JFD EXHIBITS

J-1	Blonder et al 3,259,904
J-1a	Enlarged drawings of J-1
J-2 (BT 33)	Radio and TV News Oct. 3, 1966
J-3 (BT 49)	Sketch of JFD antenna
J-4a(BT 19)	JFD antennas - sales material
J-4b(BT 20)	JFD antennas - sales material
J-5 (BT 3)	BT Color Ranger antenna
J-6	JFD Electronics ad - Popular Electronics - Sept.1965
J-7	BT catalog - Val-U-Rama
J-8	Blonder patent 3,016,510

JFD Exhibits

J-1 | Blonder et al 3,259,904
✓ J-1A - Enlarged drawings of J-1
✓ J-2 | (BT 83) Radio & TV News Oct. 3, 1966 —
J 3 | (BT 49) - Sketch of JFD antenna
✓ J 4A (BT 9) } JFD advertising - sales material
✓ J 4B (BT 20)
✓ J 5 (BT 3) - BT Color Ranger antenna -
J 6 | - JFD Electronics Ltd - "Popular Electronics" - Sept. '65

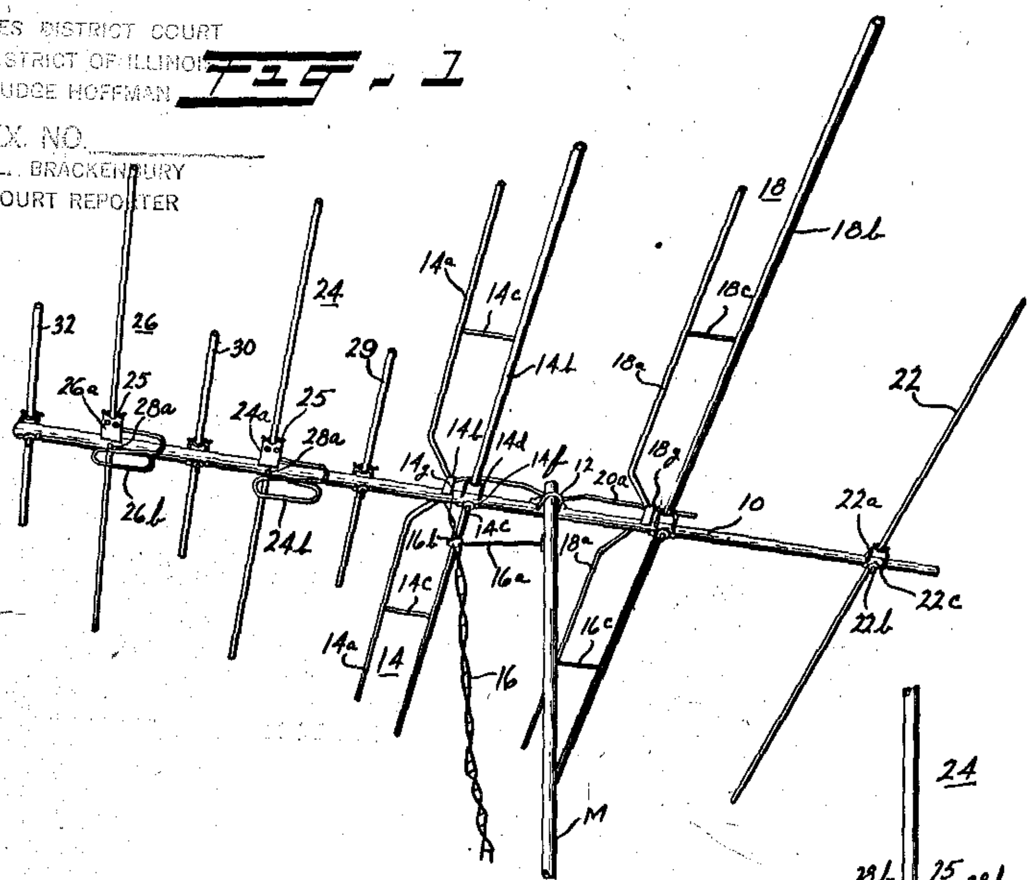
J7 | BT catalogue - Val-U-RAMA
J8 | Blonder patent 3,016,510

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

T. V. ANTENNA ARRAY

Filed July 26, 1954 2 Sheets-Sheet 1

FIG. 1



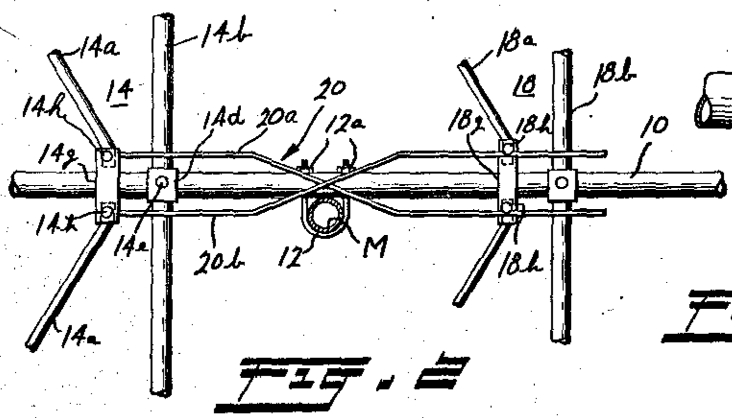


FIG. 2

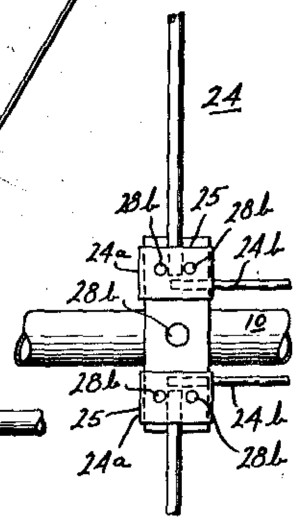


FIG. 3

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FIG. 4

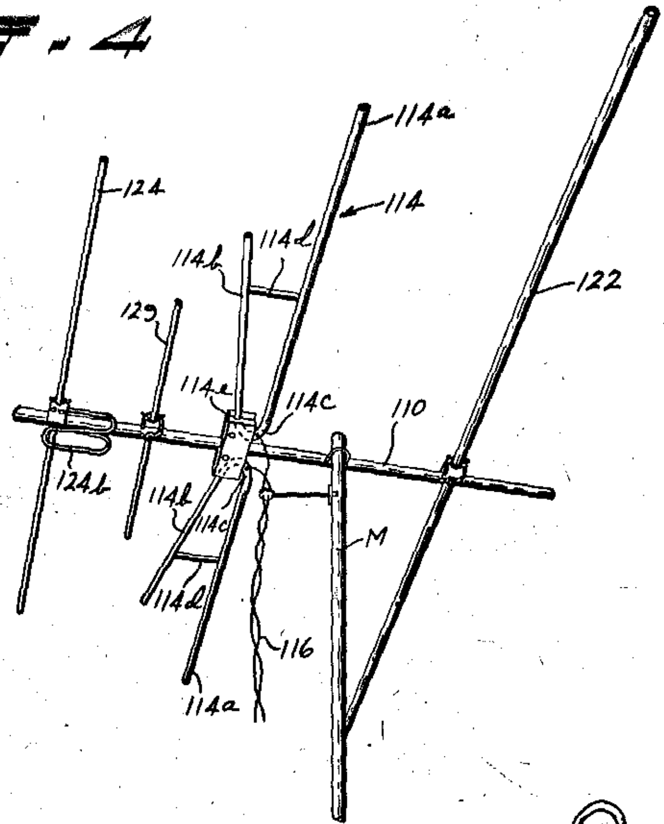
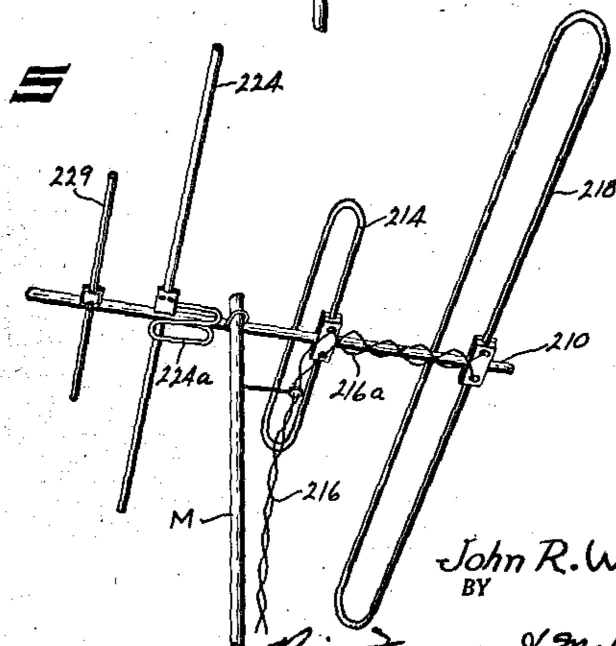


FIG. 5



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United States Patent Office

2,700,105

Patented Jan. 18, 1955

2,700,105

TV ANTENNA ARRAY

John Robert Winegard, Burlington, Iowa, assignor to Winegard Company, Burlington, Iowa, a corporation of Iowa

Application July 26, 1954, Serial No. 445,670

9 Claims. (Cl. 250—33.51)

My invention relates to an improved antenna for television reception.

Antennas for use in television reception must have a wide band characteristic giving good response over both the low frequency (54–88 megacycles) television band and the high frequency (174–216 megacycles) television band. In addition, such antennas—particularly those used in locations remote from television transmitting stations—must have a high response or gain in order that the relatively weak signals from the transmitter may be effectively received.

In accordance with the disclosure of the present application, these objectives are achieved in a structure which utilizes a driven element in conjunction with a coplanar director array located in front of this element. The director array consists of dipoles approximately one-half wave in length at a frequency in the high frequency band and connected together by a folded transmission line. The latter acts as an inductance in the low frequency band to cause the dipole to act as a simple director in the low frequency band of less than one-half wave in length. These dipoles are spaced from the driven dipole elements and from each other and are coplanar with the driven element. In addition to these dipole directors, the antenna includes a series of unitary directors located in parallel, aligned, coplanar relationship with the driven elements and with the dipole directors. These unitary directors are located approximately midway between the dipole directors and at like distances in front of the front director and in back of the rear director. Each of the unitary directors is approximately the same length as one arm of the dipole directors and resonates as a one-half wave unit at a frequency somewhat below the low frequency end of the high frequency band.

