INDEPENDENT OF FREQUENCY, the backward-wave LOG-PERIODIC LPV functions with highest efficiency across the entire TV band. Impedance, gain, reception pattern and front-to-back ratio virtually constant across each band. Performance on any channel comparable to a tuned Yagi cut to that channel.

OUTPERFORMS PREVIOUS WIDE-BAND ARRAYS ON VIRTUALLY EVERY COUNT:

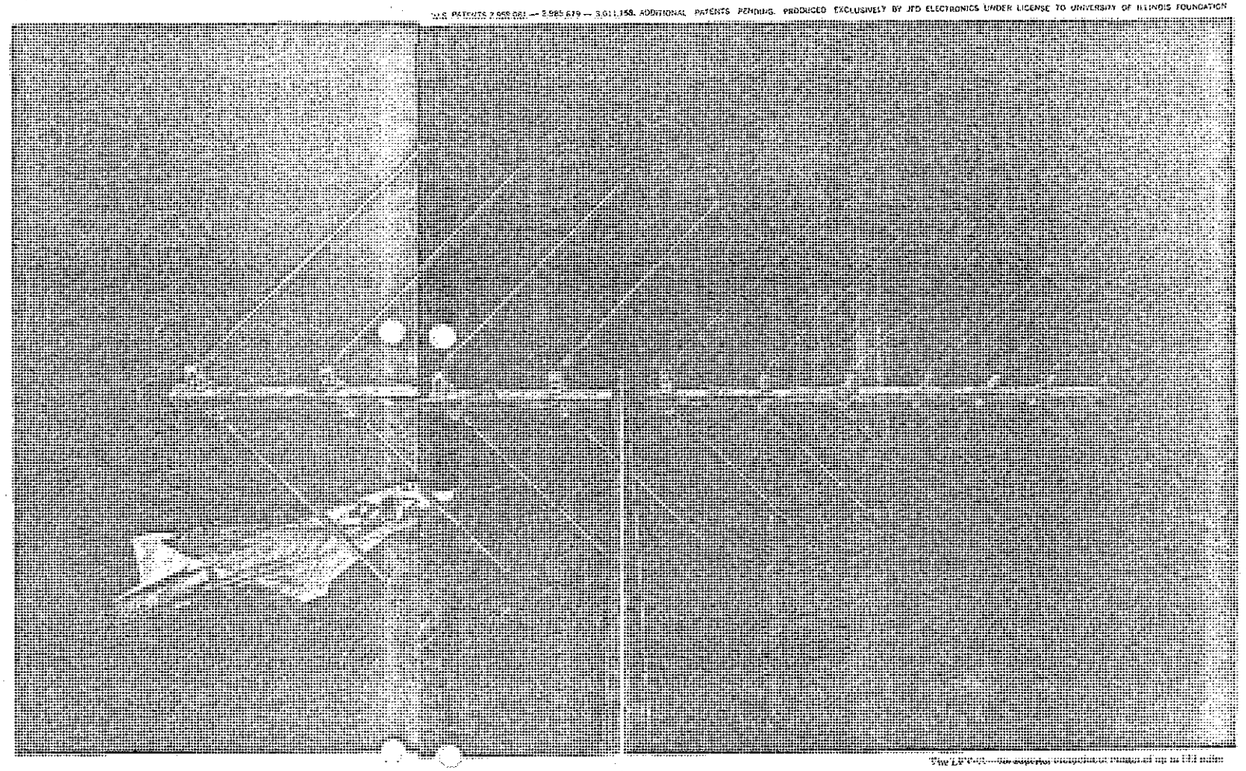
- HIGHEST GAIN — as high as 14 db. in the 17-element LPV!
- SHARPEST DIRECTIVITY — on high bands as well as low!
- HIGHEST FRONT-TO-BACK RATIO — 35 db. in the LPV-11!
- LOWEST VSWR — as low as 1.2 to 1 — with constant impedance across the full bandwidth!
- FLAT RESPONSE ACROSS BOTH VHF BANDS — with greater gain on the high band, where it's needed most (average increase of gain in high band as compared with low band: 3½ db.)!
- BROADEST BANDWIDTH! — For brilliant color

This end-fire array is the most sensitive broad-band antenna ever made for TV. Here are unprecedented gain, a decisive end to snow and ghosts, the truest color yet (plus FM) — on all channels, from one uncluttered basic design!

MORE, FAR MORE THAN JUST A "FRINGE" SOLUTION, the LOG-PERIODIC LPV delivers superior reception in all multi-channel areas. It is the first true "universal" TV antenna. Makes better reception possible for practically every TV set-owner. And — for the first time — meets all antenna needs with a single antenna line!

UP TO NOW broad-band antennas have merely been piled-on conglomerations of narrow-band elements and parasitics, endlessly trimmed and modified to obtain maximum width without too great a quality loss. Such compromises are like teams of wild horses, each bent on pulling in its own direction. The assortments of parasitic elements lower the characteristic impedance of the antenna at the low end of each band, and make for signal-sapping standing waves and impedance mismatches.

BUT NOW — NO LONGER ANY NEED TO SACRIFICE QUALITY! Consisting of harmonically-resonant V-elements that operate on the log-periodic cellular principle in the fundamental and third harmonic modes, the LOG-PERIODIC LPV is essentially frequency-independent. It was designed not as a catch-all compromise, but as an integrated unit with a total environmental design, all parts working together harmoniously. It literally receives all channels "best" — with optimum sharpness, clarity, freedom from snow and ghosts.



The LPV-11 — low-angle reception at ranges up to 100 miles

BEST FOR COLOR — BEST FOR BLACK-AND-WHITE — PLUS FM AND STEREO!

For full fidelity — in black-and-white as well as color — the relative amplitudes of the various signals must be reproduced in the receiver just as they were originated at the transmitter. The JFD LOG-PERIODIC LPV is able to do this because it combines:

1. Sufficiently high gain to override set noise and provide a true, clear color picture.
2. Flat response. Gain variation of not more than 1 db. within 1.5 mc. below and .5 mc. above the color sub-carrier.
3. Narrow unidirectional polar pattern.
4. Close impedance match to help effect a low VSWR — to eliminate line reflections and transfer signal to downlead with maximum efficiency.

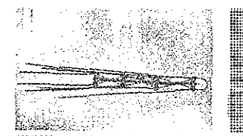
BASED ON PRINCIPLES DESIGNED TO MEET RIGOROUS AIR FORCE PERFORMANCE STANDARDS — BUILT TO UNCOMPROMISING JFD SPECIFICATIONS

Here's how the LPV tunes itself to each received frequency

1. Log periodic concept used in space communications antennas is basis for the LPV
2. Logarithmic scaling factor relates one element to the next, and makes an integrated antenna that "tunes" itself to each received frequency
3. Multi-element "cells" form along antenna for each received channel: high signal energy from each of the many dipoles in the cell adds up to high gain on each channel on both high and low TV bands and FM band
4. On high TV band, large LPV dipoles are three times wavelength of TV frequencies, "tune" to the third harmonic giving added gain
5. Forward V-ing of dipoles and crossed phasing harness give high front-to-back-ratio and directional sensitivity. Addition of directors optimizes the LPV on the high TV band

RESULT: High gain, high front-to-back ratio, and sharp directivity continuously from the lowest to the highest TV channel and including the FM band. A BREAKTHROUGH IN TV ANTENNA DESIGN

LPV CONSTRUCTION FEATURES



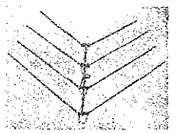
100% PREASSEMBLED FLIP QUICK CONSTRUCTION
Assembles in minutes
Simply click elements into position.
No bulky or complex dipoles to tumble with.



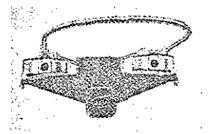
ONE INCH SQUARE ALUMINUM CROSS ARM
Extra heavy gauge aluminum boom provides strength and durability never before available in TV antennas.
Poly-plug ends keep out water—prevent wind whistle.



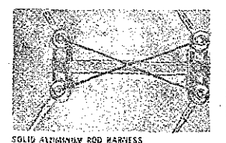




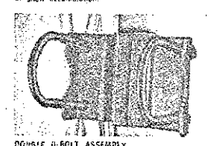
LOWEST WIND RESISTANCE OF ANY ANTENNA
The VEE-regulator presents least possible area to wind, ice or snow.



MASSIVE NEW WEATHER-PROOF INSULATOR
Designed to drain off water. Elevated center barrier prevents shorting of signal from possible rain, dirt or snow accumulation



SOLID ALUMINUM ROD HARNESS
No troublesome metering harness because there is no impedance mismatch to correct. Log-Periodic design replaces crude harness with transposed high-Q phasing bars. Harness is made of indestructible ¾" o.d. solid aluminum rod and welded in logs for permanent performance



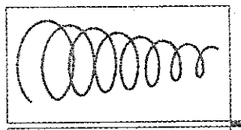
DOUBLE U-BOLT ASSEMBLY
Rugged oversized tandem U-bolt locks antenna to mast, increases structural strength.

a new high-gain all-channel antenna comparable to a yagi across the entire band

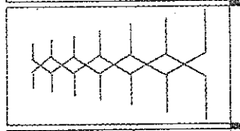
why the LPV makes all other antennas obsolete

how the Log Periodic LPV works

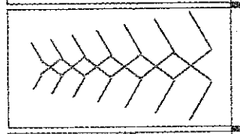
Developed to formula and not by chance—the one unique design and principle of the Log Periodic LPV solves all antenna needs...



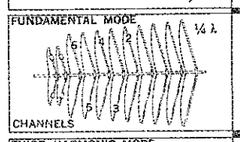
The JFD LPV antenna is a direct descendant out of the logarithmic conical spiral antenna used on the Transit satellite. This basic design is FREQUENCY INDEPENDENT—it works like a conical waveguide to yield almost constant gain, matched impedance and a unidirectional polar pattern across an extremely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

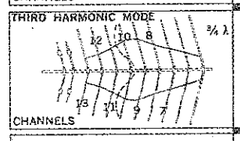


JFD's LPV antenna for TV and FM goes one step further—increases gain and front-to-back ratio while maintaining frequency independence. Forward V-ing of elements shrinks rear radiation lobes, narrows forward beam for sharp directivity, helping to eliminate ghosts and adjacent channel interference. Forward 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.

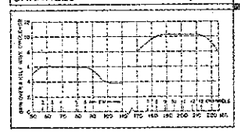
——— *indicates current distribution on fundamental mode*



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 3½ 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.

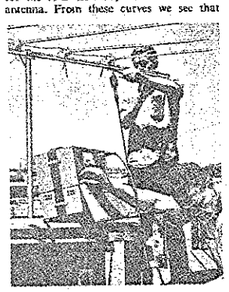
In effect, the signal is passed along as the frequency increases—the active area moving toward the apex or small end—until, as the fundamental harmonic reaches one end, the other end approaches resonance in the third harmonic. Conventional wide-band antennas are like rows of compartments, one for each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

sign" applications. This scientific approach is in marked contrast to the methods used hitherto.

Therefore, the JFD LPV antenna is so effective on the low TV band because: 1) there are a large number of elements working on every channel, and 2) the signal absorption efficiency of each dipole in the active cell is extremely high because of its low impedance at the received frequency. Another contributing factor is the high directionality of the LPV, but this will be gone into later.

High Band Operation

As the received frequency increases, that is, for channels 7 through 13. However, now the large elements at the rear of the antenna constitute 3/2-wavelength dipoles and resonate at the received frequency in the third harmonic mode. This contributes significant signal absorption at the higher VHF frequencies and increases antenna gain in these channels. The actual amount of gain realized by third harmonic operation is shown in Figure 4, the VHF gain curves for the JFD LPV-11, an eleven element antenna. From these curves we see that



JFD engineers testing frequency-independent characteristics of one of the many LPV prototypes

there is an average increase of 3¼ db in gain on the high VHF band versus the low band. The active region once again moves forward as the frequency increases.

Good TV reception requires that an antenna furnish higher gain on the high VHF band than on the low band. Propagation tests made by TV broadcast engineers indicate, and actual home TV reception has proven, that high TV band signals suffer greater signal loss with distance than do low band signals. Therefore, to receive high band stations satisfactorily, more gain is required of the antenna. This the JFD LPV antenna supplies as an inherent fact of its operation.

A close inspection of Figure 4 shows that the gain of the JFD LPV-11 (and this is typical of all antennas in the LPV series) is uniform across all channels on the low band, and higher but also uniform across all channels on the high VHF band, falling slightly at channel 13. This characteristic, of course, is because the antenna is frequency independent, but even more important relative to color TV reception, is the fact that it guarantees that all components of a composite transmitted color TV signal will be received intact. For full color fidelity, it is essential that the relative amplitudes of the various color signals be duplicated in the receiver as they were originated at the transmitter. Obviously this can only hold true if the antenna has a flat gain and phase response for the entire channel.

Constant Impedance

Of particular importance relative to gain, is the characteristic impedance of the antenna, and the closely allied factor, voltage standing wave ratio (VSWR). If the impedance of the antenna varies appreciably from that of the transmission line at any point in the band pass of the antenna, a mismatch will exist between the antenna and the downlead. Such a mismatch will decrease signal power to the set and introduce standing waves along the line leading to further signal reduction and ghosts. The LPV antenna is unique in that it maintains essentially constant impedance across the full bandwidth of the antenna. This could be attributed to the impedance balance maintained by the active region of the antenna, with relation to the complete antenna. For the active region, the impedance of the antenna is low, making for high transfer efficiency from the elements to the feedline. At the inactive regions, (inactive, that is, for that particular frequency) the impedance is high. The total impedance presented to the transmission line, however, is always relatively the same.

Voltage standing wave ratios for the LPV have been measured as low as 1.2 to 1. Such low VSWRs are typical of log-periodic antennas and derive from correct scaling of the cells and the constant impedance characteristics.

We see, therefore, that the LPV configuration does indeed maintain a nearly constant gain, impedance, and VSWR over its com-

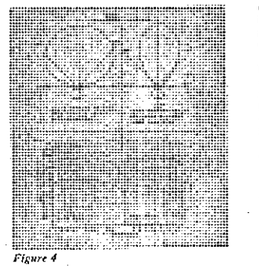


Figure 4

plete bandwidth. Rather than serving as a limited group of pigeonholes that accept discrete frequencies (or channels) with sharp cutoffs, the LPV antenna is like a continually moving belt, accepting smoothly any frequency that hops onto it. The fact that these reception characteristics can occur on an antenna as small as the LPV (the fact that a bandwidth spread of ten to one can occur at all, is due to the logarithmic relation of the elements.

Directivity, High Front-To-Back Ratio

As important as high gain and constant impedance are in fringe area reception, the antenna would be worthless without good directional sensitivity. Even in the heart of cities, good directional response is necessary to reject the ghost-causing interference signals that bounce from building to building. In fringe areas, interfering signals from adjacent channels and other sources, picked up by the antenna from the rear and sides, cause venetian blind effects, herringbones, fading, ghosts and other picture distortions.

Yagi antennas obtain good directivity and high front-to-back ratios by the use of parasitic elements—directors and reflectors for a sharp forward pattern. The LPV antenna obtains its sharp forward response pattern from its periodic structure and the V-ing of the elements.

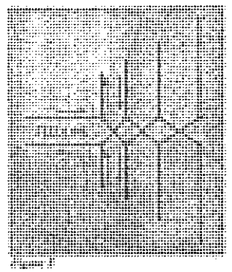
Consider Figure 5, which is a simplified diagram of a four-cell LPV antenna, front-fed, and using a twisted phasing harness. (For purposes of this explanation we will consider the antenna as a signal transmitter, however, the same effect holds true in reception.) Note that because the elements of the adjacent dipoles are not fed in parallel, they are in phase opposition. This effectively cancels radiation to the rear. Furthermore, the length of the harness plus the air space between adjacent elements adds up to produce a 360 degree phase shift between the signals radiated from the first and second elements (or between any two adjacent elements) *in the forward direction*, i.e., in the direction of the feedline. A 360 degree phase shift actually puts both radiated waves in phase for additive signal strength.

In the reverse direction, that is, toward the rear of the antenna, the story is quite different. Now the fact that the harness is crossed, introduces a 180 degree phase shift in the signal path between adjacent elements, putting the radiation from them out of phase in the backward direction.