It is therefore a general object of the present invention to provide an improved antenna suitable for television reception.

A further object of the present invention is to provide an improved antenna suitable for television reception and characterized by high sensitivity extending over the full television frequency range of 54–88 megacycles and 174–216 megacycles.

Further it is an object of the present invention to provide an antenna of the above type utilizing an inline construction; having low wind resistance; having low cost; having minimum weight; and having a maximum degree of simplicity and reliability.

Additionally, it is an object of the present invention to provide an improved director system for a television antenna and effective over both the 54–88 megacycle band and the 174–216 megacycle band.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following description taken in connection with the accompanying drawing in which:

Figure 1 is a view in perspective of a television antenna constructed in accordance with the present invention.

Figure 2 is an enlarged fragmentary top plan view of the support post and adjacent portions of the antenna structure;

Figure 3 is a view still further enlarged and showing the central portions of a dipole director and the adjacent portions of the support bar;

Figure 4 is a view in perspective of another television antenna having director elements constructed in accordance with the present invention; and,

Figure 5 is a view in perspective of still another antenna utilizing the director elements of the present invention.

Referring now to the drawing, the antenna is supported by a mounting mast M which extends in vertical direction and is supported by suitable means (not shown). At the top of the mast M, a horizontal mounting bar **10** is affixed by any suitable means. In the structure shown, the bar **10** is held in place by the U-boat **12** which is received in the bar **10** and is drawn tight by suitable nuts **12a**, Figure 2, to anchor the mounting bar **10** rigidly in place. As shown in the figures, the various antenna elements are affixed to and supported by the bar **10**.

The front driven element is shown generally at **14**. This element consists of a forward dipole portion defined by arms **14a** and a rear unitary portion defined by the continuous bar **14b**. As shown, the dipole arms **14a** are connected to the unitary bar **14b** by the rearwardly extending arms **14c**, each of which is connected to the dipole arm **14a** at approximately the mid-point of its length and extends rearwardly in direction parallel to the bar **10**. The rear unitary bar **14b** is affixed to the support bar **10** by a saddle bracket **14d** which embraces bar **10** and forms a partially cylindrical seat for bar **14b**. The bar **14b** is held tightly against the bracket **14d** and the latter is held tightly on bar **10** by bolt **14e** and thumb nut **14f**.

The adjacent ends of the dipole **14a** are joined by spacer **14g** which is of insulating material, such as Bakelite and has terminal posts **14h** to receive the ends of the open transmission line **16** which are received in the terminal posts and are drawn to tight seating relation by the terminal posts. This transmission line is held adjacent the binding posts **14h** by the arm **16a** which is affixed at one end to the mast M and at the other end has an insulating sleeve **16b** which receives the transmission line.

A similar driven element **18** is located rearwardly on bar **10** in relation to the unit **14**. The unit **18** is of like construction using dipole arms **18a**, a unitary bar **18b** extending parallel to and in line with the elements and a pair of connecting bars **18c** approximately midway on the dipole elements and extending parallel to the support bar **10** between the dipole elements **18a** and the unitary rear element **18b**. The dipole elements **18a** are likewise connected at their adjacent ends to the insulating spacer **18g** which has binding posts **18h** to receive the open transmission line **20** defined by conductors **20a** and **20b** which is received on the binding posts **14h** at its front end and receives the binding posts **18h** at its rear end.

The forward driven element **14** is of such length as to receive most efficiently in the high frequency television band of 174–216 megacycles. In this frequency range the transmission line **20**, including the stub portions outboard of element **18**, acts as a one-half wave open line to present a very high impedance across the transmission line **16**. The rear driven element **18** is of length to receive most efficiently in the low frequency television band of 54–88 megacycles. In this frequency range the transmission line **20** acts as a non-resonant line.

Rearwardly of the unit **18**, there is provided a reflector **22** which consists of a unitary bar extending parallel to and in coplanar aligned relationship with the units **14** and **18**. This bar is attached to the support bar **10** by the saddle **22a** and by the anchor bolt **22b** and thumb nut **22c** as shown.

Forwardly of the driven element **14** a pair of dipole directors **24** and **26** respectively are provided. These directors are carried from the support bar **10** by the insulating blocks **24a** and **26a**, respectively, each block being seated on the support bar **10** and held snugly thereon by a bolt **28a**. At its top face, each block **24a** and **26a** has a pair of conducting clamp pieces **25**, Figure 3, which are held snugly down on the arm of the dipole **24** by bolts **28b** which protrude beneath the block. Each block **24a** and **26a** also receives the ends of the coupling unit **24b** or **26b** as the case may be, thus establishing an electrical contact between the coupling unit and the director. These coupling units are in the form of folded closed resonant lines as shown.

The arms of dipoles **24** and **26** are made slightly shorter than the arms of dipole **14a**. The resonant lines **24b** and **26b** are resonant, in conjunction with the capacitance of the adjacent parts such as bar **10**, at approximately the frequency at which the dipoles **24** and **26** are half wave in length. Thus, at these frequencies the dipole arms are effectively disconnected. However, at lower frequencies the lines **24b** and **26b** do not function as resonant lines but rather as short-circuiting connections with some inductive effect thus causing the dipoles **24** and **26** to act as unitary directors in these frequence ranges and to appear to have a somewhat lower natural resonant frequency than their physical length would indicate.

A series of three unitary directors **29**, **30**, and **32** are likewise mounted on the support arm **10** in positions straddling the dipole directors **24** and **26**. As shown, these directors are mounted on the support bar **10** in the same fashion as reflector **22**, that is, by the use of a saddle and an appropriate mounting bolt. The directors **29**, **30**, and **32** are approximately the same length as the arms of the respective dipoles **24** and **26**. Moreover, the directors **29**, **30**, and **32** are spaced from dipoles **14a**, **24** and **26**, by approximately the same distances so that directors **29** and **30** are substantially midway between the respective dipoles and director **32** is about the same distance in advance of the dipole **26**.

In an actual television receiving antenna constructed in accordance with the present invention the following dimensions were used:

Length of director **32**	24 inches.
Distance between director **32** and dipole **26**	6¼ inches.
Length of each arm of dipole **26**	25 inches.
Length of resonant line **26b**	18 inches (to give an antiresonant frequency of about 180 megacycles).
Distance between dipole **26** and director **30**	6¾ inches.
Length of director **30**	25 inches.
Distance between director **30** and dipole **24**	5½ inches.
Length of resonant line **24b**	18 inches (to give an antiresonant frequency of about 180 megacycles).
Distance between dipole **24** and director **29**	7 inches.
Length of director **29**	25¾ inches.
Length of dipole arms **14a**	25 inches.
Distance between director **29** and the parallel portions of dipole arms **14a**	4 inches.
Length of arms **14c**	4 inches.
Length of bar **14b**	70 inches.
Length of transmission line **20**	28 inches.
Length of dipole arms **18a**	38 inches.
Length of bars **18c**	4 inches.
Length of bar **18b**	99 inches.
Length of reflector **22**	110 inches.
Distance between reflector **22** and bar **18b**	24 inches.

An antenna constructed in accordance with the above dimensions has been found to give good response over the entire television frequency range with an average gain of about 6 decibels over a simple dipole.

It will be observed that the antenna above described is an antenna wherein all of the antenna elements lie in a common plane. This provides a desirably low wind resistance. It also makes it possible to mount the antenna parts on the common support bar **10**. In addition, the antenna is of rugged construction and is simple in design, features which contribute to its general usefulness.

In the antenna above described it has been found possible to receive all television bands without difficulty. The directional characteristics are approximately those of a dipole with a single reflector so that the antenna displays a substantial degree of directivity without being unduly critical.

The spacings between the various elements of the antenna of Figure 1 may be adjusted to vary the antenna characteristics such as the impedance as seen by the transmission line **16**. Within reasonable limits these spacings are not critical although for normal television use approximately the proportions of Figure 1 are preferred.

The characteristics of the resonant elements **24b** and **26b** are greatly influenced by the capacitance effects of the adjacent parts, particularly the support arm **10** which is of metal such as aluminum. The capacitance resulting from this arm together with the capacitance of the hardware such as the clamps **25**, causes these resonant elements to resonate at a frequency considerably lower than their length would indicate. This is a highly desirable feature of the structure of the present invention since the inductive reactance of these elements in the low frequency band is lower than would otherwise be the case. As a consequence of this lower inductance the units **24** and **26** effectively act as directors in the full 54–88 megacycle band. Were it not for this effect, the director action of these elements would be lost near the high frequency end of this band, and, indeed, these elements might even act as reflectors and defeat their purpose.

The action of the directors **24** and **26**, in conjunction with directors **29**, **30** and **32** can be regarded as that of a high band director system using elements **29**, **30** and **32** interposed on a low band director system using elements **24** and **26**. However, the action of the coupling units **24b** and **26b** is to avoid the shielding effect otherwise associated with directors **24** and **26** and to cause these directors to give some director action in the high frequency band. At the same time, however, the coupling units **24b** and **26b** provide a degree of inductive reactance at the low frequency band and thus give rise to good director action in that band even though the length of directors **24** and **26** would otherwise be too small at the high frequence end of that band.

Figure 4 shows an alternative antenna structure using a director system constructed in accordance with the present invention. In this system the mast M carries a support bar or boom **110** which in turn carries reflector **122**. Forwardly of the reflector there is provided a two band driven element **114** of the type described and claimed in my copending patent application entitled "Dual Band Antenna," Serial No. 446,010, filed July 27, 1954. In brief, this driven element consists of a pair of spaced colinear dipole arms **114a** of length to operate effectively in the low frequency band. A pair of forward angled dipole elements **114b** are mounted at the inboard ends of dipole elements **114a** by means of the connecting and supporting arms **114c** and **114d**. The entire unit is affixed to the boom **110** by an insulating support **114e** as described more particularly in the above-identified application. Transmission line **116** is connected to the inboard ends of the arms **114a** as shown.

The arms **114d** are so positioned on the dipole arms **114b** and **114a** as to define—in conjunction with the outboard portions of these dipole arms—a half wave open circuited resonant transmission line in the high frequency band. This reflects a very high impedance which causes the portions of arms **114a** and **114b** inboard of arms **114d** to operate substantially independently of the outboard portions in the high band, thus giving rise to action similar to that of a simple half wave dipole.