Naturally, because of the log periodic factor, the spacing between elements on the LPV antenna is not constant, and neither are the lengths of the various harness bars. These variations, however, conform to the variations in wavelength across the TV band so that within any active cell the spacing is correct to produce the required phase shift. In actual production, to optimize the phase shift effect, JFD engineers have changed the lengths of the elements slightly to make them either slightly inductive or capacitive at the required signal frequency, introducing a phase lead or lag. Operating within the cell, and in combination with the phasing bars, this results in the required constant phase shift to produce a backward wave toward the feedline.

Additional directional sensitivity in the higher frequency band, where it is needed most, is obtained by V-ing the elements forward. A straight half wave dipole receiving a signal three times its resonant frequency exhibits a radiation pattern like that shown in Figure 6a. Notice that its signal sensitivity is dissipated among three forward lobes. If the elements of this same dipole are directed forward into a V, the pattern becomes Figure 6b—in effect, the two side lobes are brought together and merged with the center lobe as the elements are brought toward each other. (The rearward lobes are drastically reduced by the methods described in the preceding paragraphs.) V-ing, therefore, increases the directional response and sensitivity of the dipole at the higher frequencies, where the elements are acting in the 3/2-wavelength mode.

The complete LPV TV antenna exhibits the reception patterns of Figure 7a for the low band, sharpening up to Figure 7b in the high band. It is interesting to note, that this highly directive pattern is maintained



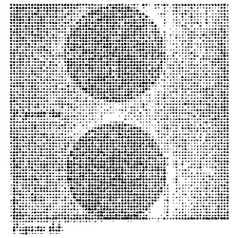
through the FM band too. In actual tests at the JFD antenna laboratories, the LPV-11 with 9 active cells and 2 directors, maintained a front-to-back ratio of 35 db, with a gain of 8 db across the low band and 11½ db across the highs. In comparison, a somewhat longer yagi antenna adjusted to provide a front-to-back ratio of 25 db at the middle of its band, fell to 15 db at the edges, and more important, provided a bandwidth of only 7 percent, at a gain equal to that of the LPV.

Although reflector elements are unusable for the LPV, director elements may still be used effectively to enhance the directional response for fringe and far fringe area reception. The directors must be so designed and spaced on the antenna that they do not interfere with the environment of the log periodic design. The spacing is determined experimentally for each of the antennas in the LPV series which is supplied with directors. The directors, themselves are of two types: 1) a single continuous element and 2) two colinear elements separated by an insulator. They are designed to "peak up" the response at the low and high ends respectively of the upper VHF TV band.

For City and Far Fringe

Since the frequency independence of the LPV antenna depends on the scaling of the elements, any number of intermediate cells may be narrowed without affecting the essential characteristics of the antenna. To narrow, or shorten an LPV antenna, a smaller value of tau is chosen from the design nomographs. If, for a fringe area model, a tau of 0.9 is used, then the second element from the rear will be nine tenths as large as the rearmost element. With a smaller tau, say 0.6 for example, the second element from the rear will be only six tenths as large as the rear element, and so on to the succeeding elements toward the front of the antenna. It is also apparent that the number of elements must decrease because the length of the frontmost dipole is fixed by the high frequency limit of the antenna. It is approximately a half wavelength at the high end of the VHF TV band. And since, with a smaller tau, the elements get shorter faster, the frontmost element length is arrived at sooner. Thus, the overall antenna is shorter—or narrower.

Narrowing the cells will, of course, reduce the gain, but the radiation pattern, high front-to-back ratio, and constant impedance will not be changed because these are functions of the adherence to the proper scaling factors and do not depend on the number of dipoles. When a shortened LPV antenna is used in a relatively strong signal area, narrower cells will contribute less signal to the downlead for any particular frequency, but the increased received signal strength will compensate for this. At the same time, it is no less important than suburban and city reception areas use an antenna with high front-to-back ratio and low VSWR. City viewers are bedevilled by ghosts caused by signal reflection from tall buildings and other obstructions between the transmitter and receiving antenna. The sharp directivity of the LPV assures direct signal pickup,



while the low VSWR makes for efficient transfer of this signal to the downlead.

There are six different models of the LPV antenna designed by JFD engineers for different reception areas. Each array can be described by the number of cells it contains. These models are as follows:

LPV-4:	Four active cells
LPV-6:	Six active cells
LPV-8:	Seven active cells and one director
LPV-11:	Nine active cells and two directors
LPV-14:	Thirteen active cells and one director
LPV-17:	Fifteen active cells and two directors

Each of these antennas has been specifically designed to guarantee the full advantages of the log periodic concept for different reception areas. The LPV-4 is recommended for viewers who live up to fifty miles from the transmitter. For reception up to 75 miles, the model LPV-6 is appropriate. The LPV-8 and LPV-11 are suggested for 100 and 125 mile reception, respectively. And for the farthest fringes, 150 and 175 miles from the transmitter, or for TV DXing, JFD engineers recommend the LPV-14 and LPV-17.

INNOVATIONS

This advanced series of TV antennas incorporates not only the latest electrical concepts, but also the most rugged mechanical features. The one inch square boom is constructed of extra heavy gauge aluminum for extreme strength and element stability under high winds and heavy ice and snow loading. Poly-plug ends keep out water and prevent wind whistle.

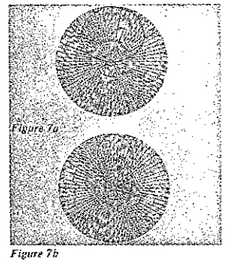


Figure 7a

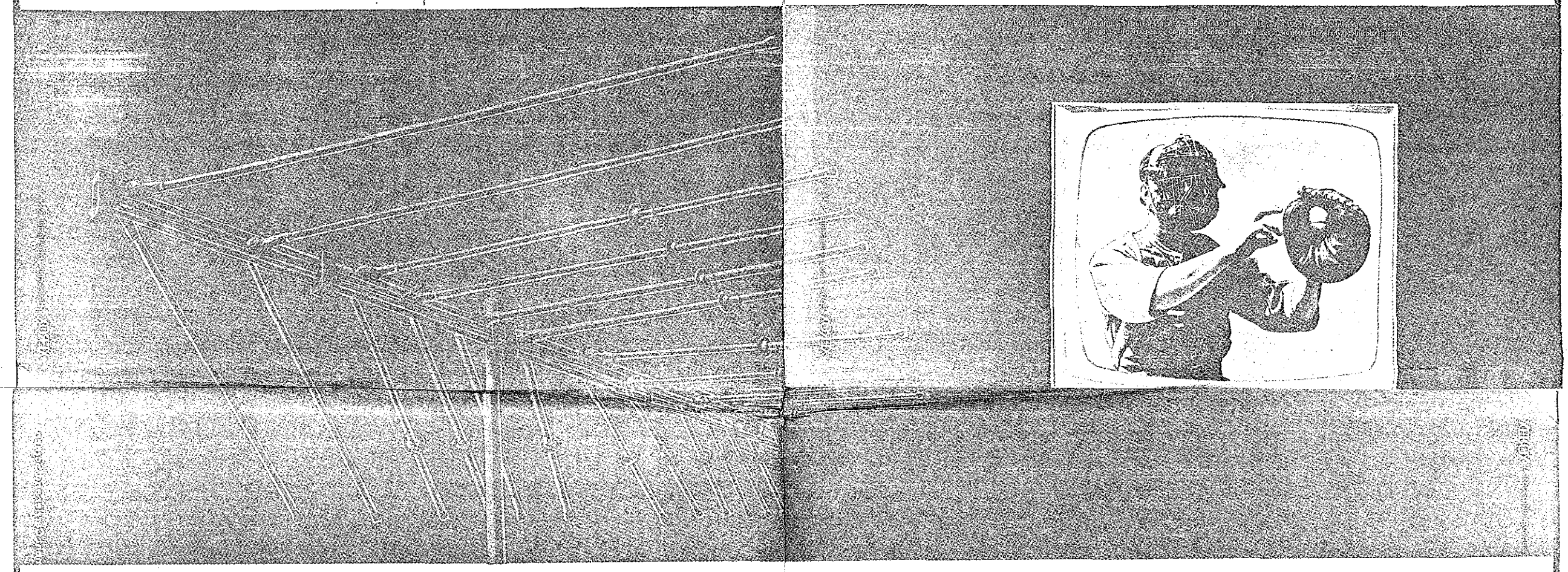
Figure 7b

Because it is desirable to maintain the low impedance transfer of signal from the resonant elements to the feeder line, the transposed high-Q phasing bars are made of ½ inch solid aluminum rod, cold welded into permanent position. The high tensile strength aircraft-aluminum elements are maintained in the V position by circular spring lever brackets with double locks. Element alignment is kept true by the use of heavy wall cadett reinforcements at vital bracket connections. And finally, the entire antenna is gold alodized for protection against atmospheric corrosion.

In summary, it is fitting to quote Dr. John Dyson, one of the pioneering scientists of the University of Illinois Antenna Research Laboratory, who did much of the early research on antennas. "The frequency-independent antennas have opened up a new era in wide-band antennas. The conception (of these antennas) . . . has produced advances in the state of the (antenna) art that now puts pressure on the electronics engineer to design equipment that will match the available antenna bandwidths."

The log-periodic V antenna developed by Dr. Paul Mayes and the JFD Electronics Corp. is a fitting match for today's most sensitive TV receiver tuners. More than that, it offers improved reception from any TV set, no matter how old and assures the owner that he is ready for color TV and any improvement in television for years to come.

Don't Be 1/2-Set.. Be All Set!



ENJOY BETTER COLOR PICTURES
GET ALL CHANNELS 2 TO 83— *plus FM/Stereo!*

JFD LPV-VU

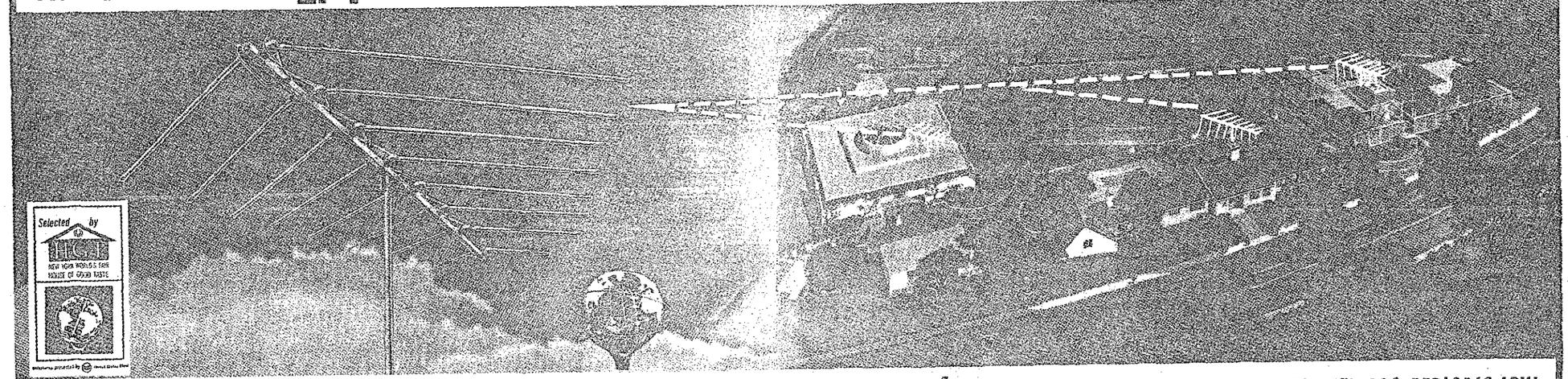
LOG-PERIODIC TV/FM ANTENNA

featuring "Cap-Electronic Dipoles" for extra 82-channel power! • ONLY 1 DOWN-LEAD REQUIRED

Form No. 835 Litho in U.S.A. 11-64

70 MILLION FAIR VISITORS WILL SEE AND HEAR ABOUT THIS REMARKABLE NEW JFD TV/FM ANTENNA!

THE PATENTED LOG-PERIODIC LPV—THE EXCLUSIVE CHOICE OF THE NEW YORK WORLD'S FAIR HOUSE OF GOOD TASTE!



Selected by HGT NEW YORK WORLD'S FAIR HOUSE OF GOOD TASTE

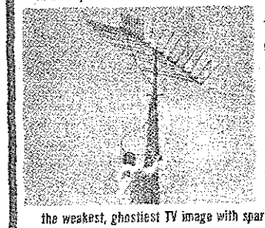
Now — the antenna designed to meet satellite telemetry needs has been adapted by JFD to help you and your customers get far better reception in COLOR, black/white, and FM!

Achievements of University of Illinois Laboratories Are Now Translated Into Finer

This means far fewer service calls . . . far more customer satisfaction with what you sell . . . for greater profits at the end of year. And, the World's Fair will dramatically demonstrate this antenna to 70 million Fair-goers in 1964 and 1965!

Cash in starting now on the profit opportunity of the year!

The space-age Log Periodic principle of the Antenna Research Laboratories of the University of Illinois has been acclaimed as the most significant antenna discovery since the invention of the Yagi. This patented Log Periodic concept—adapted by the JFD Research and Development Laboratories in Champaign, Illinois—is now available in a unique new line of LPV antennas for VHF, UHF and FM stereo.



The secret is in its frequency-independent design. All elements are designed according to the patented log periodic formula. They all work like a powerful tuned multi-element Yagi—not on just one or a few channels as do other antennas—but on all channels across the band.

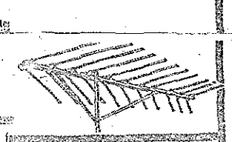
The result is far superior gain, directivity, front-to-back ratio, and VSWR that lights up the weakest, ghostiest TV image with sparkling detail and contrast—*for superb color,* as well as black and white pictures—plus fidelity FM stereo!

A NEW PERFORMANCE-PROVED LOG PERIODIC LPV FO EVERY BAND (VHF, UHF, VHF- UHF, FM STEREO)...EVERY PROBLEM (GHOS OR INTERFERENCE)... EVERY LOCATION (LOCAL, SUBURBAN, & FRINGE)- OPI PROFITABLE NEW MARKETS FOR ALL DEALERS!

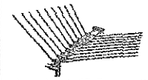
Gold Alodized VHF Log Periodic LPV TV/FM ANTENNAS for Channels 2 to 13 plus FM Ste

This LPV TV antenna series, the first ever to utilize the revolutionary Log Periodic concept, opened a new era in TV/FM performance and profits for dealers everywhere. It is today's largest selling antenna for VHF channels 2 to 13.

Gold Alodized VHF Log Periodic LPV TV ANTENNAS for channels 2 to 13 plus FM Stereo *(available in 6 area-engineered models)*



Model LPV-U9 Illustrated for local & suburban



Here's an all new UHF series employing Log Periodic design to provide the high-gain, ghost-free signal needed especially by UHF sets for sharp, steady pictures on channels 14 to 83 and channels 7 to 13. Prepares you now with the antennas you need to cash in on the great new UHF market.

Gold Alodized UHF Log Periodic LPV TV ANTENNAS for channels 14 to 83 plus VHF channels 7 to 13 (available in 4 area-engineered models)

Model LPV-ZU10 for suburban areas Illustrated



This exotic all-new UHF series obsoletes bulky parabolics and stacked bowtie-reflector and corner reflector antennas. Packs more long-distance pick-up sensitivity per element. Another ahead-of-the-industry antenna advance that puts you in command *of new UHF antenna business* in your town.

Gold Alodized UHF Log Periodic Planar Helical ZAGI TV ANTENNAS for channels 14 to 83 (available in 2 area-engineered models)

Model LPV-VU15 for suburban-fringe areas Illustrated



Tomorrow's antenna today. The most advanced application of the Log-Periodic formula — receives all FCC authorized television channels on VHF (2 to 13), on UHF (14 to 83) plus all FM and FM Stereo Frequencies. This is the first single all-channel antenna using a single down-lead to achieve this performance break-through! (Includes VHF-UHF Splitter for separate lead-ins to VHF and UHF set terminals.)

Gold-Alodized VHF-UHF Log-Periodic LPV ANTENNAS for channels 2 to 83 plus FM Stereo (soon available in 4 models)

Model LPT100 Illustrated



Never before an indoor antenna like this. The first ever engineered according to the patented log-periodic formula. Actually outperforms some roof-top UHF antennas. Tunes itself electronically (without switches) to desired channel. Gold Alodized INDOOR UHF Log Periodic Trapezoid TV ANTENNA for channels 14 to 83

You Win All Ways When You Feature The JFD LOG PERIODIC LPV!

1. Exclusive Log Periodic demonstration in one of the Fair's chief exhibits—The House of Good Taste! 2. Free dealer Holidays at the fabulous New York World's Fair! 3. Tremendous sales impact of World's Fair tie-in publicity, promotion and advertising!