The boom **110** receives director **124** forwardly of the driven element **114**. This director is like director **24**, Figure 1, and includes a coupling line **124b** to give the dual band action described above in connection with director **24**. The director **129**—constructed like director **29**, Figure 1—is interposed between director **124** and the driven element **114**.

In operation, the two arms of director **124** are effectively disconnected in the high frequency band and the director **129** operates as a director, while the driven element **114** operates in generally the same manner as if it consisted only of the portions inboard the arms **114d**. In the low band the director **124** operates as a director with the coupling **124b** contributing more inductive reactance and the arms **114a** and **114b** of the driven element operate in a manner similar to a half wave dipole.

Figure 5 shows still another antenna having a director system constructed in accordance with the present invention. In this antenna the boom **210** carries a pair of spaced low band and high band folded dipoles, 218 and 214, respectively. Transmission line 216 is connected to the dipole 218 and—through a resonant section 216*a* to the low band dipole 218. The section 216*a* acts as an open one-half wave line at the high band to decouple the low band dipole 218 in this band, whereas the effect of the dipole 218 is negligible at the low band.

The director 224, constructed like director 24, Figure 1, is located forwardly of the driven elements 214 and 218 and acts primarily to give director action in the low frequency band. The resonant coupler 224*a* contributes inductance to director 224 at the low frequency band and electrically separates the arms of director 224 in the high frequency band. A second director 229 is located forwardly of the director 224 and is cut to length to act as a director in the high frequency band.

While the present invention is particularly applicable to television antenna applications, it is usable generally where a high frequency antenna must operate in two frequency bands, one about twice the frequency of the other. One such application is that of amateur radio antennas for use in, say, both the 10 meter and 20 meter amateur bands, either for transmitting or receiving.

It will be noted that the directors 24, 26, 29, 30 and 32 are in parallel coplanar relation with respect to the remaining elements of the antenna. In addition, these directors are symmetrical about the boom 10 and—hence are aligned with each other and with the remaining elements.

While I have shown and described a specific embodiment of the present invention it will, of course, be understood that various modifications and alternative constructions may be made without departing from its true spirit and scope. In particular, it is possible to vary individual dimensions from those shown to accent the response of the antenna to particular frequencies or to suppress such response. These adjustments can be made on a cut and try basis to accommodate the antenna to particular conditions or to provide a characteristic deemed superior for general use to that of the antenna as specifically described above. I therefore intend by the appended claims to cover all antennas falling within their true spirit and scope.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A television antenna to receive signals over a wide frequency band comprising in combination: a pair of coplanar parallel spaced driven units each having a forward dipole and a closely spaced rear unitary element, the dipole being connected to the unitary element by transverse conductors positioned approximately midway along each arm of the dipole; a plurality of dipole directors each having total length approximately one-half wave in length at a frequency near the low frequency end of the band located forwardly and in coplanar parallel relation with the driven units, the dipoles being spaced from each other and from the forward driven unit; antiresonant elements tuned to a frequency near the high frequency end of the band connecting the adjacent ends of the arms of the dipole directors; and unitary directors approximately one-half wave in length at the high frequency end of the band, the last mentioned directors being interposed approximately midway between the adjacent dipole directors and between the forward driven element and the adjacent first dipole director.

2. An antenna for use in receiving signals throughout the frequency range of the low frequency and high frequency television bands comprising in combination: a driven element operable to receive signals in said bands from a predetermined direction; a plurality of coplanar parallel aligned director elements located in said direction from the antenna; each of said elements being approximately one-half wave in length at the high frequency end of the high frequency band; a plurality of pairs of dipole director elements in coplanar parallel aligned relation with said first mentioned director elements, the total length of each of said last directors being approximately one-half wave in the low frequency band, the pairs of dipole director elements being interposed substantially midway between the first mentioned director elements; and resonant couplings connecting the adjacent ends of the dipole director elements, the couplings being resonant at frequencies in the high frequency band and having an inductive reactance in the low frequency band whereby in the high frequency band the pairs of director elements act individually as half wave directors without shielding the first mentioned directors and in the low frequency band the pairs of director elements act in unison as low band directors.

3. An antenna for television use comprising in combination: a driven element adapted to receive signals from a predetermined direction and over a wide range of frequencies; a plurality of parallel coplanar director elements in spaced relation and located in said direction from the driven element, said elements being resonant at a frequency at the high frequency end of the range; a plurality of laterally spaced pairs of like director elements in parallel coplanar relation with and interposed between the first director elements in said direction to define dipoles; and coupling elements connecting the adjacent ends of the directors of said last pairs, the coupling elements being resonant at a frequency in the high frequency end of the range whereby in the high frequency end of the range the pairs of director elements act individually as resonant directors without shielding the first mentioned director elements and at the low frequency end of the range the pairs of directors act in unison as resonant directors.

4. In an antenna for television use to receive signals in both the high frequency and low frequency television band, the improvement comprising: a driven element adapted to receive television signals; a unitary director located in parallel coplanar relation with the driven element, the director being approximately one-half wave in length in the high frequency band; a dipole director located in coplanar parallel aligned relation with the driven element and unitary director, the dipole director having total length substantially a half wave length in the low frequency television band; and a resonant transmission line having a large shunt capacitance connecting the inboard ends of the dipole director and resonant in the high frequency band, whereby in the high frequency band the dipole director acts as a pair of individual resonant directors without shielding the driven element or unitary director and in the low frequency band the dipole director acts as a unitary resonant director.

5. A director system for a two band antenna, the director system comprising in combination: a unitary director of length to operate as a director in the high frequency band; and a dipole director in coplanar parallel aligned relation with the unitary director, the dipole director consisting of colinear dipole arms joined at their inboard ends by a coupling unit resonant in the high frequency band, the length of the dipole director being such as to give director action in the low frequency band in conjunction with the impedance of the coupling unit, whereby in the high frequency band the dipole director acts as a pair of individual resonant directors without shielding effects and in the low frequency band the dipole director acts as a unitary resonant director.

6. A director system boom for a two band antenna having a longitudinal support boom, the director system comprising in combination: a unitary director of length to operate as a director in the high frequency band, the unitary director being affixed in centered relation on the boom; and a dipole director mounted on the boom in coplanar parallel aligned relation with the unitary director, the dipole director consisting of dipole arms insulatingly supported in colinear relation from the boom; and a coupling unit joining the inboard ends of the dipole arms, the coupling unit comprising a closed parallel wire transmission line conductively attached to the inboard ends of the dipole arms respectively, extending in parallel relation to the boom for part of its length adjacent the dipole arms to embrace the same, and in a plane normal to the boom extending in U-shaped configuration about the boom for the remainder of its length, the coupling unit being resonant in the high frequency band in conjunction with the capacitance of the boom, the length of the dipole director being such as to give director action in the low frequency band in conjunction with the impedance of the coupling unit.

7. An antenna for television use comprising in combination: a conducting support boom; a driven element mounted on the boom in centered relation and adapted to receive signals from one direction lengthwise of the boom and over a wide range of frequencies; a plurality of parallel coplanar director elements mounted on the boom in spaced centered relation in said direction from the driven element, said elements being resonant at a fre-

quency at the high frequency end of the range; a plurality of colinear pairs of director elements carried by the boom in parallel coplanar relation to and interposed between the first director elements in said direction to define dipoles, each director of each of said pairs being insulatingly supported from the boom at its inboard end; and closed parallel wire transmission lines conductively attached to the inboard ends of the dipole arms, respectively, each transmission line extending in parallel relation to the boom for part of its length adjacent the dipole arms to embrace the same and in a plane normal to the boom extending in U-shaped configuration about the boom for the remainder of its length, each transmission line being resonant in the high frequency band in conjunction with the capacitance of the boom, the length of each dipole being such as to give director action in the low frequency band in conjunction with the impedance of the transmission line.

8. A television antenna to receive signals over a wide frequency band comprising in combination: a conducting boom; a pair of coplanar parallel spaced driven units each having a forward dipole and a closely spaced rear unitary element, the dipole being connected to the unitary element by transverse conductors positioned approximately midway along each arm of the dipole, each of said driven units being mounted on the boom; a plurality of dipole directors having a pair of colinear arms insulatingly mounted on the boom, each dipole director having a total length of approximately one-half wave in length at a frequency near the low frequency end of the band and located forwardly and in coplanar parallel relation with the driven units, the dipole units being spaced from each other and from the forward driven unit; closed parallel wire transmission lines connected to the inboard ends of the dipole directors, respectively, each transmission line embracing the boom for a part of its length adjacent the dipole director and in a plane normal to the boom extending in U-shaped configuration about the boom for the remainder of its length and being tuned to a frequency near the high frequency end of the band to cause the dipole director arms to operate individually at the high frequency end of the band and in unison at the low frequency end of the band; and unitary directors approximately one-half wave in length at the high frequency end of band, the last directors being interposed approximately midway between the adjacent dipole directors and between the forward driven element and the adjacent first dipole director.

9. In combination, for use in a TV antenna operable over both the 54–88 megacycle band and the 174–216 megacycle band: a conducting support boom; a driven element mounted on the boom and operable to receive signals from a predetermined direction in both of said bands; a dipole director comprising a pair of colinear arms insulatingly supported from the boom forwardly of the driven element with respect to said predetermined direction, the total length of the director being approximately one-half wave in the 54–88 megacycle band; and, a closed transmission line connected at its ends, respectively, to the dipole arms, said line straddling the boom over the part of its length adjacent the dipole arms and in a plane normal to the boom extending in U-shaped configuration about the boom over the remainder of its length, the transmission line being tuned to resonate in conjunction with the capacity of the boom in the 174–216 megacycle band to cause the dipole arms to operate as individual directors in that band.