In 1964 and 1965, JFD puts the prestige and drawing power of the antenna you sell—the New York World's Fair!

Millions at the Fair, millions more everywhere in America will see, hear and read why the House of Good Taste chose the JFD Log Periodic LPV as the only antenna to be used in its showcase of the finest in American home living.

This powerful new marketing force will be at work building record Log Periodic LPV Sales and profits for you!

PLUS!—

Every JFD VHF, UHF or VHF-UHF Log-Periodic LPV you buy between March 1, 1964 and August 31, 1965 earns you valuable JFD Fair Festival *Certificates which you can:*

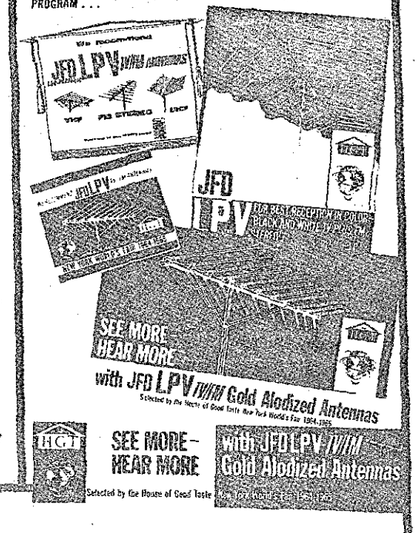
1. Trade in for FREE World's Fair Adult Admission Tickets (worth 150 points) or . . .
2. Trade in for FREE 3-day, 2-night Fair Week-ender holiday (worth 3,000 points) or . . .
3. Redeem for $1.25 cash for each 150 points, from JFD.

JFD Dealer Point Values for Log-Periodic Antennas:

Model	Points	Model	Points
LPV17	60	LPV-U15	20
LPV14	50	LPV6, LPV6PM	15
LPV11	35	LPV4, LPV4PM	10
LPV-U21	30	LPV-U9	10
LPV8, LPV8PM	25	LPV-U5	5

IT'S THE PROFIT/ENTERTAINMENT OPPORTUNITY OF THE YEAR!

—AND TO HELP YOU SELL MORE LPV LOG PERIODIC ANTENNAS, JFD OFFERS YOU A SENSATIONAL WORLD'S FAIR TIE-IN PROMOTION PROGRAM . . .



HGT SEE MORE—HEAR MORE with JFD LPV Gold Alodized Antennas Selected by the House of Good Taste

THERE IS ONLY ONE GENUINE PATENTED LOG-PERIODIC V-ANTENNA **JFD LPV**

Only JFD is licensed exclusively by the University of Illinois Foundation to make the patented Log-Periodic LPV and all other Log-Periodic type TV and FM antennas. No other so-called Log-Periodic antenna can work like the JFD Log-Periodic LPV because only JFD uses the *original patented Log-Periodic design formula of the Antenna Research Laboratories of the* University of Illinois. Rely on the JFD LPV and see why at the moment of truth, the picture is the proof—that the LPV works best! Now in stock at your JFD distributor.

LICENSED UNDER ONE OR MORE OF U.S. PATENTS 2,958,081; 2,985,879; 3,013,268; 3,105,240 AND ADDITIONAL PATENTS PENDING IN U. S. A. AND CANADA. PRODUCED BY JFD ELECTRONICS CORPORATION UNDER EXCLUSIVE LICENSE FROM THE UNIVERSITY OF ILLINOIS FOUNDATION.

Copyright JFD Electronics Corp. 1964

THE KNOW-HOW OF THE WORLD'S NEWEST AND FINEST ANTENNA LABORATORIES IS BUILT INTO EACH JFD LPV ANTENNA YOU SELL!



The Log-Periodic concept is the result of five years of intensive electronic studies at the Antenna Research Laboratories of the University of Illinois and JFD. Located in Champaign, Illinois (home of the University of Illinois), the vast new JFD research center is the largest *and most complete of its kind.*

Professor Paul Mayes at the Antenna Research Laboratories of the University of Illinois, originator of the log-periodic trapezoid antenna concept

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

INSIST ON JFD LOG-PERIODICS WITH THE EQUIPMENT YOU SELL FOR MORE SALES AND PROFITS!

Write for complete details or see your JFD LPV distributor today!

JFD

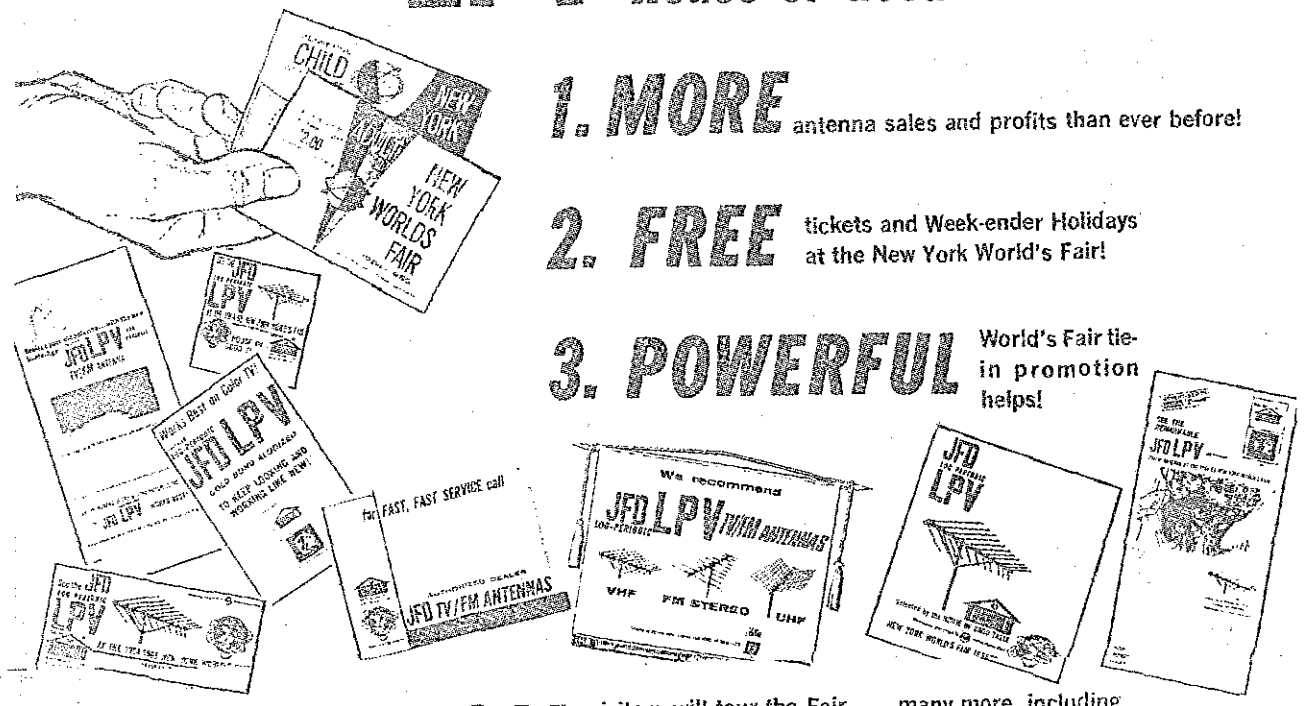
JFD ELECTRONICS CORPORATION
15th Avenue at 62nd Street, Brooklyn, N. Y. 11219

JFD Electronics Southern Inc., Oxford, North Carolina
JFD International, 64-16 Woodside Ave., Woodside 77, N. Y.
JFD Canada, Ltd., 51 McCormack Street, Toronto, Ontario, Canada
495-505 W. Hastings Street, Vancouver 3, B.C.

ADVERTISED IN Western Sunset

YOU WIN ALL WAYS WHEN YOU FEATURE THE JFD LOG-PERIODIC LPV

the exclusive choice of the New York World's Fair House of Good Taste!



1. MORE antenna sales and profits than ever before!

2. FREE tickets and Week-ender Holidays at the New York World's Fair!

3. POWERFUL World's Fair tie-in promotion helps!

70 MILLION

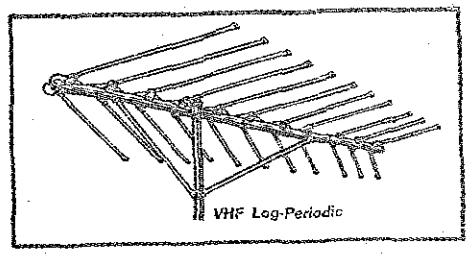
visitors will tour the Fair . . . many more, including thousands in your trading area, are going to be influenced by what is shown at the Fair.

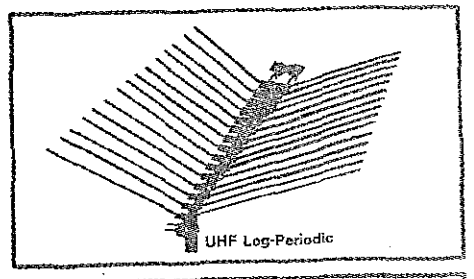
Make the most of the tremendous publicity that the JFD LPV will generate at the New York World's Fair by converting it into cash in the till, now!

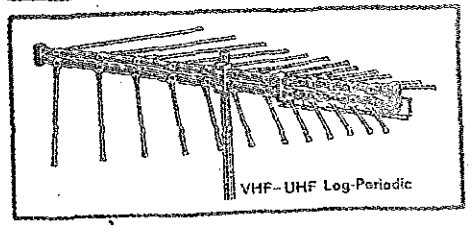
Count yourself in on this exciting program by making the Log-Periodic LPV the antenna for all your installations. *Come in and see us now so we can:*

1. Demonstrate to you the latest JFD Log-Periodic antenna developments coming from the JFD Champaign, Illinois Antenna Research & Development Labs.
2. Tell you how you can get free tickets and Week-end holidays at the fantastic New York World's Fair just by selling JFD LPVs.
3. Show you all the promotion and display material that makes your World's Fair LPV headquarters.

Look inside for all the details. Decide now to make the great performance and acceptance of the JFD Log-Periodic LPV a big part of your 1964-1965 merchandising plans.

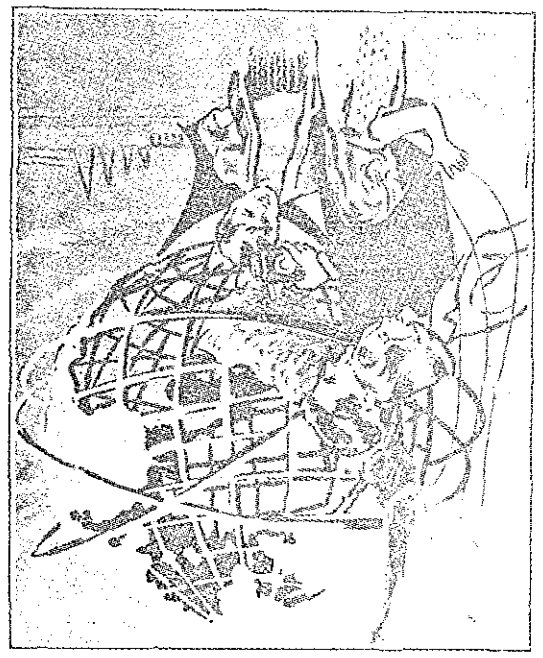






Patent No. 3,131,400 issued to U. S. A. 4-28

Here is the hottest profit opportunity of the year!



BE OUR GUEST

AT THE MOST EXCITING EXTRAVAGANZA OF THE YEAR . . .

—the fabulous 1964-1965 New York World's Fair Festival!



HERE IS HOW

Every JFD VHF or UHF Log-Periodic LPV you buy between March 1, 1964 and August 31, 1965 earns you valuable JFD Fair Festival Certificates (see schedule below) which you can:

1. Trade in for FREE World's Fair Adult Admission Tickets (worth 150 points) or . . .
2. Trade in for FREE 3-day, 2-night Fair WEEK-ENDER HOLIDAY (worth 3,000 points) or . . .
3. Redeem for $1.25 cash for each 150 points, from JFD.

USE THEM FOR YOURSELF AND YOUR FAMILY . . . USE THEM AS INCENTIVES TO YOUR CUSTOMERS TO PROMOTE MORE JFD LPV ANTENNA SALES!

START NOW . . . MAKE SALES/POINTS WITH JFD ANTENNAS!

ENJOY THE GREATEST SHOW EVER ASSEMBLED

50 different nations and 50 states will be represented. You'll see the first public demonstration of nuclear fission . . . a moon exploration team at work . . . water shows, ice shows, continental circus, monorails, the Wild West, auto thrills, space capsule and hundreds of other spectacular sights.

AND TO HELP YOU SELL MORE LPV ANTENNAS, JFD OFFERS YOU A SENSATIONAL WORLD'S FAIR TIE-IN PROMOTION PROGRAM . . .

A stunning array of full-color official World's Fair displays, banners, streamers, brochures, folders, cards, newspaper mats, and dozens more advertising aids will power your own *local sales campaign—earn you more profits and tickets* toward your FREE FAIR HOLIDAY.

JFD DEALER LPV POINT VALUES

model	points	model	points
LPV17	60	LPV-U15	20
LPV14	50	LPV-U21	15
LPV11	25	LPV6, LPV6FM	10
LPV-U21	30	LPV4, LPV4FM, LPV-U9	6
LPV6, LPV6FM	20	LPV-U9	

Obtainable from your JFD distributor when you

JFD

LAW OFFICES

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
A. R. OSTRAUSKI

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE
CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

October 7, 1966

RECEIVED
OCT 10 1966
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

Mr. William A. Marshall
Merriam, Marshall, Shapiro & Klose
30 West Monroe Street
Chicago, Illinois 60603

Re: University of Illinois Foundation
v. Blonder-Tongue Laboratories v.
JFD Electronics Corporation

Dear Bill:

On October 24th we would like to take the deposition of Hjalmar W. Johnson and whatever other officer or employee of the Foundation that is responsible for the following documents, all of which we would like to have brought to the deposition:

1. Copies of all news releases, public announcements, and advertisements emanating from University of Illinois and University of Illinois Foundation relating to the log-periodic antennas covered by the patent in suit and relating to any and all licenses under such patent and any and all litigation or intended litigation involving the patent in suit including, but not limited to, the present litigation with Blonder-Tongue.

2. Copies of all writings authorizing the news releases, announcements, and/or advertisements referred to in paragraph 1 and relating to the use of the same.

3. Copies of all corporate by-laws, minutes and other documents authorizing University of Illinois and University of Illinois Foundation to grant licenses under the patent in suit, including, but not limited to, the commitment of University of Illinois Foundation with regard to policing said patent, the percentage of sales to be received by University of Illinois Foundation and the establishment of the policy relating to such policing.

4. Copies of any and all requests for exemptions from state and federal taxes by University of Illinois and

University of Illinois Foundation during the period of the license under the patent in suit to JFD, and copies of all other documents that set forth the scope of activities engaged in by University of Illinois and University of Illinois Foundation and/or the sources of income that qualify for such tax exemption.

5. Copies of all agreements including, but not limited to, employment agreements between the inventor of the patent in suit and each of University of Illinois and University of Illinois Foundation.

6. Copies of all correspondence, memoranda, corporate records and other documents of University of Illinois and University of Illinois Foundation authorizing University of Illinois Foundation to hold title to and to license the patent in suit.

7. Copies of the license agreement and all other agreements, memoranda and writings relating to the licensing and commercialization with JFD and all others in connection with the patent in suit.

8. Copies of all correspondence, memoranda, corporate records and other documents granting permission to or bearing upon the right of JFD to use the name of any of University of Illinois, University of Illinois Foundation or its employees or the inventor of the patent in suit in connection with advertising, selling and otherwise promoting the antennas licensed by University of Illinois Foundation to JFD under the patent in suit.

Sincerely,

JRA:DB

bcc: Mr. Robert H. Rines

CHARLES J. MERRIAM
WILLIAM A. MARSHALL
JEROME B. KLOSE
NORMAN M. SHAPIRO
BASIL P. MANN
CLYDE V. ERWIN, JR.
ALVIN D. SHULMAN
EDWARD M. O'TOOLE
ALLEN H. GERSTEIN
OWEN J. MURRAY
DONALD E. EGAN
NATE F. SCARPELLI

LAW OFFICES
MERRIAM, MARSHALL, SHAPIRO & KLOSE
THIRTY WEST MONROE STREET
CHICAGO, ILLINOIS 60603

TELEPHONE
FINANCIAL 6-5750

October 14, 1966

RECEIVED
OCT 15 1966
HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

Richard S. Phillips, Esquire
Hofgren, Wegner, Allen,
Stellman & McCord
Sutie 2200
20 North Wacker Drive
Chicago, Illinois 60606

Re: University of Illinois Foundation
v. Blonder-Tongue Laboratories, Inc.
and Allied Radio Corporation
Civil Action No. 66 C 567

Dear Dick:

Enclosed is a copy of the first contract between the Foundation and JFD which has been edited to remove confidential information.

Sincerely yours,

Basil P. Mann

BPM/mto

Enclosure

RECEIVED
OCT 19 1966
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

RECEIVED
OCT 19 1966
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

LICENSE AGREEMENT

THIS LICENSE AGREEMENT entered into this 31st day of May, 1962, by and between the UNIVERSITY OF ILLINOIS FOUNDATION, a non-profit corporation organized and existing under and by virtue of the laws of the State of Illinois, hereinafter referred to as "LICENSOR," and JFD ELECTRONICS CORPORATION, a corporation organized and existing under and by virtue of the laws of the State of New York, hereinafter referred to as "LICENSEE."

WITNESSETH:

WHEREAS, LICENSOR is the owner of the entire right, title and interest in and to Letters Patent of the United States as follows:

2,958,081, dated October 25, 1960 - J. D. Dyson - entitled "Unidirectional Broadband Antennas,"

2,985,879, dated May 23, 1961 - R. H. DuHamel - entitled "Frequency Independent Antennas,"

3,011,168, dated November 28, 1961 - D. E. Isbell - entitled "Frequency Independent Unidirectional Antennas,"

as well as U. S. applications for Letters Patent of the United States, Serial No. 26,589, filed May 3, 1960 by D. E. Isbell entitled "Frequency Independent Unidirectional Antennas," Serial No. 59,671, filed September 30, 1960 by P. E. Mayes and R. L. Carrel entitled "Frequency Inde-

pendent Unidirectional Antennas," Serial No. 79,432, filed December 29, 1960 by J. D. Dyson and P. E. Mayes entitled "Circularly Polarized Omnidirectional Antenna." and Serial No.

as well as the invention set forth and described in and by each of the aforesaid Letters Patent of the United States and applications for Letters Patent of the United States; and

WHEREAS, LICENSOR holds the sole right to grant the license right herein granted and agreed to be granted; and

WHEREAS, LICENSEE is desirous of securing, for the term of years hereinafter set forth, an exclusive license to manufacture, use or sell, or to have made for its use or sale, apparatus of the type described and claimed in and by each of the aforesaid Letters Patent of the United States and applications for Letters Patent of the United States as the same is therein disclosed and set forth.

NOW, THEREFORE, in consideration of the foregoing and the mutual terms and conditions of this License Agreement and other good and valuable consideration, the receipt and sufficiency of all of which is hereby duly acknowledged, the parties hereto agree as follows:

1. LICENSOR hereby grants and agrees to grant to LICENSEE an exclusive non-transferable right and license in the United States to make, use or sell or have made for its use or sale any invention described in any of the afore-

mentioned Letters Patent as well as the aforesaid applications for Letters Patent, the components so manufactured, used or sold being referred to hereafter as "Licensed Articles." Said exclusive license shall extend for the term of from the date of allowance of one or more claims in either application Serial No. or Serial No. which cover and define LICENSEE's manufactured Licensed Articles. Thereafter, LICENSOR shall have the right to grant other licenses in the Licensed Articles, but in such event shall give at least ninety (90) days' notice thereof to LICENSEE, and LICENSEE's royalties, hereinafter provided, shall be no

Royalties

herein provided shall hereafter not be in effect. The license granted hereunder shall extend also to any continuation, division, or continuation-in-part of any of said applications for Letters Patent and to any reissues of any of the licensed patents.

2. All Licensed Articles manufactured and sold by LICENSEE under the terms of this License Agreement shall carry such reasonable notice as LICENSOR shall from time to time request in writing and which shall comply with the provisions of Title 35 United States Code, Section 287.

3. LICENSEE agrees to make the following payments to LICENSOR:

Royalties

The precentage royalty rate shall be computed upon the net selling price of such Licensed Articles made, used or sold by LICENSEE or made by others for its use or sale. Such royalty, however, shall be payable only upon sale of the article except in those cases in which the article is consumed by or for LICENSEE without sale. In such cases, royalties shall be computed at the normal selling price of the device. Licensed Articles made during the life of a licensed patent covering the same, but not sold until the expiration of said patent, shall be subject to royalty. In the event of cancellation of this Agreement, LICENSEE shall make a report of Licensed Articles on hand and shall pay the appropriate royalties with respect thereto. If

Royalties

So long as this license is exclusive, LICENSEE shall pay royalties

Royalties

4. LICENSEE may cancel this Agreement at any time upon ninety (90) days' notice in writing to LICENSOR. Termination of this Agreement pursuant to this or any other paragraph shall not relieve LICENSEE of the obligation to pay accrued royalties.

5. After termination of this Agreement LICENSEE shall not be subject to any estoppel by reason of its having been a LICENSEE.

6. LICENSEE agrees that it will render to LICENSOR with each such royalty payment, a report showing the period for which said payment is made, and the net sales upon which the royalty payment is computed. LICENSEE agrees to keep accurate accounts in sufficient detail to enable the royalties payable hereunder to be determined, and LICENSEE further agrees to permit a Certified Public Accountant selected by LICENSOR and acceptable to LICENSEE to inspect such records at reasonable times during regular business hours for the sole purpose of verifying the accuracy of the reports submitted and payments made under this License Agreement, subject to the condition that

LICENSOR shall give written notice to LICENSEE, within six (6) months following the receipt by LICENSOR of each such quarterly report and royalty payment concerning which verification is desired, and LICENSOR, through its designated Certified Public Accountant, shall proceed promptly with the inspection of said records.

7. Royalties at rates specified in paragraph 3 hereof shall be due and payable quarterly on or before the sixtieth (60th) day following the first day of each of the months of January, April, July and October for the corresponding preceding quarterly period. LICENSEE shall furnish LICENSOR, with each royalty payment, a written statement setting forth the net sales value of the Licensed Articles sold by LICENSEE during the preceding quarterly period and the amount of royalty due and payable to LICENSOR under the terms of this License Agreement, as provided by paragraph 3 hereof.

Royalties

8. LICENSEE may grant sublicenses hereunder providing the license payments due LICENSOR are no less

than those provided herein. In such event LICENSEE shall be responsible for royalty payments by its sublicensees. Any granted sublicenses shall terminate concurrently with this License. LICENSEE shall pay over to LICENSOR as royalty payments computed at the rates specified in sub-paragraphs b and c of paragraph 2 computed upon the same basis as if LICENSEE had manufactured the Licensed Article.

9. LICENSOR may cancel this Agreement upon default of LICENSEE by giving ninety (90) days' notice to do so, and unless LICENSEE cures the default complained of during such ninety (90) day period; but no such termination shall affect the obligation of LICENSEE to pay royalties or other obligations accrued before the effective date of such notice.

10. EICENSEE shall not use, publish or circulate any advertising matter or literature (other than the foregoing patent marking statement of paragraph 2 hereof upon its Licensed Articles and labels used therewith) containing a reference to the University of Illinois or to the University of Illinois Foundation except with the prior written authorization of LICENSOR as to such reference. Such written authorization may be obtained from the Executive Director of the University of Illinois Foundation, which authorization will not be unreasonably withheld.

11. LICENSOR does not warrant the validity of any Letters Patent of the United States herein licensed

and agreed to be licensed as issued upon the application for Letters Patent of the United States hereinabove identified, or any Letters Patent of the United States resulting from the filing of any divisional, reissue or continuation application thereof, nor does LICENSOR accept any liability with respect to enforcement of the said licensed Letters Patent of the United States, as herein provided, against third party infringers or any liability with respect to defending LICENSEE against infringement of any United States or foreign Letters Patent which may at any time be asserted against LICENSEE. LICENSOR agrees to hold one-half (1/2) of the royalties received in a fund to be employed for protection and enforcement of the licensed patents against infringers, such accumulation to be made until such fund reaches ten thousand dollars ($10,000.00) and thereafter for a period of five (5) years from the date hereof or until no substantial infringement exists, whichever date shall be later. At the end of the aforesaid period, LICENSOR may at its discretion disburse said fund into its own account. In the event that LICENSOR does not reasonably enforce said Letters Patent, LICENSEE shall have the right, if it desires and at its own expense, to institute and prosecute claims against third parties for infringement and may apply one-half (1/2) of royalties to apply against the expense of the same, and may retain any recoveries therein.

12. If any licensed claim is held invalid by the final decision of a court or appropriate tribunal, LICENSEE shall not be required to pay royalties hereunder with respect to the subject matter of that claim unless and until the final decision of another appropriate court finds such claim patentable.

13. In the event of breach of this License Agreement by either party hereto, the party not in default may at its election terminate the same by ninety (90) days' written notice to such effect served upon the other party, the notice to briefly set forth the breach or default relied upon to effect termination. In the event the party in default makes full restitution for the breach or default relied upon within said ninety (90) day period, then this License Agreement shall continue in full force and effect.

14. It is agreed that the rights herein granted and agreed to be granted and the obligations and liabilities here imposed and incurred shall apply with equal force and effect to any wholly owned subsidiary now or hereafter directly owned or controlled by LICENSEE and that the acts done by or on behalf of such subsidiary shall, for the purpose of this Agreement, be deemed to be the acts done by the LICENSEE, as the party directly owning or controlling such subsidiary, but nothing contained herein shall be construed as granting to any subsidiary

any rights or advantages which shall continue after such subsidiary has ceased to be a subsidiary, or has ceased to be directly or indirectly owned or controlled by LICENSEE as herein contemplated. In the event of a sale between LICENSEE or any subsidiary of LICENSEE and a corporation acting otherwise than at arms length, the net selling price shall be computed with respect to the first uncontrolled sale to a person who is acting at arms length.

15. It is further agreed that if LICENSEE becomes bankrupt or insolvent or enters into any composition with creditors, or invokes the provisions of any bankruptcy or insolvency statute, or any law for the relief of debtors now in force or hereafter enacted, this License Agreement and the licenses and rights here granted to LICENSEE shall forthwith terminate and cease.

16. It is further understood and agreed that this License Agreement is not assignable by LICENSEE without the written consent of LICENSOR and that LICENSEE cannot release itself from the obligations hereunder by any assignment or transfer of any hereunder licensed United States Letters Patent or any applications for Letters Patent of the United States, and that, subject to the limitations hereinbefore set forth, this License Agreement, the benefits thereof and the obligations and liabilities imposed thereby shall extend to the successors in business of each of the parties hereto.

17. In the event that this License Agreement is terminated prior to the expiration date of any Letters Patent of the United States under which a right and license is herein granted, LICENSOR agrees that LICENSEE shall have the right to sell or otherwise dispose of, within a period of one (1) year, any stock of Licensed Articles on hand as of the date of termination subject to the payment to LICENSOR of royalty as provided in paragraph 3 hereof.

18. Notices called for hereunder shall be deemed properly given if duly sent by United States first-class mail and addressed, in the case of LICENSOR, to the University of Illinois Foundation, Illini Union Building, Urbana, Illinois, and in the case of LICENSEE, to JFD Electronics Corporation, 6101 Sixteenth Avenue, Brooklyn 4, New York.

19. This Agreement is considered to have been executed and delivered within the State of Illinois and it is the intention of the parties that it shall be construed and interpreted in the light of the laws of the State of Illinois and the patent laws of the United States of America, whichever shall be applicable under the circumstances.

IN WITNESS WHEREOF, each of the parties hereto has caused this document to be executed by its duly authorized officers and with full authorization of its

managing Board of Governors or Board of Directors, as the case may be, and its corporate seal to be affixed hereon on the day, month and year first above written.

UNIVERSITY OF ILLINOIS FOUNDATION

By _____
President

Attest:

_____
Secretary

JFD ELECTRONICS CORPORATION

By _____
Vice President

Attest:

Albert Finkel
PRESIDENT.

_____
Secretary

Sworn to before me this 1 day of June 1964

_____

SEYMOUR W. GELLER
Notary Public, State of New York
No. 24-1309350
Qualified in Kings County
Commission Expires March 30, 1965

LAW OFFICES

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE

CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

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

October 17, 1966

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

Re: University of Illinois Foundation
v. Blonder-Tongue Laboratories Etc.

Dear Mr. Rines:

Attached please find copy of revised answers to plaintiff's first set of interrogatories. Sorry I neglected to send you this before I left on my trip.

Yours very truly,

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

John Rex Allen

JRA:DB
Enc.

RECEIVED
OCT 18 1966
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

RECEIVED
OCT 17 1966
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

LICENSE AGREEMENT

THIS LICENSE AGREEMENT entered into this 1st day of December, 1965, by and between the UNIVERSITY OF ILLINOIS FOUNDATION, a non-profit corporation organized and existing under and by virtue of the laws of the State of Illinois, hereinafter referred to as "LICENSOR," and JFD ELECTRONICS CORPORATION, a corporation organized and existing under and by virtue of the laws of the State of New York, hereinafter referred to as "LICENSEE."

WITNESSETH:

WHEREAS, LICENSOR is the owner of the entire right, title and interest in and to Letters Patent of the United States as follows:

Inventor(s)	Patent No.	Issued	Title
Dyson	2,958,081	10-25-60	Unidirectional Broadband Antenna Comprising Modified Balanced Equiangular Spiral
DuHamel	2,985,879	5-23-61	Frequency Independent Antennas
Isbell	3,011,168	11-28-61	Frequency Independent Unidirectional Antennas
Mayes & Carrel	3,108,280	10-22-63	Log Periodic Backward Wave Antenna Array

Inventor(s)	Patent No.	Issued	Title
Carrel & Mayes	3,150,376	9-22-64	Multi-Band Log Periodic Antenna
Mayes & Carrel	Re 25,740	3-9-65	Log Periodic Backward Wave Antenna Array
Dyson & Mayes	3,188,643	6-8-65	Circularly Polarized Omnidirectional Cone Mounted Spiral Antenna
Isbell	3,210,767	10-5-65	Frequency Independent Unidirectional Antennas

as well as applications for United States Letters Patent as follows:

Inventor(s)	Serial No.	Filed	Title

PENDING PATENT APPLICATIONS

as well as the inventions set forth and described in and by each of the aforesaid Letters Patent of the United States and applications for Letters Patent of the United States; and

WHEREAS, LICENSOR also is the owner of the entire right title and interest in and to Letters Patent of countries other than the United States as follows:

Country	Inventor	Patent No.	Issued	Title
Canada	Mayes & Carrel	715,685	8-10-65	Frequency Independent Unidirectional Antenna (corresponding to re-issue U.S. 25,740)

; and

WHEREAS, LICENSOR also is the owner of the entire right title and interest in and to applications for patent in countries other than the United States as follows:

Country	Inventor	Serial No.	Filing Date	Corresponding U.S. Pat. or Application or Title

PENDING FOREIGN PATENT APPLICATIONS

; and

WHEREAS, LICENSOR may from time to time after the date on which this agreement comes into force and during the term thereof, acquire additional patents and applications for U.S. Letters Patent and additional applications for patent in countries other than the United States; and

WHEREAS, LICENSOR holds the sole right to grant the LICENSE herein granted and agreed to be granted; and

WHEREAS, the parties hereto did on May 24, 1962 enter into a license agreement related to the said patents and applications for patent and the then applications for patent which have now issued and the said parties, now that patents have issued and experience has been obtained under the prior license agreement, now desire to enter into a more extended license agreement which will insure a reasonable income to LICENSOR for a period of years and make it possible for LICENSEE to undertake a reasonable investment in anticipation of sales over a reasonable number of years; and

WHEREAS, LICENSEE desires to secure and LICENSOR desires to grant, for the term of years hereinafter set forth an exclusive license to manufacture, use or sell, or to have made for its use or sale, apparatus of the type described in and by each of the aforesaid Letters Patent of the United States and application for Letters Patent of the United States and by each of the applications and patents in each country other than the United States.

NOW, THEREFORE, in consideration of the foregoing and the mutual terms and conditions of this LICENSE AGREEMENT and other good and valuable consideration, the receipt and sufficiency of all of which is hereby duly acknowledge, the parties hereto agree as follows:

1.. This AGREEMENT is a substitute for and replaces and terminates all prior agreements between the parties including specifically the prior LICENSE AGREEMENT of May 24, 1962 and any extensions and modifications thereof.