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

DIRECTIONAL WIRELESS AERIAL SYSTEM

Filed April 6, 1936

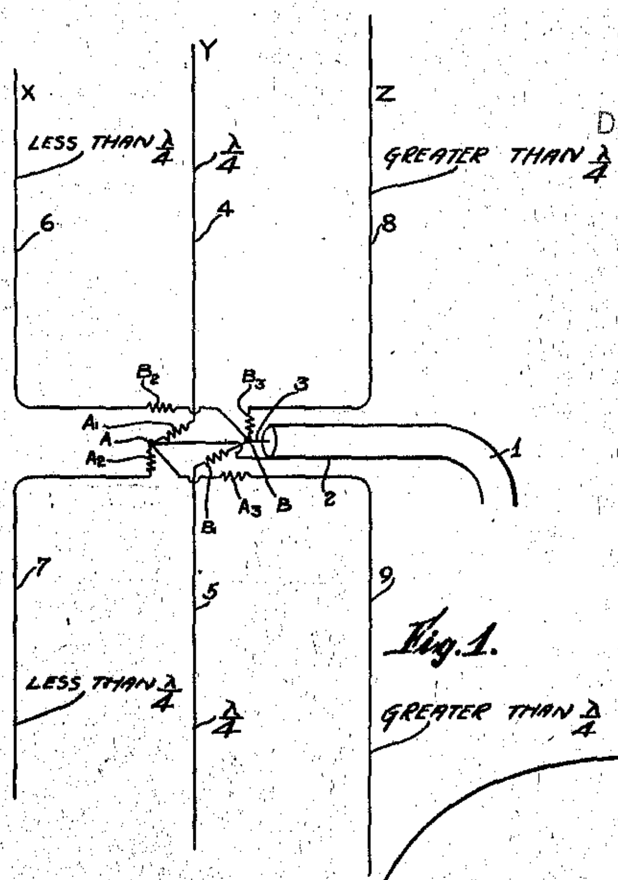

Fig.1.

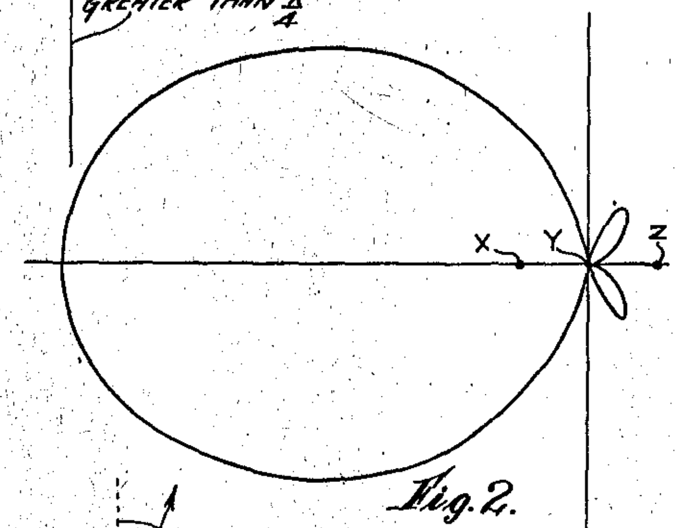

Fig.2.

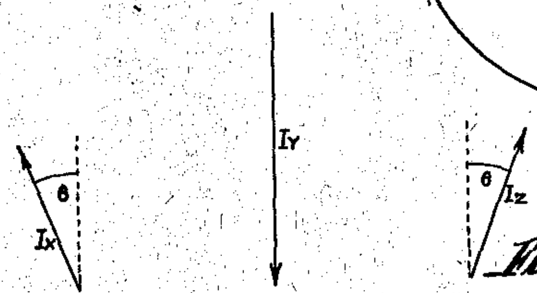

Fig.3.

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Patented Jan. 18, 1938

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UNITED STATES PATENT OFFICE

2,105,569

DIRECTIONAL WIRELESS AERIAL SYSTEM

Eric Lawrence Casling White, Hillingdon, and William Spencer Percival, Hanwell, England, assignors to Electric & Musical Industries Limited, Hayes, England

Application April 6, 1936, Serial No. 72,920
In Great Britain April 3, 1935

7 Claims. (Cl. 250—33)

The present invention relates to directional wireless aerial systems such as can be used either for transmission or for reception of electro-magnetic waves. When used for transmission, they are required to radiate the maximum portion of the radiated energy in the direction of the receiving station. When used for reception, they are required to receive as great a portion of the radiation from the transmitter as possible, and to exclude unwanted radiations such as interference arriving in other directions. The arrays can be of similar type for both transmitting and receiving. The gain in efficiency compared with a non-directional radiator or receiver, whether it be expressed as the ratio of wanted to unwanted power radiated, or as signal to noise ratio, is the same for a given type of array. The only difference between transmitting and receiving arrays is that in a receiving array, where the signal strength is sufficient to eliminate any trouble due to noise in the receiving amplifiers, the power efficiency of the array is not of importance, provided that the correct directional diagram is obtained in order to reduce interference pick-up as much as possible. In a transmitting array it is important to keep the power efficiency good in order that a large radiation may be obtained. Arrays may be designed either to give a good horizontal distribution (e. g. to transmit maximum power westward towards a westerly receiving station), or they may be designed to give a good vertical distribution (e. g. radiate maximum power horizontally instead of up and down), or to give a combination of both these desirable properties.

For convenience in description reference will be made more particularly in this specification to transmitting systems and it is to be understood that the systems discussed are also applicable to reception.

In order to obtain such directional arrays it is usual to use radiating elements (which may generally be a quarter to a half a wavelength long), spaced at intervals of a quarter to a half a wavelength apart and suitably phased so that radiation adds up for the wanted direction but subtracts for unwanted directions. The elements of the array may be separated vertically, along the direction of transmission, or across the direction of transmission.

The elements of an array are usually arranged vertically, although other arrangements may be used for some purposes, and they may be spaced apart vertically (for example arranged one above the other) or horizontally. In some cases the line of elements is along the direction of transmission and in other cases it is across it. The resulting radiation diagrams obtained from various arrangements have been very fully plotted in publications. It is however usually considered that a separation between elements of about a quarter wavelength is necessary in order to develop directional diagrams, since without this separation it is impossible to obtain addition of the effects of two elements in one direction and subtraction in another. Consequently, these directional arrays occupy considerable space, and cannot satisfactorily be employed on any but very short wavelengths.

It is the principal object of this invention to provide new or improved directive arrays where the separations between successive elements are shorter than a quarter wavelength, thus allowing a great saving in space to be effected.

According to the present invention there is provided an aerial array comprising a centre element and two outer elements arranged side by side and substantially co-planar and parallel with one another, the two outer elements being spaced apart from the centre element by a distance less than one quarter of the wavelength of signals to be transmitted or received and the elements being so connected that the outer elements are phased at least 135° out of phase with respect to the centre element and that the product of the effective length of and the current flowing in each of the outer elements is substantially half the product of the effective length of and the current flowing in the centre element, characterized in that the said elements are connected to two members of a feeder through lengths of conductor or impedance elements or through both lengths of conductor and impedance elements, whereby the phases and magnitudes of currents flowing in the elements are arranged to have values such that the resultant polar diagram of the array is substantially in the form of the product of a cardioid and a figure of eight.

The electrical phasing described above refers not necessarily to the phase of the currents supplied to an element of a transmitting array since the interaction of the elements may modify the phase of the currents within the elements. The phase relationships described refer in a transmitting array to the phase of the actual currents in the transmitting elements. Similarly the phasing in a receiving array (which involves the same electrical connections) refers to the phase relationships introduced between the voltages applied to the receiver input. The connections are more simply considered by treating an array as being a transmitting array and adjusting the phasing connections so as to obtain correct currents in and voltages on the elements: the array so designed may then be used as a receiving array by replacing the generator by a suitable receiver.

The phasing of the connections to elements of the array may be modified so as to allow for capacity and mutual induction effects of adjacent or closely mounted elements of the array being greater than such effects between widely spaced elements of the array.

The impedance of the feeder and transmitting or receiving apparatus is matched to the impedance of the array, due allowance being made for the change in radiation resistance of any element produced by the adjacent action of elements which are electrically phased almost in opposition.

The invention will now be described by way of example with reference to the accompanying diagrammatic drawing wherein—

Fig. 1 shows an array according to the invention,

Fig. 2 shows a typical polar diagram of an array according to the invention, and

Fig. 3 is a vector diagram of the currents in the elements of Fig. 1.

Referring to Fig. 1 of the drawing, a two wire feeder 1, which is shown as being of the concentric type, is coupled at one end to a wireless transmitting apparatus (not shown). The other ends of the two conductors 2, 3 are indicated by the references A and B and to each of these ends three resistance elements are connected. Those connected to end A are denoted by references A_1, A_2 and A_3 and those connected to end B are denoted by B_1, B_2 and B_3. The central element Y of an aerial array comprises a pair of conductors 4, 5 in the form of straight tubes or rods, each having a length equal or nearly equal to a quarter of the wavelength of signals to be transmitted. These two conductors are arranged in a vertical line, the lower end of the upper conductor 4 and the upper end of the lower conductor 5 being adjacent the end of the feeder remote from the transmitter, and being connected to the free ends of resistance elements A_1 and B_1 respectively. A second pair of conductors 6, 7 constituting the second element X of the array and also of length equal or nearly equal to one quarter of the wavelength, are connected at one end to the free ends of resistance elements B_2 and A_2 respectively. These conductors are arranged to extend horizontally for a distance equal to about $\frac{1}{11}$ of the wavelength and they are then each bent through a rightangle, in a vertical plane through the central aerial element, so that the conductor 6 extends vertically upwards from the point of bending and conductor 7 extends vertically downwards as shown. A third pair of conductors 8, 9 similar to the second pair 6, 7 is arranged to form a third element Z, co-planar with elements X and Y, in such a way as to form a structure which is symmetrical about element Y. The upper conductor 8 of element Z is connected to the free end of resistance element B_3 and the remaining conductor 9 is connected to the free end of the resistance element A_3.

The complete array therefore comprises six conductors forming three aerial elements X, Y and Z, each conductor being connected, through a resistance element, to one conductor of the feeder 1. The currents in the elements X and Z differ in phase from the current in element Y by 180° (caused by the reversal of connections to the feeder wires) less the comparatively small phase change introduced by the resistances and the residual reactances of the elements.

A spacing of about $\frac{1}{11}$ of the wavelength between adjacent elements is preferable since, with this spacing, it has been found that the resistance elements require all to be of substantially the same value. The frequency selectivity is then the same for all the elements and the currents in the elements remain in the same ratio to one another at the side band frequencies and at the carrier frequency. The polar diagram is therefore substantially independent of frequency over a substantial range of side band frequencies.

When the aerial elements are accurately tuned, they operate as series resonance circuits, and their reactance is therefore zero. A change in the coupling resistances has then no effect on the phase of the currents in the elements but merely serves to adjust the current amplitudes.

The polar diagram which is required is that obtained by multiplying each radius vector of a cardioid by the radius vector in the same direction of a figure of eight. An example of such a polar diagram is shown in Fig. 2, in which the elements X, Y, Z of Fig. 1 are shown in plan view.