2. LICENSOR hereby grants and agrees to grant to LICENSEE an exclusive non-transferable right and license only in the field of receiving antennas for television and FM broadcasting stations

and antennas for amateur and citizens band transmission and reception in the United States and in all countries other than the United States to make, use or sell or have made for its use or sale any invention described in any of the aforementioned Letters Patent as well as the aforesaid applications for Letters Patent and any invention, acquired by LICENSOR, prior to or during the term or extended term of this agreement which invention shall be subsidiary, auxiliary, useful or necessary to practice or use the inventions herein licensed or which shall be an improvement thereof and any continuation, division, utility model, design or continuation-in-part application relating to said licensed patents or applications and to any reissues of any licensed patents. The components so manufactured, used or sold are herein referred to as "LICENSED ARTICLES".

a. LICENSEE is also granted an option to acquire a non-exclusive license under the licensed patents and inventions for all fields other than the field of the exclusive license granted herein at the same royalty rates but subject to equal treatment with the most favored LICENSEE.

3. LICENSEE shall make the following payments to LICENSOR:

a. With respect to "LICENSED ARTICLES" covered by the claims of any issued patent in the country where made or sold, ROYALTY

b. With respect to "LICENSED ARTICLES" covered by the claims of a pending application in the country where made or sold, but not covered by the claims of any issued

patent (provided that said claims reasonably stem from the disclosure of the pending application and provided that LICENSOR'S attorney shall state to LICENSEE his opinion that the claims should reasonably be allowed). ROYALTY

c. No more than a single royalty shall be paid with respect to any "LICENSED ARTICLE" regardless of the number of patents of the LICENSOR in the United States and countries other than the United States which may be applicable thereto.

d. The percentage royalty rate shall be computed upon the net selling price by LICENSEE of such LICENSED ARTICLES made, and or sold by LICENSEE or made by others for its use or sale, the selling price shall be the invoicing price less discounts, allowance, and returns. Such royalty, however, shall be payable only upon sale of the article except in those cases in which the article is consumed by or for LICENSEE without sale; in such latter cases, royalties shall be computed at LICENSEE'S usual selling price of the article.

e. LICENSED ARTICLES made during the life of a licensed patent covering the same, but not sold until the expiration of said patent, shall be subject to royalty.

f. On termination of this agreement at the end of its term or renewed terms or on termination for any other cause, LICENSEE shall make a report of LICENSED ARTICLES on hand and shall pay royalties with respect thereto.

g. Royalties as provided herein shall be due and payable quarterly on or before the sixtieth (60th) day following the first day of each of the months of January, April, July and October for the corresponding preceding quarterly period. LICENSEE shall furnish LICENSOR, with each royalty payment, a written statement setting forth the actual sales of the LICENSED ARTICLES sold by LICENSEE during the preceding quarterly period and the amount of royalty due and payable under the terms of this LICENSE AGREEMENT.

h. The royalty payments shall be made by the LICENSEE together with reports for each quarterly period.

i. LICENSEE agrees to keep accurate accounts in sufficient detail to enable the royalties payable hereunder to be determined, and LICENSEE further agrees to permit a Certified Public Accountant selected and paid by LICENSOR and acceptable to LICENSEE to inspect such records at reasonable times during regular business hours for the sole purpose of verifying the accuracy of the reports submitted and payments made under this LICENSE AGREEMENT, subject to the condition that LICENSOR shall give written notice to LICENSEE within six (6) months following the receipt by LICENSOR of each such quarterly report and royalty payment concerning which verification is desired and LICENSOR through its designated Certified Public Accountant shall proceed promptly with the inspection of said records during regular business hours adjusting his inspection times to the reasonable convenience of LICENSEE'S personnel.

4. The LICENSE herein granted is and shall be and remain exclusive to LICENSEE during the term of this AGREEMENT and any renewal thereof under the following terms and conditions:

a. There is established below a schedule of minimum annual royalties together with a method for varying the said minimum royalties.

b. In the event that, for any annual period, the payments of royalty by LICENSEE to LICENSOR on account of LICENSEE'S and sublicensees sales shall fall below the minimum scheduled annual royalties for said annual period, then LICENSOR shall have the following option exercisable by LICENSOR by notice in writing to LICENSEE not more than sixty (60) days after the receipt by LICENSOR of the report and payment by LICENSEE with respect to the fourth quarter for each annual period;

i. to maintain the exclusive nature of this License but to require that LICENSEE grant sub-licenses under this AGREEMENT to such antenna manufacturers of LICENSEE'S selection as will bring the total of licensed articles sold in the United States to seventy-five percent (75%) of the total of all antennas sold in the United States and infringing at least one non-adjudicated claim or one adjudicated valid claim of a licensed patent,

and to require that LICENSEE sub-license one competitive manufacturer in each foreign country in which LICENSOR'S licensed patents have issued and are subject to this agreement and where LICENSEE'S share of the market for "infringing" antennas is less than 30% of the market in that country.

A. In the event that LICENSOR shall elect to exercise this option, LICENSEE shall make every reasonable effort to effect such sublicense(s), and LICENSOR agrees to render such assistance as LICENSEE may require in effecting such sublicenses.

c. The schedule of minimum annual royalties as the basis for the option set forth in sub-paragraph b hereof shall be as follows:

SCHEDULE OF MINIMUM ROYALTY

d. In the event of renewal of this agreement beyond K as hereinafter provided, then the minimum annual royalties shall be at K per year as a base; if, at any time after K, either party desires that the said minimum

annual royalty should, in fairness, be adjusted and the other party does not on request agree to the adjustment, the parties agree that either party may submit to the American Arbitration Society, New York, for determination, the establishment of a different minimum annual royalty rate, and the decision of the arbitrators will be binding. Either party may make such a request for adjustment and require such arbitration not more often than once each year; and the decision of the arbitrators may, whenever made, be retroactive to cover the calendar year in which the initial request for adjustment was made. Among the factors which the arbitrators are expected to consider are the number of color television sets sold each year which are presently believed to particularly benefit from and require the enhanced quality of reception afforded by antennas made in accordance with the licensed invention; the, possibly growing, impact of increased use of portable color television sets which are not presently expected to use antennas made in accordance with the licensed invention and, therefore, may decrease the market for licensed antennas; the possibly growing, impact of C.A.T.V. type of reception which substitutes a community antenna for individual antennas and, therefore, may further decrease the market for licensed antennas; and other factors which at the time of arbitration are then known or believed to have an effect on the market for licensed antennas.

5. All LICENSED ARTICLES manufactured and sold by LICENSEE under the terms of this LICENSE AGREEMENT shall

carry such reasonable notice as LICENSOR shall from time to time request in writing which notice LICENSOR warrants will comply with the law.

6. LICENSEE shall have the right to grant sublicenses hereunder; in such event, LICENSEE shall be responsible for transmission to LICENSOR of its share of the royalty payments received from its sublicensees. Any sublicenses shall terminate concurrently with the termination of this License. All of the applicable terms of this License Agreement for the protection of LICENSOR with respect to marking and times of payment, default and termination, reports and payments shall be deemed to be incorporated by reference in such sublicenses and a copy of this AGREEMENT shall be attached to such sublicenses with certain areas blocked out at the discretion of LICENSEE.

a. LICENSEE shall charge any sublicensee a royalty rate no less than that required to be paid by LICENSEE to LICENSOR.

ROYALTY

7. This AGREEMENT shall be effective as of January 1, 1966 and shall terminate DATE unless renewed.

RENEWAL OPTIONS DELETED *

a. LICENSEE shall have the option during the period * to notify LICENSOR of its desire to renew the AGREEMENT for an additional *

On sending of such notice by LICENSEE, this AGREEMENT shall thereafter be extended to terminate * and shall operate under the conditions herein set forth and specifically the minimum royalty conditions of paragraph 4.

b. LICENSEE shall, if this AGREEMENT has been extended to * have the further option to renew the same to expire *, by sending a notice to LICENSOR during the period *
In such event, the LICENSE shall remain exclusive but there shall be no minimum royalty provision.

c. This LICENSE shall be deemed to be a paid-up license (and no further royalties shall be due) with respect to any licensed patents or applications for patent which have been issued or are currently pending as of * and with respect to any divisional, continuation or reissue patents of such then issued or pending applications on the occurrence of either of the following:

1. *

2. The payment by or through LICENSEE to LICENSOR of royalties totaling *

d. With respect to any patent or patents of LICENSOR which may become subject to this LICENSE other than those set forth above, royalties, under this AGREEMENT shall, after [redacted] be resumed by LICENSEE with respect to such patents and such products of LICENSEE as fall within the claims of such patents.

8. LICENSEE shall not use, publish or circulate any advertising matter or literature (other than the foregoing patent marking statement of paragraph 2 hereof upon its Licensed Articles and labels used therewith) containing a reference to the University of Illinois or to the University of Illinois Foundation except with the prior written authorization of LICENSOR as to such reference. It is understood that authorization previously granted shall stand. Such written authorization may be obtained from the Executive Secretary of the University of Illinois Foundation, which authorization will not be unreasonably withheld.

9. LICENSEE may cancel this AGREEMENT at any time upon ninety (90) days' notice in writing to LICENSOR. Termination of this AGREEMENT pursuant to this or any other paragraph shall not relieve LICENSEE of the obligation to pay accrued royalties.

10. After termination of this AGREEMENT, LICENSEE shall not be subject to any estoppel by reason of its having been a LICENSEE.

11. LICENSOR may cancel this AGREEMENT upon default of LICENSEE by giving ninety (90) days' notice to do so,

and unless LICENSEE cures the default complained of during such ninety (90) day period; but no such termination shall affect the obligation of LICENSEE to pay royalties or other obligations accrued before the effective date of such notice.

12. LICENSOR does not warrant the validity of any Letters Patent of the United States herein licensed and agreed to be licensed as issued upon the application for Letters Patent of the United States hereinabove identified, or any Letters Patent of the United States resulting from the filing of any divisional, reissue or continuation application thereof, nor does LICENSOR accept any liability with respect to enforcement of the said licensed Letters Patent of the United States, as herein provided, against third party infringers or any liability with respect to defending LICENSEE against infringement of any United States or foreign Letters Patent which may at any time be asserted against LICENSEE.

13. LICENSOR agrees to hold one-half (1/2) of the royalties received in a fund to be employed for protection and enforcement of the licensed patents against infringers, such accumulation to be made until such fund reaches ten thousand dollars ($10,000.00), and thereafter for a period of five (5) years from the date hereof or until no substantial infringement exists, whichever date shall be later. At the end of the aforesaid period, LICENSOR may at its discretion disburse said fund into its own account.

14. In the event that LICENSEE shall call the attention of LICENSOR in writing to an infringing device made and sold by a competitor of LICENSEE and shall demand that an action for infringement be brought by LICENSOR with respect thereto and in the event that LICENSOR shall fail to institute such action within thirty (30) days after sending of such notice, then LICENSEE shall have the right at its own expense to institute and prosecute an action with respect to such infringement and may apply one-half (1/2) of royalties to the expense of the same, and payment shall be reduced accordingly.

From any such recovery, LICENSEE may further reimburse itself for its expenses; if any funds are then left, then from such funds in said recovery, LICENSEE shall pay LICENSOR the royalties previously withheld with respect to or on account of such action; if thereafter, any funds remain from such recovery, that shall be divided evenly between LICENSOR and LICENSEE.

This right of LICENSEE to send notice and demand for action and to bring action for infringement shall not be limited to a single action for infringement but shall extend to such actions against such parties as LICENSEE deems necessary, not in excess of ** at any one time, provided that at no one time shall such actions involve duplication of issues against the same ultimate party in interest. In the event, however, that LICENSEE shall elect to bring an action which shall increase the number of pending actions brought by LICENSEE

** CONFIDENTIAL BUSINESS INFORMATION DELETED

above the said number, it may do so; but in such latter event, it may withhold only such part of the royalty as will leave the LICENSOR [redacted] of the entire royalty due LICENSOR in any one year, after deduction of LICENSEE'S and LICENSOR'S expenditures and commitments for expenditures for litigation; it being understood, however, that LICENSOR'S such expenditures and commitments for expenditures will not for this purpose exceed [redacted] of the royalties due in any one year.

15. If any licensed claim is held invalid by the final decision of a court or appropriate tribunal, LICENSEE shall not be required to pay royalties thereunder with respect to products covered by that claim unless and until the final decision of another appropriate court finds such claim patentable.

16. In the event of breach of this License Agreement by either party hereto, the party not in default may at its election terminate the same by ninety (90) days' written notice to such effect served upon the other party, the notice to briefly set forth the breach or default relied upon to effect termination. In the event the party in default makes full restitution for the breach or default relied upon within said ninety (90) day period, then this License Agreement shall continue in full force and effect.

17. It is agreed that the rights herein granted and agreed to be granted and the obligations and liabilities here imposed and incurred shall apply with equal force and

effect to any wholly owned subsidiary now or hereafter directly owned or controlled by LICENSEE and that the acts done by or on behalf of such subsidiary shall, for the purpose of this AGREEMENT, be deemed to be the acts done by the LICENSEE, as the party directly owning or controlling such subsidiary, but nothing contained herein shall be construed as granting to any subsidiary any rights or advantages which shall continue after such subsidiary has ceased to be a subsidiary, or has ceased to be directly or indirectly owned or controlled by LICENSEE as herein contemplated. In the event of a sale between LICENSEE or any subsidiary or LICENSEE and a corporation acting otherwise than at arms length, the net selling price shall be computed with respect to the first uncontrolled sale to a person who is acting at arms length.

18. It is further agreed that if LICENSEE becomes bankrupt or insolvent or enters into any composition with creditors, or invokes the provisions of any bankruptcy or insolvency statute, or any law for the relief of debtors now in force or hereafter enacted, this License Agreement and the licenses and rights here granted to LICENSEE shall forthwith terminate and cease.

19. It is further understood and agreed that this License Agreement is not assignable by LICENSEE without the written consent of LICENSOR except to a successor of the entire business of LICENSEE related to television antennas and that LICENSEE cannot release itself from the obligations hereunder by any assignment or transfer of any hereunder

licensed United States Letters Patent or any applications for Letters Patent of the United States, and that, subject to the limitations hereinbefore set forth, this License Agreement, the benefits thereof and the obligations and liabilities imposed thereby shall extend to the successors in business of each of the parties hereto.

20. In the event that this License Agreement is terminated prior to the expiration date of any Letters Patent of the United States under which a right and license is herein granted, LICENSOR agrees that LICENSEE shall have the right to sell or otherwise dispose of, within a period of one (1) year, any stock of Licensed Articles on hand as of the date of termination subject to the payment to LICENSOR of royalty as provided in paragraph 3 hereof.

21. University Patents Inc. of Illinois, Chicago, Illinois, is hereby appointed by LICENSOR as administrator of this AGREEMENT on behalf of LICENSOR. Notices and payments required hereunder shall be deemed properly given if duly sent by United States first-class mail and addressed, in the case of LICENSOR: University Patents Inc. of Illinois, 30 West Monroe Street, Chicago, Illinois; and in the case of LICENSEE: JFD Electronics Corporation, 15 Avenue at 62 Street, Brooklyn, New York 11219.

22. This AGREEMENT is considered to have been executed and delivered within the State of Illinois, and it is the intention of the parties that it shall be construed

and interpreted in the light of the laws of the State of Illinois and the patent laws of the United States of America, whichever shall be applicable under the circumstances.

23. If LICENSOR shall acquire after the date on which this agreement comes into force and during the term thereof, any patent rights which fall within the field of receiving antennas for television and FM broadcasting stations and antennas for amateur and citizens band transmission and reception in the United States or in any other country, LICENSEE shall have the opportunity to include those after-acquired inventions in this agreement. If the acquisition of said after-acquired inventions obligate LICENSOR to impose terms and conditions over and above those of this agreement or shall require LICENSOR to pay to or share royalties with, the person from whom such patent rights are acquired by LICENSOR, LICENSEE shall have an option to have such after-acquired patent rights included with the licenses granted in paragraph 2 hereof. Within sixty (60) days after such acquisition LICENSOR shall advise LICENSEE of the general nature thereof and of the additional terms and conditions, if any, involved in the acquisition of such rights, and shall forward to LICENSEE copies of any and all issued Letters Patent or patent applications involved in the acquisition. LICENSEE shall then have the right, within sixty (60) days of the notice from LICENSOR to include such patent rights in the licenses above granted by either tendering to LICENSOR a reimbursement of the expenses incurred in such acquisition or by agreeing to assume the

additional obligations of LICENSOR. If, at any time during said sixty (60) day period LICENSEE so requests LICENSOR in writing, LICENSOR will forward to LICENSEE all patent application papers and other material in its possession which relate to the patent rights in question, in which case the termination date of the period will be extended when necessary to that LICENSEE will have no less than sixty (60) days after receipt as such applications and other material to make its election. Failure of LICENSEE to elect within the applicable time period shall exclude such patent rights from the LICENSES herein granted. This paragraph 23 is not intended to require any additional obligation consideration when it pertains to any after-acquired inventions that emanate from the University of Illinois. The same sixty (60) day provision shall apply but LICENSEE shall not be required to assume any additional obligation in order to elect to include after-acquired inventions emanating from the University of Illinois.