Fig. 3 shows a vector diagram of the currents in the elements of Fig. 1. The products of the effective currents in and the lengths of the elements X, Y and Z are denoted by I_X, I_Y and I_Z respectively. If θ is the angle (in radians) such that the phases of I_X and I_Z are $\pi-\theta$ and $\pi+\theta$ with respect to the current in element Y respectively, and if $I_X=I_Z$, then for zero radiation in a direction perpendicular to the plane of the array

$$2I_X \cos\theta = I_Y \quad (1)$$

For zero radiation in the direction X—Z

$$I_X - I_Y \cos(\phi-\theta) + I_Z \cos(2\phi-2\theta) = 0 \quad (2)$$

where ϕ represents the phase angle introduced by the separation of adjacent elements. Thus if d is the distance between adjacent elements

$$\phi = \frac{2\pi}{\lambda} d$$

When $I_X=I_Z$, this equation reduces to

$$2I_X \cos(\phi-\theta) = I_Y \quad (3)$$

From Equations (1) and (3) it will be seen that $\cos\theta = \cos(\phi-\theta)$ from which

$$\theta = \frac{\phi}{2} = \frac{\pi d}{\lambda}$$

Thus if

$$d = \frac{\lambda}{11}$$

then

$$\theta = \frac{\pi}{11} = \text{about } 16^\circ$$

The current in one outer element must therefore be advanced in phase by

$$\frac{\pi}{11}$$

and the current in the other outer element must be delayed by

$$\frac{\pi}{11}$$

with respect to the phases of the currents which would flow if the connections and lengths were exactly as described above. This advancement and delay of the phases of the currents in the outer elements may be obtained by adjusting the lengths of the conductors of outer elements X and Z, conductors 6 and 7 being arranged to have a length slightly less than one quarter of a wavelength thereby relatively advancing the phase of the currents in these elements and conductors 8 and 9 being arranged to have a length slightly greater than one quarter of a wavelength thereby relatively retarding the phase of the currents therein. The outer aerial elements X and Z are then no longer tuned series resonance circuits and an increase in the values of the resistance elements A_2, B_2, A_3, B_3 decreases the phase difference of the outer elements X and Z with respect to the centre element Y.

A small change of phase or amplitude of the currents in the elements changes the normal polar diagram (the diagram obtained by multiplying the magnitude of the radius vector of a figure of eight by the magnitude of the radius vector, in the same direction, of a cardioid) so that the resultant may be in the form of the diagram obtained by multiplying together the magnitudes of corresponding radius vectors of two limacons.

The radiation for a given current in an aerial element will be less with the type of array here discussed than would be obtained with the more normal widely spaced elements. On the other hand, the effect of the proximity and substantially opposite phasing of the element is to reduce the radiation resistance of the individual elements so that, if the ohmic resistance and dielectric losses are small, the same power in the array will generate much larger currents and so compensate for the reduced radiation obtained per ampere. The effect of the proximity of the aerial elements in the array here considered, is to modify the radiation resistance of the elements so that the matching conditions for the feeder are quite different for this type of array from what they are with the usual widely spaced arrays. In order to utilize the good power efficiency possible from closely spaced arrays, it is necessary to match the feeder with due allowance to a modified radiation resistance and to ensure that the ohmic and dielectric losses are not unnecessarily large. A transformer for matching the feeder to the array may be of the quarter wave type comprising a quarter wave section of feeder adjacent the aerial of suitable characteristic impedance or of any other known or suitable type.

We claim:

1. An aerial array comprising a centre aerial element and two outer aerial elements arranged side by side and substantially co-planar and parallel with one another, the two outer aerial elements being spaced apart from the centre aerial element by a distance less than one quarter of the wavelength of signals to be transmitted or received, a feeder comprising two conductor members, and connections including impedance elements between said aerial elements and said members for arranging that the product of the effective length of and the current flowing in each of the outer aerial elements is substantially half the product of the effective length of and the current flowing in the centre aerial element and that the outer aerial elements are so phased at least 135° out of phase with respect to the centre aerial element that the resultant polar diagram of said array is substantially in the form of the product of a cardioid and a figure of eight.

2. An aerial array comprising a centre aerial element and two outer aerial elements arranged side by side and substantially co-planar and parallel with one another, the two outer aerial elements being spaced apart from the centre aerial element by a distance less than one quarter of the wavelength of signals to be transmitted or received, a feeder comprising two conductor members, and connections including impedance elements, comprising lengths of transmission line between said aerial elements and said members for arranging that the product of the effective length of and the current flowing in each of the outer aerial elements is substantially half the product of the effective length of and the current flowing in the centre aerial element and that the outer aerial elements are so phased at least 135° out of phase with respect to the centre aerial element that the resultant polar diagram of said array is substantially in the form of the product of a cardioid and a figure of eight.

3. An aerial array comprising a centre aerial element and two outer aerial elements arranged side by side and substantially co-planar and parallel with one another, the two outer aerial elements being spaced apart from the centre aerial element by a distance less than one quarter of the wavelength of signals to be transmitted or received, a feeder comprising two conductor members, and connections including impedance elements comprising resistances between said aerial elements and said members for arranging that the product of the effective length of and the current flowing in each of the outer aerial elements is substantially half the product of the effective length of and the current flowing in the centre aerial element and that the outer aerial elements are so phased at least 135° out of phase with respect to the centre aerial element that the resultant polar diagram of said array is substantially in the form of the product of a cardioid and a figure of eight.

4. An aerial array comprising a centre aerial element and two outer aerial elements arranged side by side and substantially co-planar and parallel with one another, said aerial elements each comprising two conductors each of length substantially equal to one quarter of the wavelength of signals to be transmitted or received, the two outer aerial elements being spaced apart from the centre aerial element by a distance less than one quarter of said wavelength, a feeder comprising two conductor members, and connections including impedance elements between said aerial elements and said members for arranging that the product of the effective length of and the current flowing in each of the outer aerial elements is substantially half the product of the effective length of and the current flowing in the centre aerial element and that the outer aerial elements are so phased at least 135° out of phase with respect to the centre aerial element that the resultant polar diagram of said array is substantially in the form of the product of a cardioid and a figure of eight.

5. An aerial array comprising a centre aerial element and two outer aerial elements arranged side by side and substantially co-planar and parallel with one another, the two outer aerial elements being spaced apart from the centre aerial element by a distance substantially equal to one eleventh of the wavelength of signals to be transmitted or received, a feeder comprising two conductor members, and connections including im-

pedance elements between said aerial elements and said members for arranging that the product of the effective length of and the current flowing in each of the outer aerial elements is substantially half the product of the effective length of and the current flowing in the centre aerial element and that the outer aerial elements are so phased at least 135° out of phase with respect to the centre aerial element that the resultant polar diagram of said array is substantially in the form of the product of a cardioid and a figure of eight.

6. An aerial array comprising a centre aerial element and two outer aerial elements arranged side by side and substantially co-planar and parallel with one another, said aerial elements each comprising two conductors, said conductors of said centre aerial element each being substantially equal to one-quarter of the wavelength of signals to be transmitted or received, the conductors of one outer aerial element each being arranged to have an effective length slightly less than a quarter of said wavelength, while the conductors of the other outer aerial element are each arranged to have an effective length slightly greater than one-quarter of said wavelength, said two outer aerial elements being spaced apart from the centre aerial element by a distance less than one-quarter of said wavelength, high frequency translating apparatus, and connections from said apparatus to said aerial elements so arranged and designed that the currents in one outer aerial element lead in phase and the currents in the other outer aerial element lag in phase the currents in the centre aerial element.

7. An aerial array comprising a centre aerial element and two outer aerial elements arranged side by side and substantially co-planar and parallel with one another, the two outer aerial elements being spaced apart from the centre aerial element by a distance approximately one-eleventh of the wavelength of signals to be transmitted or received, a feeder system for said aerial elements, and means for causing the currents in the outer aerial elements to differ in phase by substantially the same amount with respect to the phase of the currents in the centre aerial element, the currents in said outer aerial elements differing in phase from the current in said centre aerial element by greater than 90° but less than 180°.

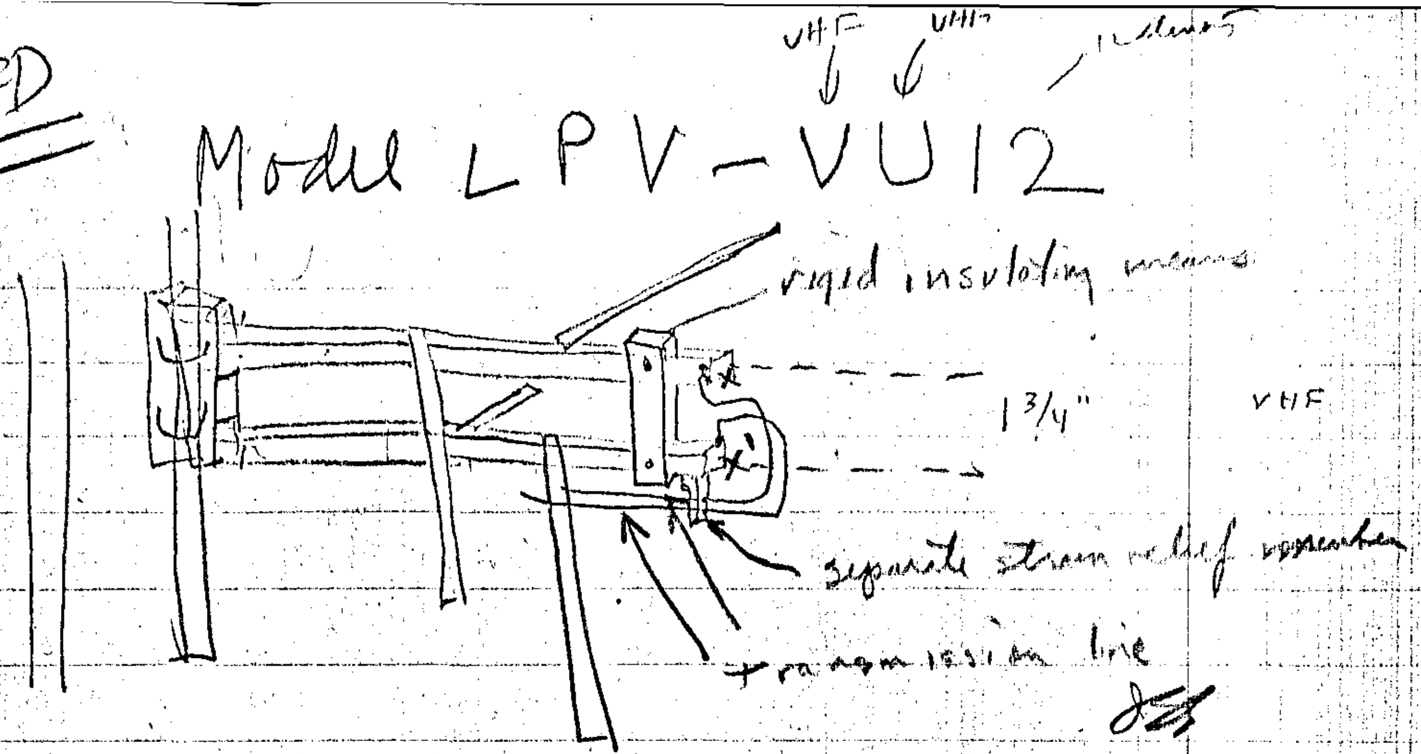
ERIC LAWRENCE CASLING WHITE.
WILLIAM SPENCER PERCIVAL.