IN WITNESS WHEREOF, each of the parties hereto has caused this document to be executed by its duly authorized officers and with full authorization of its managing Board of Governors or Board of Directors, as the case may be, and its corporate seal to be affixed hereon on the day, month and year first above written.

UNIVERSITY OF ILLINOIS FOUNDATION

Attest:

Ray E. Snyder
~~Secretary~~ Vice President

By _____
President, University Foundation, Inc.

JFD ELECTRONICS CORPORATION

Attest:

Edward Finkel
Secretary Vice-President

By Albert Finkel
President

LAW OFFICES

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
A. R. OSTRAUSKAS

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE
CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

October 24, 1966

Mr. I. Irving Silverman
Silverman & Cass
105 West Adams Street
Chicago, Illinois 60603

RE: University of Illinois Foundation
v. Blonder-Tongue Laboratories
v. JFD Electronics Corporation

Dear Mr. Silverman:

This supplements our letter of October 7, 1966, in connection with the depositions of Prof. Mayes and Mr. Finkel to be taken on October 24. We request that you produce:

1. Copies of all advertisements, circulars, catalogs, news releases, brochures, instructions to distributors and salesmen, memoranda, and other writings dealing with log-periodic antennas manufactured by JFD under its license from University of Illinois Foundation under Isbell 3,210,767 and/or Mayes et al Re.25,740 (hereinafter, "said patents") and the patent applications that matured into said patents.

2. Copies of all correspondence, documents, and other writings between University of Illinois and/or University of Illinois foundation and JFD and others relating to all license agreements under said patents, all negotiations for such licenses and the administration of such licenses, including but not limited to, the policing of said patents by way of suits against alleged infringers of the patent in suit including Blonder-Tongue.

3. Copies of all correspondence, memoranda, documents and other writings relating to the authorization of JFD to use the name of any and all of University of Illinois, University of Illinois Foundation, the inventor of said patents or other employees of University of Illinois and University

of Illinois Foundation in connection with log-periodic antennas, advertisements relating thereto and said patents.

4. Copies of all correspondence, documents and other writings relating to the hiring by JFD of the former Blonder-Tongue antenna department manager.

5. Any employment contract with such former manager.

6. Copies of the drawings of all JFD log-periodic antennas embodying the invention of said patents together with the dates that such antennas were first manufactured including but not limited to JFD antenna models set forth in paragraph 14 of the counterclaim herein. (LPV-V[illegible]18, 15, 12, 9 and 6, LPV-TV 19, 16, 13 and 10)

In addition we wish:

7. Any employment agreement between Paul Mayes and JFD.

8. Any other agreement between Paul Mayes and JFD relating to the antennas manufactured by JFD.

Blonder-Tongue has no objection to the addition to the lawsuit of Mayes et al Re.25,740 provided the University of Illinois Foundation and JFD agree that any Blonder-Tongue patent which issues subsequently hereto may also be added.

Very truly yours,

Richard S. Phillips

RSP:iag

cc: Mr. William A. Marshall
Mr. Robert H. Rines

3 (4)

At Work in the New Frontiers of Electronics

JFD LECTRONICS CORPORATION

15th Avenue at 62nd Street, Brooklyn N. Y. 11219 • Phone 212 DE 1-1000 • TWX-NY25040

July 15, 1964

RECEIVED
JUL 17 1964
MERRIAM, SMITH & MARSHALL

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

Attention: Mr. Sam Smith

Re: Foundation Patents and
JFD Log Periodic Antennas

Dear Sam:

With reference to our conversation of this morning, I am indicating below the status of our present line of Log Periodic antennas and referencing them, for your information, to the patents both issued and pending.

JFD No.	Frequency Range	Patent Reference
LPV-4	54-88 mc	Mayes & Carrell
LPV-6	88-108 mc	Reissue Application
LPV-8	174-216 mc	
LPV-11	Channels 2-6	
LPV-14	Channels 7-13	
LPV-17	FM	
LPV-U5	470-890 mc	Mayes & Carrell
LPV-U9	Channels 14-83	Patent #3,108,280
LPV-U15		
LPV-U21		
LPV-ZU10	470-890 mc	Mayes - Zig Zag
LPV-ZU20	Channels 14-83	Patent Pending

400045

JFD Canada, Ltd., 51 McCormeck Street, Toronto, Ontario, Canada

JFD Electronics-Southern, Inc., Oxford, North Carolina 27565
JFD International, 64-14 Woodside Ave., Woodside, New York 11377

JFD ELECTRONICS CORPORATION
15th Avenue at 62nd Street, Brooklyn N. Y. 11219 • Phone 212 DE 1-1000 • TWX-NY25040

Mrs. Sam Smith (Cont.)

JFD No.	Frequency Range	Patent Reference
LPV-VU9	54-88 mc	Possibly Carrell & Mayes
LPV-VU12	88-108 mc	Patent Pending
LPV-VU15	174-216 mc	Additional patent to be
LPV-VU18	470-890 mc	applied for by JFD
	Channels 2-6	
	Channels 7-13	
	Channels 14-83	
	FM	
LPL-FM4	88-108 mc	Possibly Isbel
LPL-FM6	FM	Patent Pending
LPL-FM8		Additional patents to be
LPL-FM10		applied for by JFD

I am also enclosing for your records, a temporary sketch of the LPV-VU series and assembly drawings of the LPL-FM series.

Also enclosed is the literature on the LPV-U series and the LPV-ZU series of UHF antennas. The LPV-U series is presently covered by Mayes and Carrell and the LPV-ZU falls under the pending Mayes Log Periodic Zig Zag.

You will note in the LPV-VU series covering both VHF and UHF, that the antenna falls under the zoned intermittent type spelled out by Carrell and Mayes. However, although the dipoles in this group are of the "V" formation, the lab is also working on straight dipole antennas and combinations of the "V" and the straight dipoles, which I believe are covered in the claims of the Carrell and Mayes. If I am wrong in this assumption, please let me know.

With reference to your request to see all the latest literature, and ads, my advertising department is closed this week for vacation. However, they will be in Monday and I will get this information out to you next week.

A00048

JFD Canada, Ltd., 51 McCormack Street, Toronto, Ontario, Canada
JFD Electronics-Southern, Inc., Oxford, North Carolina 27565
JFD International, 64-14 Woodside Ave., Woodside, New York 11377

At Work in the New Frontiers of Electronics

JFD LECTRONICS CORPORATION

15th Avenue at 62nd Street, Brooklyn N. Y. 11219 • Phone 212 DE 1-1000 • TWX-NY25040

Mr. Sam Smith (Cont.))

In the future, as a matter of procedure, we will notify you in the above manner, of any new antennas designed at our laboratory.

Sincerely,

Ed Finkel

Ed Finkel

EF/ss
cc-S. Faber

A000047

JFD Canada, Ltd., 51 McCormack Street, Toronto, Ontario, Canada

JFD Electronics-Southern, Inc., Oxford, North Carolina 27565
JFD International, 64-14 Woodside Ave., Woodside, New York 11377

RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

November 22, 1966

COPY

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

Dear Dick:

Thank you for your letter of November 21 informing us that the Foundation hopes to get the material within the next week or so.

We had intended to meet last week at Blonder-Tongue to complete the collection of their material, but this was thwarted by Court depositions in another action.

We hope to be able to get at this next week.

Cordially,

RINES AND RINES

RHR/BD

By_____

cc: Isaac S. Blonder ✓

LAW OFFICES

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
A. R. OSTRAUSKAS

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE
CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

November 23, 1966

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

RE: UIF v. BT v. JFD

Dear Mike:

I have your letter of November 21 regarding the material to be produced. I have checked this against the list I sent you with my letter of October 31 and find only one item on your list which was not on mine. This is the listing of the prior art resulting from a search. I had not included it in my list as there was some question at the time regarding the propriety of the request. We have had subsequent correspondence on this.

I believe that item 8 of my list was clarified in the New York depositions of Mr. Finkel. Item 11 was covered orally during the Chicago deposition.

Very truly yours,

Richard S. Phillips

RSP:iag

cc: Mr. Robert H. Rines
Mr. I. S. Blonder
Mr. Basil P. Mann

LAW OFFICES
Silverman & Cass
PATENTS · TRADEMARKS · COPYRIGHTS
105 W. ADAMS STREET · CHICAGO, ILLINOIS, U.S.A. 60603
TELEPHONE 726-6006
AREA CODE 312
CABLE:
I. IRVING SILVERMAN
MYRON C. CASS
SIDNEY N. FOX
JAMES L. KNIGHT
GERALD R. HIBNICK, IND. BAR

November 21, 1966

NOV 23 1966
HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD
Our Ref. 6418

Richard S. Phillips, Esq.
Hofgren, Wegner, Allen, Stellman & McCord
20 N. Wacker Drive - S. 2200
Chicago, Illinois

Re: U. of I. Foundation v. Blonder-Tongue v. JFD -
Civil Action No. 66 C 567.

Dear Dick:

To expedite discovery in compliance with the local rules, there is itemized below a list of items which were culled from Mr. Blonder's deposition as desired to be produced by you. The listing below also identifies the page of the transcript of Mr. Blonder's deposition on which reference is made to the item.

RSP List

Page No.		Item
9	154	Purchase Order for an antenna of the "new LPV series" referred to in J-2.
10	201	Information in respect of the prosecution of corresponding patent applications in any foreign countries (i.e., corresponding to patent in suit).
12	234	Reports on tests conducted on purchased LPV TV series antenna.
13	236	Results of tests and measurements conducted on "new antenna series of October 3, 1966". BT 33 (J-2) LPV-VU.
14	273	Schenfeld's residence address.

	Page No.	Item
	278	Search results "in Washington", listing of prior art located in this search.
16	293	Specific information and documents or tie-in sales and things of this sort.
15	293-4	Blueprints, specifications, notebooks, memoranda and technical reports, i.e., COLOR RANGER series with bracket portions omitted of blueprints.
16	299	Copies of all letters of indemnification that BT provided.
17	301	All documents relating to the adoption of the RANGER name on all of the antenna products of BT.
18	304	Date of publication of the instruction sheets for COLOR RANGER series antennas.
19	304	Invoices pertaining to the first commercial sale of the GOLDEN ARROW, GOLDEN DART and COLOR RANGER antennas.
20	304	Invoices and documents with respect to the mold produced for making the insulation parts of the GOLDEN DART and GOLDEN ARROW antennas.
21	313-314	Identification of antenna manufacturers other than JFD which make antennas believed to infringe the Blonder patent in suit, exhibit J-1, and identification of the specific antennas believed to infringe.
21	315	Identification of the model of the Finney UHF section that did not infringe the Blonder patent because it is a double boom made to have a substantially co-planar arrangement by putting "S" shaped devices in the dipoles.

Page No.	Item
22 316	Any requests for licenses under J-1.
30,31 365	Salesmen, distributors, service people and everyone else involved in allegations of anti-trust - events, names, and specific evidence particularly relating to "drop your line or else be sued by JFD" communicated to BT by parts distributors.
23 376	Address of Jerry Cohn.
23 377	Last known address of John Lineman.
30 382-3	Data concerning customers who were threatened with suit if JFD's entire line was not handled exclusively.
24,25 404-5	"Identify, in any JFD advertising or any releases or advertising of the Foundation wherein the Foundation or JFD have publicized the features of the manner in which the transmission line is connected to the feed end of the antenna, that is, the end adjacent the rigid insulating means you referred to, and also the strain relief that we are referring to."
25 405	"Also in connection with the manner in which the antenna is mounted to the mast."
26,27 405-6	Identification of specific advertisements of JFD which show false marking. Also, cartons of JFD which have patent numbers that do not apply to actual antennas shipped in them.
27 406-7	Does false marking charges apply to LPV VU or LPV TV series?
28 408	Reports on field tests of BT GOLDEN DART and GOLDEN ARROW antennas.
29 411	Listing of patent infringement suits brought by BT.
30 425-6	Information as to loss of sales and customers lost (names, addresses, dates and descriptive details with respect to each instance which will be relied upon)

Page No.	Item
425-6	as specifically referred to in connection with paragraph 7(i) of the Counterclaim and the anti-trust count. Also, a complete description of damages sustained in each instance and explanation of how goodwill was damaged or lost in connection with each instance and identification of the potential customers referred to.

I appreciate that you have supplied me with a list of items that you were going to produce pursuant to Mr. Blonder's deposition and that there will be items common to both lists. May I go on record as stating that one production of the requested item common to both lists will be acceptable to me?

I look forward to your early compliance with the foregoing request.

Sincerely yours,

SILVERMAN & CASS

Myron C. Cass

MCC/gm

cc: Robert H. Rines, Esq.
Basil P. Mann, Esq.

P.S. The list which you supplied with your letter of October 31, 1966 refers to items Nos. 1 through 8 and 11 which have not been repeated on the above list. I presume that you will supply these items also.

LAW OFFICES

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
A. R. OSTRAUSKAS

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE
CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

November 23, 1966

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

RE: IOF v. BT v. JFD

Dear Bob:

I had hoped to talk with you this afternoon, but as you have not returned my call, I am writing so that you will have up-to-date information on Friday morning.

Pete Mann has advised me that they have collected everything which has been requested, with the exception of a few notebooks that are of questionable relevance and can be examined at Champaign. The other documents and materials are now at their office in Chicago.

Cass tells me they have the things which were requested during the Chicago depositions. He had not been advised of the material which JFD agreed to produce at the New York deposition of Finkel. He does not know what progress has been made on this. Mr. Grant will be available for depositions in Champaign the week of December 5. He would prefer that the depositions be taken Tuesday or Wednesday.

Both Mann and Cass inquired again regarding the materials to be provided by Blonder-Tongue. I hope that you will be able to get most of this together and send it to me next week. Pete Mann is particularly interested in technical information regarding the effect of changes in boom spacing. Presumably this data is in Mr. Shenfeld's notebook.

Call me when you get a chance so that we may discuss the schedule of the depositions.

Very truly yours,

RSP:lag
cc: Mr. I.S.Blonder

Richard S. Phillips

LAW OFFICES

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
A. R. OSTRAUSKAS

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE
CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

November 23, 1966

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

RE: IUF v. BT v. JFD

Dear Bob:

I have had an opportunity to read the transcript * of Mr. Finkel's deposition. I enclose a copy of a list of material to be produced by JFD.

Very truly yours,

Richard S. Phillips

RSP:lag

* Enclosure

cc: Mr. I. S. Blonder
Mr. Basil P. Mann
Mr. Myron C. Cass

MATERIAL TO BE PRODUCED BY JFD
(Requested at Finkel Deposition)

1. Date of purchase of Blonder-Tongue ARROW or DART antenna. (Page 48)

2. Results of comparison tests of Blonder-Tongue antenna. (Page 49)

3. Tests or other evidence of infringement supplied to the Foundation with regard to Blonder-Tongue DART and ARROW antennas and correspondence between Mayes and JFD or any other writings bearing on the relationship between the Blonder-Tongue antennas and the Isbell work. (Page 51)

4. All drawings, notebooks or other writings showing dual boom construction and the earliest dates of dual boom construction at JFD. (Page 54)

5. The names of all people who worked with Mr. Grant on any dual boom construction at JFD Laboratories in the spring of 1963. (Page 56)

6. Any documents bearing on the request to JFD from Sears for a VHF-UHF antenna or relating to the initiation of the development project in response to the Sears request. (Page 59)

LAW OFFICES

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE

CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

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

November 22, 1966

VIA AIR MAIL

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

Dear Ike:

* I enclose a copy of a letter from Cass, the attorney for JFD, with regard to some minor changes in the transcript of your deposition. If you have any objections to these changes, let me know by the second of December so that I can check with Mr. Cass and the reporter.