JFD EXHIBITS

J-1	Blonder et al 3,259,904
J-1a	Enlarged drawings of J-1
J-2 (BT 33)	Radio and TV News Oct. 3, 1966
J-3 (BT 49)	Sketch of JFD antenna
J-4a(BT 19)	JFD antennas - sales material
J-4b(BT 20)	JFD antennas - sales material
J-5 (BT 3)	BT Color Ranger antenna
J-6	JFD Electronics ad - Popular Electronics - Sept.1965
J-7	BT catalog - Val-U-Rama
J-8	Blonder patent 3,016,510

JFD

Model LPV-VU12



Seen at B-T wed. May 18-66

LPV-VU 18, 15, 12, 9, 6
LPV-TV 19, 16, 13, 10, 7, 5, 3.

"New" May 1'65 catalog.

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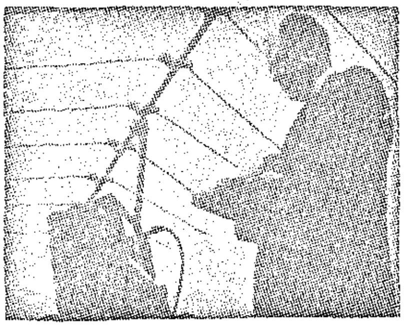
PENGAD - Bayonne, N.J.

Ex J-4a



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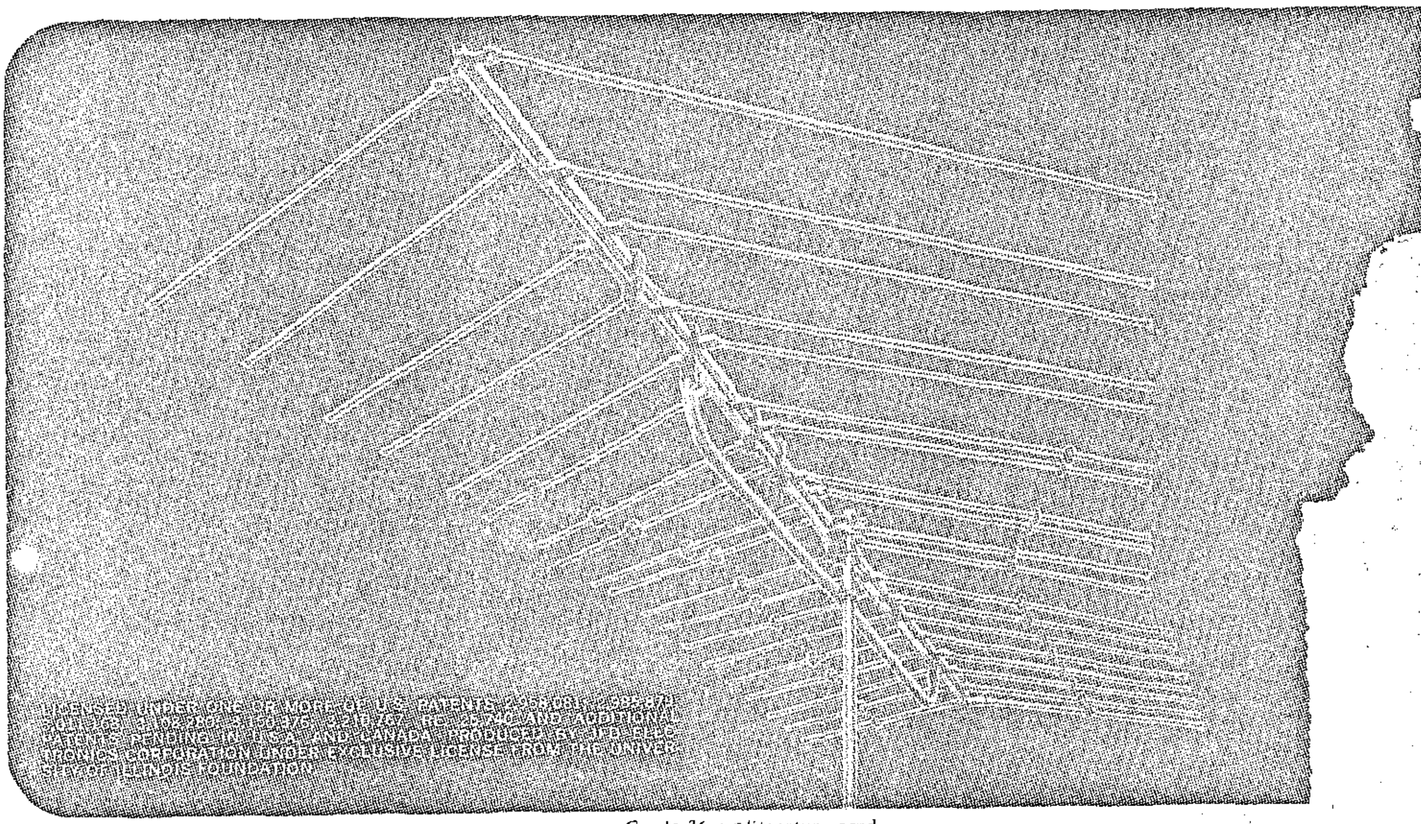

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Seven LPV-TV models to choose from — meet any location or budget needs!

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BY FAR—the best antenna for VHF COLOR performance because it combines...

- The electronic perfection of the patented frequency independent Log Periodic concept of the **University of Illinois Antenna Research Laboratories.**
- New **capacitor-coupled Cap-Electronic** elements that respond on the **third** harmonic mode for **highest** effective gain. More harmonically resonant elements mean higher signal-to-noise ratios, better ghost rejection, sharper directivity on high VHF band—where it's most needed, especially in **color.***
- **True dual-band directors** separately tune to high and low bands for added gain and directivity on all channels.
- **Flat frequency response** (± ½ db across entire channel) for studio-quality color regardless of channel tuned.

New LPV-TV Log Periodic antenna series incorporates new capacitor-coupled element concept for improved response, especially in color, on channels 2 to 13.

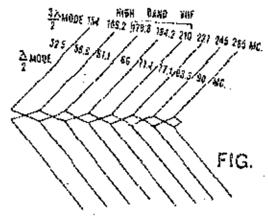

FIG. 1

Fig. 1 shows how a VHF log periodic with eight conventional V-dipoles might look. The resonant frequencies of the dipole elements in the low VHF band are indicated near midpoint of each dipole. The 3/2 wavelength resonant frequencies are indicated near the ends of each dipole. (Note that only three dipoles resonate at frequencies in the high VHF band.)

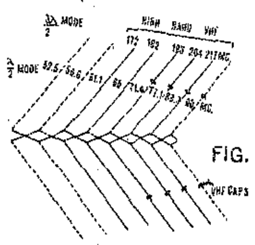

FIG. 2

However, by introducing parallel plate capacitors into the dipoles and by carefully adjusting the value of this capacitance and its position on the dipole, as shown in Figure 2, the resonant frequencies of the dipole can be shifted in the 3/2 wavelength mode. In this way, the dipole can be made to resonate at two desired frequencies: e.g., 88 and 216 mc.

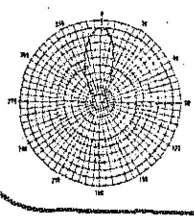

FIG. 3

Result: the active region in the high band extends over five of the eight original dipoles instead of three, as in Fig. 2, with a performance improvement of 66⅔%. The new capacitor-coupled dipoles also present more capture area on the **low band** than ordinary dipoles. Thus LPV-TV antennas offer, on **both bands, higher** and more uniform gain, **lower** side-lobe levels, narrower beamwidths, for vastly improved ghost **rejection** (see Fig. 3).

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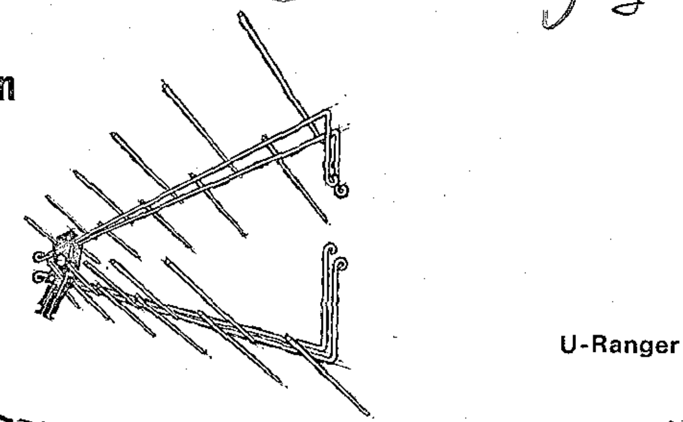