Sincerely yours,

Richard S. Phillips

RSP:iag

* Enclosure

cc: Mr. Robert H. Rines

LAW OFFICES
Silverman & Cass
PATENTS · TRADEMARKS · COPYRIGHTS
105 W. ADAMS STREET · CHICAGO, ILLINOIS, U.S.A. 60603
TELEPHONE 726-6006
AREA CODE 312
CABLE: SILCAS

I. IRVING SILVERMAN
MYRON C. CASS
SIDNEY N. FOX
JAMES L. KNIGHT
GERALD R. HIBNICK, IND. BAR

November 21, 1966

Our Ref. 6-418

Mrs. Helen K. Thomas
Official Court Reporter
United States District Court
219 South Dearborn Street - R. 2328A
Chicago, Illinois

Re: U. of I. Foundation v. Blonder-Tongue Laboratories v. JFD Electronics, Civil Action No. 66 C 567

Dear Mrs. Thomas:

With respect to the deposition of Isaac S. Blonder taken on October 25, 26 and 28, 1966 by Lucile E. Moore in the above entitled cause, I wish to call attention to the corrections in the transcripts which are to be made prior to filing with the Court. A copy of this letter is being sent to Mr. Richard Phillips, counsel for defendant, for his approval.

Page 156, line 5, change "UHF" to --VHF--.

Page 170, line 23, change "BT-49" to --J-3--.

Page 176, line 12, change "1" to --one--.

Page 184, line 20, change "spacing" to --facing--.

Page 185, lines 8 and 10, change "specifications" to --specification--.

Page 186, lines 3, 8, and 12, change "expediential" to --exponential--.

Page 195, line 18, change "do" to --are-- and
change "extend" to --extant--;
line 21, delete semi-colon (;) and insert a
period (.); change "among" to --Among--.

Page 197, line 10, change "portion" to --position--.

Page 201, line 2, change "Cass" to --Blonder--.

Page 210, line 18, change "laboratories" to --laboratory--
and insert --vehicles-- after "laboratory"
and before the period (.).

Page 213, line 15, delete the word "between".

Page 236, line 18, insert --tests-- after "to".

Page 238, line 21, change "on" to --in--.

Page 246, line 14, after the word "themselves", delete
the comma (,) and insert a period (.);
change "when" to --Then--.

Page 266, line 21, delete question mark (?) and insert
two hyphens (--);
line 23, insert two hyphens (--) before "Of"
and change "Of" to --of--.

Page 268, line 8, after the word "Yes", change the period (.)
to a comma (,);
line 20, insert --In-- before "J-1-a" and insert
a comma (,) after "J-1-a".

Page 271, line 12, change "Then" to --In--.

Page 280, line 1, delete the words "in your possession".

Page 287, line 8, change "he" to --we--.

Page 301, line 22, change "And" to --On--.

Page 308, line 17, change "that" to --an--.

Page 311, line 19, change "antenna" to --Antenna--.

Page 316, line 10, change "of the" to --other--.

Page 332, line 20, change "normance" to --norance--.

Page 359, line 9, after "displacement", insert a comma (,).

Page 367, line 6, delete "57,";
line 7, delete "61,".

Page 414, line 22, change "method" to --means--.

If no objections to these corrections are received from Mr. Phillips within two weeks from the date hereof, I request that these corrections be made with the understanding that Mr. Phillips approves and the transcripts filed with the Court.

Very truly yours,

SILVERMAN & CASS

By Myron C. Cass
Myron C. Cass,
One of the Attorneys for
Counterclaim Defendant,
JFD Electronics Corporation

MCC/gm

cc: Richard S. Phillips, Esq.
Attorney for Defendant and
Counterclaimant

Fee - U. of Ill. v. Plastics Inquire

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

THE UNIVERSITY OF ILLINOIS FOUNDATION, Plaintiff,	)	
v.	)	Civil Action No.
JERROLD ELECTRONICS CORPORATION, & R. COOPER JR., INC. Defendants.	)	66C 636

ANSWER

FIRST DEFENSE

Defendants deny the commission of any act of infringement; and deny that United States Letters Patents No. 3,150,376 and No. 3,210,767 were duly or legally issued. Defendants are without knowledge or information to form a belief as to whether the allegations in paragraphs 6 and 7 of the Complaint are true.

SECOND DEFENSE

The plaintiff's assignors were not the first inventors of the articles covered by the patents specified in the Complaint.

THIRD DEFENSE

The acquisition and assertion of rights by the plaintiff under the patents specified in the Complaint are ultra vires under its charter and as a non-profit corporation organized under the laws of the State of Illinois.

FOURTH DEFENSE

This suit is brought as a result of a conspiracy in violation of the federal antitrust laws between the plaintiff and JFD Electronics Corporation, a competitor of the defendant, Jerrold Electronics Corporation, and its affiliate, Technical Appliance Corporation.

FIFTH DEFENSE

The patents specified in the Complaint are invalid because they do not involve inventions.

SIDLEY, AUSTIN, BURGESS & SMITH

By _____
Attorneys for Defendants

I CERTIFY that a copy of the foregoing Answer was served upon the attorneys for the plaintiff by mail on the _____ day of June, 1966.

_____

UNITED STATES DISTRICT COURT, NORTHERN DISTRICT OF ILLINOIS
Eastern DIVISION

Name of Presiding Judge, Honorable Julius J. Hoffman

Cause No. 66 C 567 Date April 26, 1966

Title of Cause THE UNIVERSITY OF ILLINOIS FOUNDATION v. BLONDER-TONGUE LABORATORIES, INC. and ALLIED RADIO CORPORATION

Stipulation

Brief Statement of Motion Stipulation extending time to answer or otherwise plead to and including May 25, 1966

add

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 Merriam, Marshall, Shapiro & Klose
30 West Monroe Street

Representing Plaintiff

Names and Addresses of opposing counsel (if any) and names of parties they represent. Hofgren, Wegner, Allen, Stellman & McCord
20 North WackerDrive
Representing Defendants

RECEIVED
APR 28 1966
HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

On Stipulation

Reserve space below for notations by minute clerk

Time for defendants to answer or otherwise plead to the Complaint herein is extended to and including May 25, 1966.

Judge J. Hoffman

RECEIVED
APR 29 1966
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

Hand this memorandum to the Clerk.
Counsel will not rise to address the Court until motion has been called.

Now we can use —

Bit depth is theirs

Surface Survey Handbook — 1966

Robotics Electronics ~~1965~~ Dec. '65

May 18, 1966

Mr. Dick Helhoski
Blonder Tongue Labs, Inc.
9 Alling Street
Newark, New Jersey 07102

Dear Dick:

Per our telephone conversation regarding antennas, I have enclosed copies of the information that we received from JPD.

See you at the show!

Yours truly,

SACRAMENTO ELECTRONIC SUPPLY CO.

C. E. Bohmbach, Jr. (Skip)
Manager

Encls.

cc: Rines & Rines
10 Post Office Square
Boston, Mass.

RECEIVED
MAY 23 1966
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

LAW OFFICES

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

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE

CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

May 31, 1966

RECEIVED
JUN - 1 1966
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

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

Re: University of Illinois Foundation v.
Blonder-Tongue Laboratories, Inc.
and Allied Radio Corporation
Civil Action No. 66 C 567

Dear Mr. Rines:

Your letter of May 26 and the brief were received this morning. I think you have a good chance of having your motion granted as I reviewed most of the cases you cited and found them to support your position.

It was my understanding from our phone conversation that you had the brief substantially done and your letter accompanying the motion likewise so indicated. If I had known that you needed more time I might have obtained a couple more days for you to file the brief but Judge Hoffman is a stickler for prompt filings and I therefore felt it was not wise to ask for more time. In my opinion the brief is very well done and I do not see any reason for you to apologize for it.

We served and filed the brief today. We will keep you advised of developments.

Yours very truly,

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

John Rex Allen

JRA:DB

May 2, 1966

VIA AIR MAIL

John Rex Allen, Esq.
Hofgren, Wegner, Allen, Stellman & McCord
20 North Wacker Drive
Chicago Illinois 60606

Re: C.A. 66 C 567 -Univ. of Illinois Foundation
v. Blonder-Tongue Labs, et al

Dear Mr. Allen:

We acknowledge receipt and thank you for your letter of April 28th with copy of the court order enclosed, and your letter of April 29th.

We are ordering copies of the two additional patents to which you refer so that my son may have the complete piuture before him upon his return.

Very truly yours,

RINES AND RINES

DR:H

By_____

LAW OFFICES

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

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE
CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

April 29, 1966

RECEIVED
MAY - 2 1966
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

Mr. David Rines
Rines and Rines
No. Ten Post Office Square
Boston, Mass. 02109

Re: The University of Illinois Foundation
v. Blonder-Tongue Labs., Inc. and
Allied Radio Corporation
Civil Action No. 66 C 567

Dear Mr. Rines:

I am sorry that my letter of April 26 was not clear. What I intended to say was that our client had been sued in another case by the University of Illinois Foundation on two patents other than Patent No. 3,210,767. The patents were Nos. 3,150,376 and Re. 25,740. The manufacturer in that case, The Finney Manufacturing Company of Bedford, Ohio, entered its appearance and took over the defense of the suit whereupon our client Allied Radio Corporation was dismissed as a party defendant. We did no work whatsoever on that case other than to arrange for the manufacturer to come in and defend and then arrange for our client to be dismissed.

What I intended to say by the last paragraph of my above letter was that Patent No. 3,210,767 may be added to the former suit by supplemental complaint and, if it is, your case may be transferred from Judge Hoffman, to whom it is now assigned, to Judge Marovitz, to whom the earlier case is assigned.

I hope that this clears up any difficulty you might have in the matter.

Yours very truly,

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

John Rex Allen

JRA:DB

LAW OFFICES

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE

CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

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

April 28, 1966

Mr. David Rines
Rines & Rines
10 Post Office Square
Boston, Mass.

Re: The University of Illinois Foundation
v. Blonder-Tongue Laboratories, Inc. and
Allied Radio Corporation
Civil Action No. 66 C 567

Dear Mr. Rines:

Attached please find copy of order entered in the above case extending time to answer etc.

Yours very truly,

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

John Rex Allen

JRA:DB
Enc.

RECEIVED
APR 29 1966
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

Press

PLEASE RETURN THIS

Speed Reply

TO

HARRY A. GILBERT
BLONDER-TONGUE LABORATORIES, INC.
9 ALLING STREET, NEWARK, NEW JERSEY 07102

May 25, 1966
DATE

To

Mr. Robert H. Rines
Rines & Rines
No. Ten Post Office Sq.
Boston, Mass.

SUBJECT

JFD AD....

Message

Hi Bob:

We thought the enclosed copy of Jfd ad which appeared in the May 23rd issue of Radio & Television Weekly would be of interest to you. We had a call in to your office today so that I could read those parts which Harry Gilbert wanted you to be aware of.

Take care.

Mildred Miller
SIGNED

ORIGINATOR — DO NOT WRITE BELOW THIS LINE

Reply

TO _____ DATE _____

RECEIVED
MAY 26 1966
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

_____
SIGNED

ORIGINATOR FOLD MARKS

ADDRESSEE FOLD MARKS

103 SR

ADDRESSEE — *RETURN WHITE COPY*

Sears

Everything for
Spring through Summer
1966



This dress is from
our all-new
Junior Department
PAGES 18-51

Index
begins on page 635

SEARS, ROEBUCK
AND CO.
PHILADELPHIA, PA. 19132

★

Satisfaction guaranteed
or your money back
YOU CAN COUNT ON US

LAW OFFICES

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE

CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

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

September 9, 1966

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

Re: University of Illinois Foundation
v. Blonder-Tongue Laboratories, Inc.

Dear Mr. Rines:

This will confirm today's phone conversation in which I advised you that counsel for the Foundation are unwilling to enter into the stipulation to extend your time to answer the second set of interrogatories, now due next Wednesday. They agreed, however, that if we file the answers by the 19th, no objection would be made to the late filing.

We agreed that you would send me the answers in time to file them on the 19th rather than have me go in and ask Judge Hoffman for an extension of time which would surely lead to his criticism.

Sincerely,

JRA:DB

RECEIVED
SEP 12 1966
RINES AND RINES
NO. TEN POST OFFICE SQUARE BOSTON

LAW OFFICES

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

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE

CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

September 7, 1966

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

Re: University of Illinois Foundation
v. Blonder-Tongue Laboratories, Inc.

Dear Mr. Rines:

Judge Hoffman is not sitting this week, and we therefore presented the judgment and motion to Judge Will who signed the judgment and granted the motion after counsel for the University of Illinois said they had no objection to it.

After leaving the courtroom I discussed the matter with plaintiff's counsel and asked if he would be willing to enter an appearance on behalf of JFD. He advised me that he has been very careful all along in these matters not to represent JFD who have counsel here in Chicago. He thought that the firm of Silverman and Cass would probably represent them in our case. In any event, I have arranged for service of the counterclaim on JFD. I am hopeful that the service will be made this week.

I might add that the University of Illinois Foundation was given twenty days to reply to the counterclaim. When do you want me to serve notice of taking the deposition of Dr. Johnson?

Sincerely,

JRA:DB

RECEIVED
SEP - 8 1966
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

September 7, 1966

Mr. Isaac S. Blonder
Blonder-Tongue Laboratories, Inc.
9 Alling Street
Newark 2, New Jersey

Re: University of Illinois Foundation, v.
Blonder-Tongue Laboratories, Inc. et al

Dear Ike:

The University of Illinois is asking further questions of us by way of a second set of interrogatories and we propose to answer these, and then hit them with our own notice for taking oral deposition of the staff of the University of Illinois Foundation and JFD Electronics.

Would you please prepare notes of the answers to these questions so that when I come to your plant some time next week (we shall call for a definite mutual agreeable time) we can complete this matter.

Cordially,

RINES AND RINES

By_____

RHR:H
Enclosures

cc: Mr. H. Gilbert

September 7, 1966

VIA AIR MAIL

John Rex Allen, Esq.
Hofgren, Wegner, Allen, Stellman & McCord
20 North Wacker Drive
CHICAGO, ILLINOIS 60606

Re: University of Illinois Foundation
v. Blonder-Tongue Laboratories, et al

Dear Mr. Allen:

Thank you for revising and retyping the draft of the answer and counterclaim and the motion to join FJD Electronics.

We have received the second set of interrogatories and have forwarded a copy to our client for commencing the preparation of the answers.

We note this cannot be completed before September 10th and would therefore request that you arrange for an extension of time, say, to the end of the month for the filing of the answers.

In the meantime, we shall prepare material relating to our own notice to take depositions and shall communicate with you further in this regard.

Again, thank you for your very able attention to these matters.

Cordially,

RINES AND RINES

RHR:H

By_____

cc: Harry Gilbert
cc: Isaac S. Blonder

LAW OFFICES

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

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE

CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

September 1, 1966 EWR

RECEIVED
SEP 6 1966
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

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

Re: University of Illinois Foundation
v. Blonder-Tongue Laboratories, Inc.

Dear Mr. Rines:

Attached please find copy of the following documents in the above case:

1. Order on Stipulation dismissing Allied Radio Corporation.

2. Answer and Counterclaim.

3. Notice of Motion to Join JFD Electronics Corporation as a Party Counterclaim Defendant.

4. Motion to Join JFD Electronics Corporation as a Party Counterclaim Defendant.

We have made some changes in the counterclaim draft that you sent us.

Probably the major change is in eliminating Allied Radio as a counterclaimant. We have just had a case for unfair competition before Judge Hoffman where there were multiple parties involved and because one of the parties plaintiff and one of the parties defendant were citizens of Illinois the complaint was dismissed. To make sure that this problem would not arise we arranged with counsel for plaintiff to dismiss the complaint so far as Allied Radio is concerned.

Our time to object to plaintiff's second set of interrogatories expires on September 7th. I am assuming that you do not intend to file objections to these interrogatories.

At one time we thought of adding to the counterclaim the usual boilerplate defenses to patent infringement. It was decided that we did not know enough about the case to warrant this. Such defenses if they appear proper can always be added by an amended answer.

The answer and counterclaim were filed with the Clerk of the Court today. As Judge Hoffman is not sitting now the motion and stipulation cannot be presented until next Wednesday.

I tried but without success to sound out plaintiff's counsel as to whether or not they would oppose the motion. It seems that they had not been advised that JFD had offices here or, if they were so advised, they pretended they were not. In any event, apparently somebody else has to make the decision so I won't know until Wednesday.