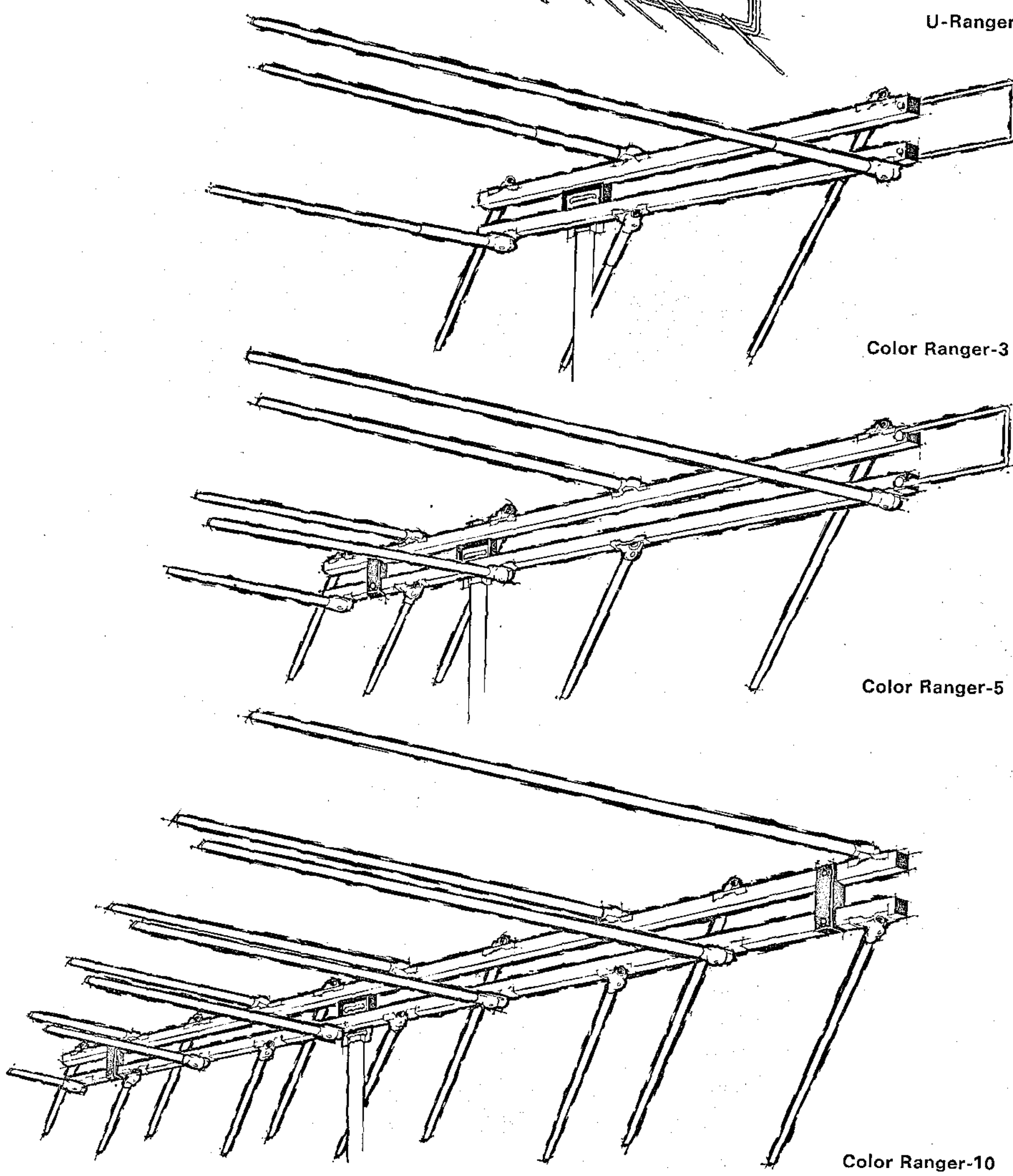

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J-6

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Enjoy All Channels 2 to 83 (FM, Too)

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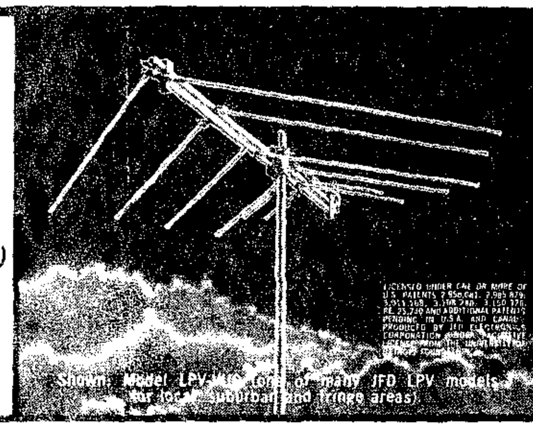

The JFD LPV Log Periodic Helps Your TV Get Sharp, Brilliant Pictures — COLOR & Black/White

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

The LPV follows the new **log periodic** formula developed for space telemetry by the famous Antenna Research Laboratories of the University of Illinois. The LPV also features new **capacitor-coupled** dipoles that work **electronically** for **full** picture power on **all** 82 VHF & UHF channels. No other antenna employs this revolutionary new patented TV antenna design.

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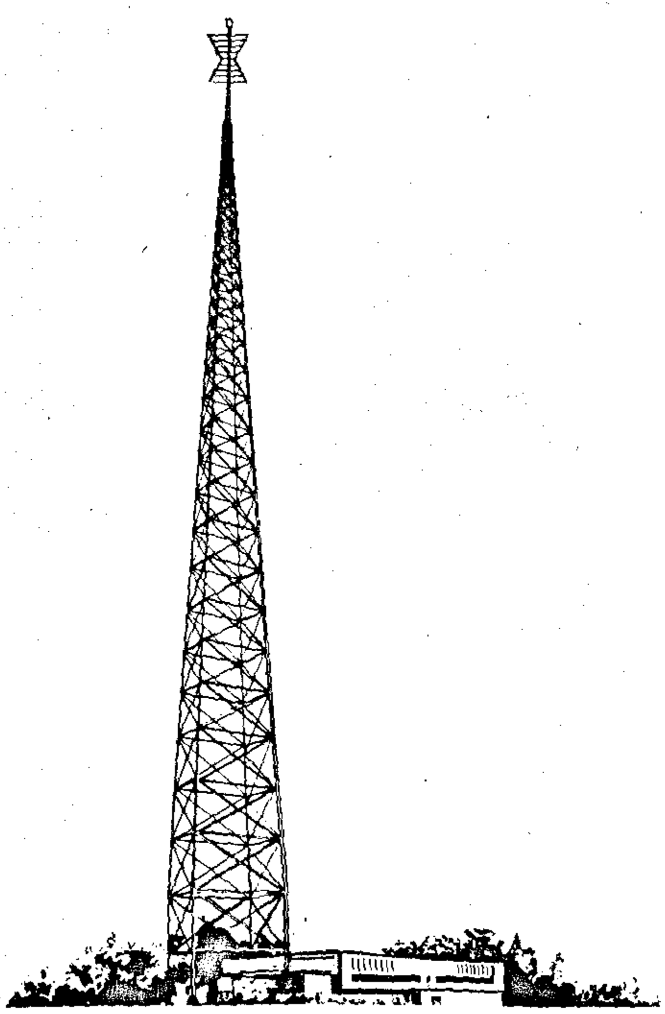

from here...

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BLONDER-TONGUE leader in UHF and VHF product design dedicates Fall, 1964 to better TV reception with the

BLONDER-TONGUE VAL•U•RAMA

How TV signal amplifiers improve reception

by Ben H. Tongue
(President, Blonder-Tongue Laboratories)

TV amplifiers can improve TV reception in many cases. There are, however, situations where no improvement is to be expected. This article will cover both situations to help you recognize potentially profitable installations.

Amplifier performance is determined by the level of internally generated noise (snow), amplification level, and degree of freedom from overload by strong local signals. Amplifiers are used as follows:

1. INCREASE CONTRAST Low cost TV sets generally have insufficient gain for weak signal reception. Old TV sets (low or high cost) often have aged tubes and insufficient gain. Low gain generally is the cause of poor contrast on weak signals. If the contrast of "snow" when the TV set is operating at full gain (no signal input) is much less than picture contrast on a strong signal, low gain is at fault.

A good amplifier, indoor or outdoor, will improve poor contrast caused by low gain. Contrast is reduced if the transmission line from antenna to TV set has a high loss. Noise (snow) is also increased by this condition. Let us assume that a good antenna is well installed and that quality transmission line is used (flat twinlead for VHF and round foam-filled twinlead for UHF).

TABLE 1 FREQUENCY	Length for 3db Loss	
Low Band VHF (Ch 3-6)	50' Wet	300' Dry
High Band VHF (Ch 7-13)	26' Wet	158' Dry
Low Half UHF (Ch 14-48)	45' Wet	90' Dry
High Half UHF (Ch 49-83)	37' Wet	74' Dry

2. REDUCE SNOW Snow appears when the TV signal-to-noise ratio is reduced. A good antenna reduces snow because of increased signal pickup. Transmission line loss increases snow because it reduces the signal reaching the first amplifier stage (booster or tuner RF stage). This reduces the signal-to-noise ratio. Here's how snow can be minimized:

a. Increasing signal pickup by using a higher gain antenna.

b. Using an amplifier which generates less noise than the TV input stage.

c. Amplifying at the antenna. If the amplifier has the same noise figure as the TV set tuner, the amplification overcomes transmission line loss, and the picture signal-to-noise ratio is nearly the same as if the TV set were at the antenna.

Point "A" applies at all times. Point "B" generally applies to low cost (tetrode tuner) and older TV sets when the amplifier is mounted near the set. Point "C" applies when the transmission line loss is appreciable. (See table 1). In this case we can improve the initial signal-to-noise ratio by using a low noise mast-mounted amplifier.

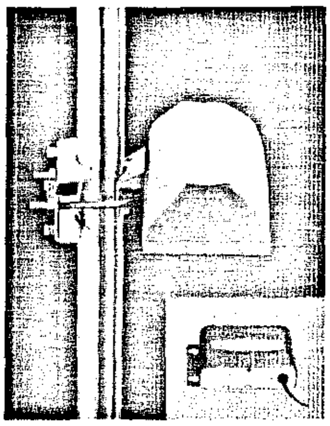
3. OVERCOME SPLITTING LOSSES Splitting a signal to drive several TV sets causes loss to each set. If the signal power is divided among two sets, each will receive ½ the original power (3db loss). This is equivalent in points "1" and "2" to an extra 3db of transmission line loss. The solution is amplification before splitting. This can restore contrast and re-establish signal-to-noise ratio (or even improve it).

One transistor amplifiers are most susceptible to overload. Two transistor amplifiers are much less susceptible, performing about the same as single tube units. Two tube and dual section tube amplifiers overload least. Frame-grid tubes provide exceptionally low noise and last longer than ordinary tubes. If interference occurs, attenuation filters can be used.