Sincerely,

JRA:DB
Enc.

LAW OFFICES

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE

CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

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

September 26, 1966

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

Re: University of Illinois Foundation v.
Blonder-Tongue Laboratories, Inc.

Dear Mr. Rines:

Attached please find copy of Plaintiff's Reply to Counterclaim of Defendant Blonder-Tongue Laboratories, Inc. in the above action.

I just received a call from Irv Silverman of Silverman & Cass stating that he had just learned from plaintiff's counsel that his client JFD had been served and asking if I would agree to a thirty day extension for his answer. I told him I would enter into a stipulation but I would not guarantee what Judge Hoffman would do. In view of the fact that his client neglected to tell him about service, I assume that Judge Hoffman will probably go along with the stipulation.

Yours very truly,

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

John Rex Allen

JRA:DB
Enc.

P.S. Since the above was written, I have received a copy of the appearance of Silverman's firm and of the stipulation which they will file tomorrow. A copy of each is attached.

RECEIVED
SEP 28 1966
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

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

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

A P P E A R A N C E

We hereby enter the appearance of JFD ELECTRONICS CORPORATION as counterclaim defendant in the above entitled case and that of SILVERMAN & CASS, I. IRVING SILVERMAN, MYRON C. CASS, and SIDNEY N. FOX, as attorneys for said counterclaim defendant.

SILVERMAN & CASS

I. Irving Silverman

Myron C. Cass

Sidney N. Fox

Attorneys for Counterclaim Defendant
105 West Adams Street
Chicago, Illinois 60603
726-6006

September 27, 1966

RECEIVED
SEP 28 1966
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

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

THE UNIVERSITY OF ILLINOIS FOUNDATION, Plaintiff and Counterclaim Defendant, v. BLONDER-TONGUE LABORATORIES, INC., Defendant and Counterclaimant, v. JFD ELECTRONICS CORPORATION, Counterclaim Defendant.	)	CIVIL ACTION No. 66 C 567

S T I P U L A T I O N

IT IS HEREBY STIPULATED AND AGREED by and between the parties to the above entitled suit, through their respective counsel, that the Honorable Court consent the counterclaim defendant, JFD ELECTRONICS CORPORATION, to have until November 1, 1966 within which to answer or otherwise plead to the Counterclaim filed in the above case by defendant and counterclaimant, BLONDER-TONGUE LABORATORIES, INC.

Counterclaim defendant represents to the Court in support of its request for this extension of time as follows:

1. The counterclaim defendant is a corporation of New York and primarily operates in New York and its principal patent counsel are Ostrolenk, Faber, Gerb & Soffen of 10 East 40th Street, New York, New York.

2. The undersigned firm, Silverman & Cass, were asked to represent the counterclaim defendant by the above-mentioned New York law firm but first learned of service of the counterclaim on September 21, 1966.

3. Arrangements are being made to meet with principal counsel for the counterclaim defendant to discuss the nature of the counterclaim.

4. For the Court's information, the said counterclaim alleges unfair competition, conspiracy, false representation, violations of the anti-trust law, patent infringement, declaratory judgment for invalidity of patent and is a highly complex document, difficult to answer or plead to without careful and complete consideration of its allegations and certainly, improper to answer by mere denial without due consultation with the client and client's principal counsel.

RECEIVED
SEP 6 1966
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

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

THE UNIVERSITY OF ILLINOIS FOUNDATION, Plaintiff and Counterclaim Defendant, v. BLONDER-TONGUE LABORATORIES, INC., Defendant and Counterclaimant, v. JFD ELECTRONICS CORPORATION, Counterclaim Defendant.	CIVIL ACTION NO. 66 C 567

NOTICE OF MOTION

TO: Merriam, Marshall, Shapiro & Klose
30 West Monroe Street
Chicago, Illinois 60603

PLEASE TAKE NOTICE that on Wednesday, September 7, 1966, at 10 A.M. Central Daylight Saving Time, or as soon thereafter as counsel may be heard, we shall appear before the Honorable Julius J. Hoffman, in the room occupied by him as a courtroom in the Federal Building, Chicago, Illinois, and then and there present the attached Motion to Join JFD Electronics Corporation as a Party Counterclaim Defendant.

RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

9/1/66

AIR MAIL
SPECIAL DELIVERY

30 August 1966

John Rex Allen, Esq.
Hofgren, Wegner, Allen, Stellman and McCord
20 North Wacker Drive
Chicago, Illinois 60606

Re: University of Illinois Foundation
v. Blonder-Tongue Laboratories Inc., et al
No. 660567

Dear Mr. Allen:

It was a pleasure meeting with you last week to discuss the above litigation. Thank you for a wonderful luncheon.

Enclosed are the promised drafts of the answer and counterclaim and a motion to add JFD, which we drafted in the Maine woods and which are being transcribed and sent to you for finalizing without our having checked them.

Upon our return, we shall suggest the noticing of depositions of at least the Foundation president, Hjalmar W. Johnson, who issued the newsreleases, and Edward Pinkel, the JFD vice-president, who filed an affidavit re the license with the Foundation in opposition to our motion to dismiss.

Cordially,

RINES AND RINES

By_____

RHR:he
Enclosures: Draft of Answer and
Counterclaim, Motion to Add JFD

cc: Messrs. Gilbert and Blonder
Blonder-Tongue Laboratories

COPY

RECEIVED
SEP 6 1966
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

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

THE UNIVERSITY OF ILLINOIS FOUNDATION, Plaintiff,	
v.	CIVIL ACTION No.
BLONDER-TONGUE LABORATORIES, INC. and ALLIED RADIO CORPORATION, Defendants.	66 C 567

ORDER ON STIPULATION

It is hereby stipulated and agreed by and between the parties hereto, through their respective counsel, that Allied Radio Corporation may be dismissed as one of the defendants herein.

MERRIAM, MARSHALL, SHAPIRO & KLOSE

Sept. _____, 1966

By_____
Attorneys for Plaintiff

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

Sept. 1, 1966

By_____
Attorneys for Defendants

SO ORDERED:

_____
U.S. District Judge

LAW OFFICES

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

20 NORTH WACKER DRIVE

CHICAGO 60606

TELEPHONE
FINANCIAL 6-1630
AREA CODE 312

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

September 23, 1966

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

Re: University of Illinois Foundation
v. Blonder-Tongue Laboratories, Inc.
Civil Action No. 66 C 567

Dear Mr. Rines:

Attached please find copy of Plaintiff's Third Set of Interrogatories to Defendant Blonder-Tongue which I assume you can answer.

Yours very truly,

HOFGREN, WEGNER, ALLEN, STELLMAN & McCORD

John Rex Allen

JRA:DB
Enc.

RECEIVED
SEP 26 1966
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

vehicles carrying 33 cameras and 13 color tape units. (NBC-TV's black-and-white mobile unit fleet is comprised of 10 vehicles carrying 30 cameras and several tape units.)

Each of the three vehicles in the new unit is a 40-foot tractor-trailer. The equipment or camera trailer carries all movable equipment such as cameras, cables, and tri-

trailer houses the tech- equipment required for the pickup and transmission of color, including the color video control center as well as the color tape facilities.

Included in the operating facilities with the three trailers are five color cameras, a black-and-white insert camera, pulse generation and distribution equipment, color tape recorders capable of "instant replay" for football and baseball coverage, a stop-motion recorder, a video switching system accommodating 20 different inputs from cameras and remote lines, and chroma key facilities.

Trust Charge Hits JFD, Foundation

CHICAGO. —Blonder-Tongue Laboratories, Inc., Newark, N. J., has filed an antitrust counterclaim in Federal Court here against the University of Illinois Foundation and JFD Electronics Corp., Brooklyn, N. Y.

The foundation charged last March that Blonder-Tongue infringed its Patent No. 3,210,767, for log periodic antennas.

In the counterclaim, Blonder-Tongue charges the foundation, in cooperation with JFD, violated antitrust laws by entering into a commerical agreement in which JFD would make, sell and distribute antennas covered by the patent. The foundation, in turn, undertook the responsibility of policing the patent and aiding commerial sales by news releases and other advertising, using the name of the foundation, it is stated. The money to be derived from the sales was to be divided between the foundation and JFD, according to the counterclaim.

Blonder-Tongue asks for preliminary and permanent injunctions against unfair competition, a judgment that its antennas do not infringe and treble damages.

Micro Seiki Shows Pickup Cartridge

TOKYO. — Micro Seiki Co. Ltd. has developed a phonograph pickup cartridge for full reproduction of high-pitched "transient sounds" and low-tone sounds of wide amplitude, *it was learned.*

A spokesman explained that their new pickup cartridge combines the various merits of three conventional pickup formulas—moving coil, moving magnet and induced magnet.

Weight is approximately eight grams. Domestic price is quoted at approximately $32.80.

The new cartridge is available for export.

Philco Price Suit

NEW YORK. — Philco Distributors, Inc. filed suit in Supreme Court to enjoin Bloom & Krup, 206 First Avenue, from selling Philco products at less than fair trade prices.

Orans, Elsen & Polstein is counsel for Philco.

Home Entertainment Sales Mgr.

for Kansas, Nebraska, Idaho, Wyoming, Utah, Nevada, Arizona, New Mexico, West Texas, Colorado. We need a Regional Sales Manager who knows how to train a dealer organization on product advantages and profits. Experienced in volume sales to distributors, chains, key retailers. Progressive manufacturer offers substantial opportunity; our own men know of this ad. Write fully.

Sales Dept.

Olympic Radio & Television

34-01 38th Avenue, Long Island City 1, N. Y.

ion
Decatur Temple

Move

Robert L. Ta
dent of manufa
Jamestown Cor
N. Y., will mov
from Salamanca
has lived for m

He will coord
tions of the
manca and Ja
from Jamestown

Mr. Taylor w
terms as Demo
Salamanca, has r
as chairman of
City Committee
move.

Outing

The Furniture
ern California has
annual golf-tenni
29 at Peacock
Country Club, ne
cisco.

Best Wishes

To Nancy Oakle
come engaged
Weeks. Miss Oakl
Home Beautiful
Gainesville, Fla., an
to be an interior

Decorators Adv

The Georgia
American Institute
Designers has bee
Massey Junior Colle
to design a suitab
for a projected r
design.

The school ha
fund for a full-
head. A minim
30 students wil
school's beginnin

Date Change

The home fu
try in the Los A
rescheduled da
Days to Sept. 1
Sam Good, cha
mittee planning

For this period,
the industry will
ture, floor coverin
cessories, appliance
other home good
Foundation which
the rehabilitation
dicts.

The items col
used to furnish Sy
Monica offices and
ters.

HOME ENTERT

INCORPORATING— HOME ENTERTAINMENT RETAILING®

TELEVISI

HOME FURNISHINGS DAILY, FRIDAY, SEPTEMBER 16, 1966

Says 2-Gun Tube Interests Motorola

DALLAS. — Motorola has shown some interest in the two-gun tube under study by Texas Instruments and Polaroid, according to Robert W. Galvin, chairman of Motorola.

Mr. Galvin said that Motorola had been in conversation with the firms but was "not privy to all developments." He feels Polaroid is not yet convinced that the tube will be marketable but finds the concept interesting and worthy of further study, he said.

At the same time, Motorola's color TV prices are not expected to climb any higher during the next year. Mr. Galvin said in an interview here that he felt that Motorola's prices would remain at present levels for the next several months to a year.



Drops Allied Radio From Patent Suit

CHICAGO. — Allied Radio Corp., here, was dismissed on agreement as a defendant to a suit by the University of Illinois Foundation charging infringement of a patent for frequency-independent, unidirectional antennas.

Blonder-Tongue Laboratories, Inc., Newark, N. J., is the remaining defendant to the Federal Court suit involving Patent No. 3,210,767. As previously reported, it has filed an antitrust counterclaim against the foundation and JFD Electronics Corp., Brooklyn, N. Y.

Hofgren, Wegner, Allen, Stellman & McCord represents Blonder-Tongue and represented Allied. Merriam, Marshall, Shapiro & Klose represents the foundation.

Motorola For Mon

BIRMINGHAM, Ala.—Th of Motorola Consumer Pr Inc., is "bullish" about the of monochrome television s

S. R. "Ted" Herkes, pre the Motorola sales s speaking before a dealer of Boma Distributors, Motorola consumer pro tributor, stated that the cline in black and white could be the result of tw

The inability of the production establishmen port demand for certain

A resultant lack of motional effort on all screen-size categories

As for Motorola's ence with monochr Mr. Herkes stated black and white AV ning well ahead of la

THERE'S

From

PLEASE RETURN THIS

Speed Reply

TO

HARRY A. GILBERT
BLONDER-TONGUE LABORATORIES, INC.
9 ALLING STREET, NEWARK, NEW JERSEY 07102

Oct. 4, 1966
DATE

To

Mr. Robert H. Rines
Rines & Rines
Ten Post Office Square
Boston, Mass.

SUBJECT

JFD ADS

Message

Dear Bob:

Here are fax copies of JFD antenna ads.

The other things that you asked for on the U/V will follow.

Millie

SIGNED

ORIGINATOR — DO NOT WRITE BELOW THIS LINE

Reply

TO _____ DATE _____

RECEIVED
OCT 5 1966
RINES AND RINES
NO. TEN POST OFFICE SQUARE, BOSTON

SIGNED

103 SR

ADDRESSEE — RETURN WHITE COPY

ORIGINATOR FOLD MARKS

ADDRESSEE FOLD MARKS

Sheraton-O'Hare Motor Hotel | Executive Office

"IFD Electronics Corp
6330 W Hermione 775-5424
distribution div 6139 W Touhy 775-6625 "

p. 718

Illinois Bell Telephone Directory 1965-66

p. 724

" " " Chicago-Suburban 1966

6810 N. Mannheim Road, Des Plaines, Illinois | Telephone: 312-827-5171 TWX: 312-827-2364

DRAFT
RHR:jg
23 May 1966

Sacramento Electronics Supply Co.
1219 S. St. Sacramento 6

UNITED STATES DISTRICT COURT
FOR THE
EASTERN DISTRICT OF NEW YORK

Civil Action
No.

BLONDER-TONGUE LABORATORIES, INC.

v.

JFD ELECTRONICS CORPORATION,
THE UNIVERSITY OF ILLINOIS FOUNDATION
and
THE UNIVERSITY OF ILLINOIS

COMPLAINT

1. Plaintiff, Blonder-Tongue Laboratories, Inc., is a corporation duly organized and existing under the laws of the State of New Jersey, having a principal place of business at 9 Alling Street, Newark, New Jersey.

2. Defendant, JFD Electronics Corporation, on information and belief, is a corporation duly organized and existing under the laws of the State of New York, having a principal place of business at 1462 62nd Street, Brooklyn, New York, within the Eastern District of New York, wherein, and elsewhere within the United States, the acts of unfair competition, anti-trust law

DRAFT
RHR:jg
23 May 1966

UNITED STATES DISTRICT COURT
FOR THE
EASTERN DISTRICT OF NEW YORK

Civil Action
No.

BLONDER-TONGUE LABORATORIES, INC.

v.

JFD ELECTRONICS CORPORATION,
THE UNIVERSITY OF ILLINOIS FOUNDATION
and
THE UNIVERSITY OF ILLINOIS

COMPLAINT

1. Plaintiff, Blonder-Tongue Laboratories, Inc., is a corporation duly organized and existing under the laws of the State of New Jersey, having a principal place of business at 9 Alling Street, Newark, New Jersey.

2. Defendant, JFD Electronics Corporation, on information and belief, is a corporation duly organized and existing under the laws of the State of New York, having a principal place of business at 1462 62nd Street, Brooklyn, New York, within the Eastern District of New York, wherein, and elsewhere within the United States, the acts of unfair competition, anti-trust law

violations and patent infringement conplained of herein were and are presently being committed, unless and until restrained by this Honorable Court.

3. Defendants, The University of Illinois and the University of Illinois Foundation, on information and belief, representing themselves as a non-profit educational institution and a non-profit [redacted] research foundation, respectively, and exempted from federal taxation upon such representation, and having principal offices at 224 Illini Union, Urbana, Illinois, are doing business jointly with said Defendant, JFD Electronics Corporation at said 1462 62nd Street, Brooklyn, New York, within the Eastern District of New York, where, and elsewhere within the United States, they have committed and are presently continuing to commit the acts of unfair competition, anti-trust law violations and patent infringement complained of herein.

4. This action arises under the patent, anti-trust and unfair competition laws of the United States (

Lanham Act),