BLONDER-TONGUE TV/FM SIGNAL AMPLIFIERS

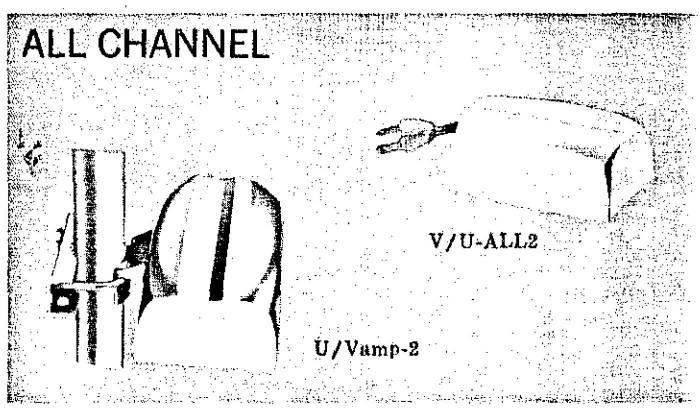
Brilliant color TV, sharp black and white TV and lifelike FM stereo reception require strong, clean signals. To provide TV viewers with the best possible reception in any area of the country, Blonder-Tongue offers the world's largest selection of signal amplifiers. There are VHF amplifiers, UHF amplifiers, FM amplifiers. And, for the first time, all-channel TV amplifiers covering every channel from 2 to 83.

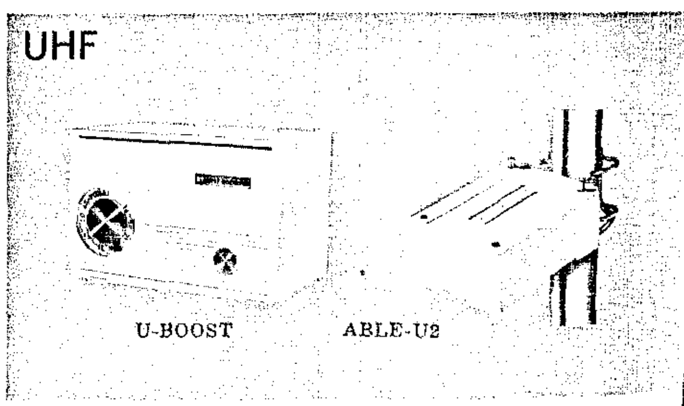
When you select a Blonder-Tongue amplifier, you can always be sure of getting the best amplifier for your specific reception problem. There are mast-mounted amplifiers designed to take advantage of the best signal-to-noise ratio available at the antenna for weak signal areas. There are indoor amplifiers, that offer convenient installation and can provide excellent results where there are relatively strong signals. You also have a choice of either tubed or transistor amplifiers. For example, transistor amplifiers offer greater gain and are most effective in weak signal areas where there are no strong local channels to cause overload.



The finest signal amplifiers in the world are also the easiest to install. Many of the mast-mounted amplifiers feature the exclusive 'Miracle Mount'. All mast mounted amplifiers feature a separate remote power supply which can be installed easily indoors near the set. Finally, secure, positive 300 ohm connections can be made in a jiffy with Blonder-Tongue patented stripless terminals.

The chart on the right hand page will serve as a guide that will help you select the best signal amplifier for your area.

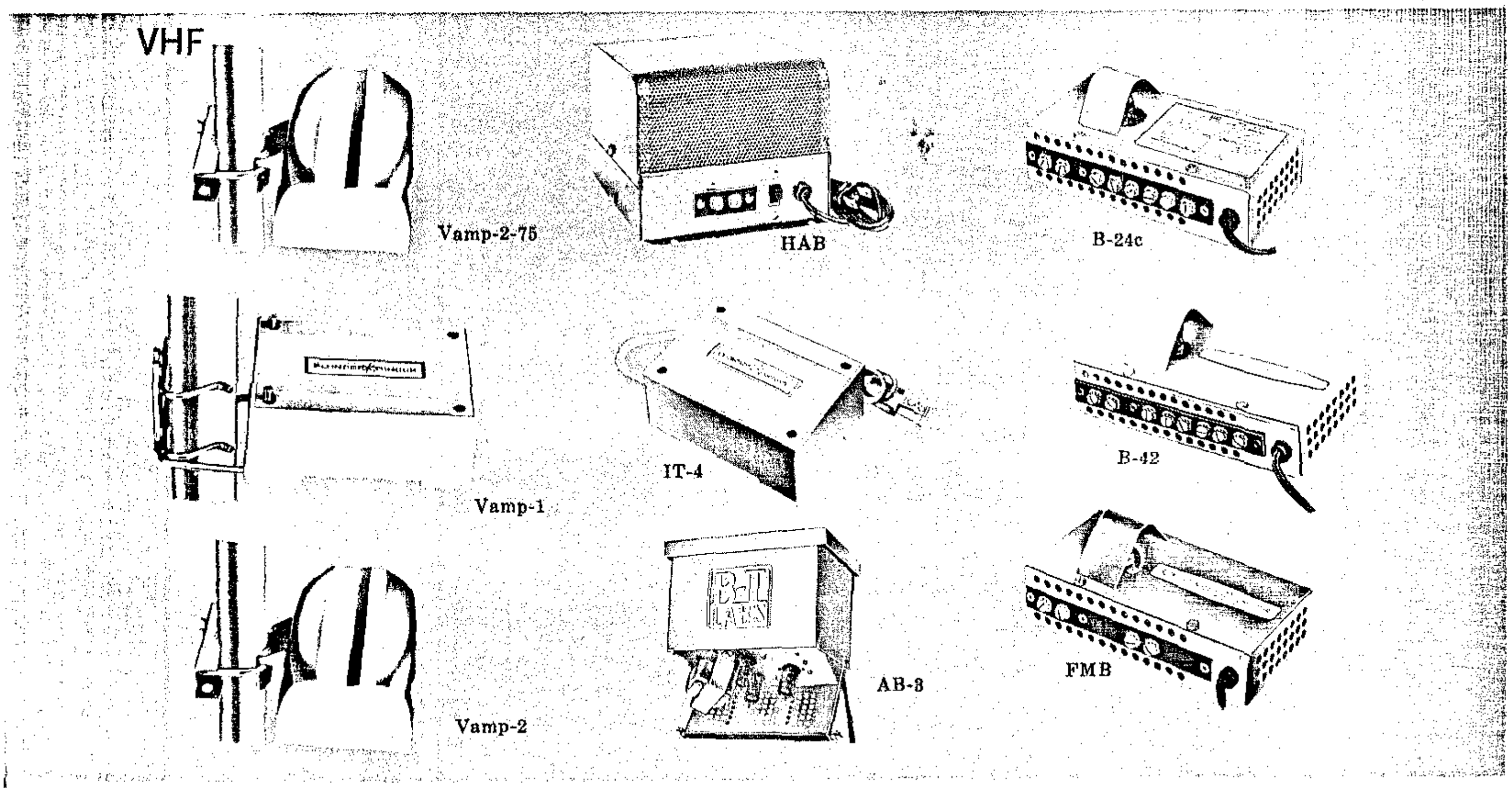




Blonder-Tongue amplifier that's best for you

BLONDER-TONGUE SIGNAL AMPLIFIERS—VHF, UHF, VHF-UHF, FM

MODEL	DESCRIPTION	COVERS CHANNEL	OUTPUTS	[illegible]
U/Vamp-2	World's first mast-mounted UHF/VHF amplifier. 2 transistors. Built-in FM filter. Remote AC power supply. Separate inputs for UHF and VHF. Single 300 ohm input at power supply accepts combined UHF/VHF twinlead.	2-83	1	$33.25
Vamp-2	*Mast-mounted* VHF *amplifier*. 2 transistors. Separate remote AC power supply. Strong overload handling capability. 2 or more sets.	2-13	2	$25.85
Vamp-1	Mast-mounted *transistor* VHF *amplifier*. Separate remote AC power supply. FM trap.	2-13	1	$17.10
Vamp-2-75	Mast-mounted 75 ohm VHF home TV amplifier system. 2 transistors. Uses coax cable. *Single* 75 ohm output can be split to 2 or more TV sets. Strong overload handling capability. Remote AC power supply. FM trap.	2-13	1 (75 ohm)	$29.55
AB-3	Deluxe, mast-mounted TV/FM amplifier. Low noise frame-grid tube. Can be used up to a *mile from* AC source. 75 and 300 ohm outputs.	2-13, FM	1 (75 or 300 ohms)	$78.50
ABLE-U2	Mast-mounted UHF amplifier. 2 transistors. Uniform response on all UHF channels. Remote power supply. Miracle Mount.	14-83	1	$26.95
V/U-ALL2	World's first indoor UHF/VHF amplifier. 2 transistors. FM filter. Single 300 ohm input accepts combined VHF/UHF twinlead. 2 sets.	2-83	2	$27.50
B-24c	Indoor VHF/FM amplifier. Uses high gain, *low-noise frame-grid* dual-section tube. 4 sets.	2-13, FM	4	$17.25
IT-4	Indoor transistor VHF/FM amplifier. Excellent interset isolation. Up to 4 sets.	2-13, FM	4	$19.95
B-42	Indoor VHF/FM using high gain, low noise, frame-grid tube. Up to two sets.	2-13, FM	2	$14.25
U-BOOST	Indoor tuneable *UHF* amp *Frame-grid tube*.	14-83	1	$17.35
HAB	Deluxe, indoor VHF/FM amplifier for professional home installations.	2-13, FM	1 (75 ohm)	$49.65
FMB	Indoor FM amplifier. Ideal for stereo and regular FM. Uses frame-grid tube.	FM	1	$14.55



UHF converter and antenna guide

Selection of right converter and antenna critical for UHF

by I. S. Blonder

Chairman of the Board,
Blonder-Tongue Laboratories, Inc.

There has been a long-standing prejudice against UHF. Since the band opened in 1952, many otherwise knowledgeable technicians have considered UHF reception to be inferior to VHF. Yet the recent New York City tests conducted by the FCC have proved that this is simply not so.

There is a reason for this paradox – equipment. In 1953, the state of the UHF art was relatively primitive. Today, experienced manufacturers like Blonder-Tongue are able to produce equipment capable of providing UHF reception that is, in many ways, superior to VHF.

The latest advance in UHF converters is solid-state circuitry. The use of transistors and tunnel diodes insures longer-life and generally lower noise figures. Also, the Blonder-Tongue patented tuners provide pinpoint, drift-free tuning. The result is brilliant color pictures and sharp black and white reception.

As for antennas, UHF has a definite advantage over VHF. Because the UHF wavelength is so small, high gain, efficient antennas are small and cost little. The periodic principle proved so successful in the U.S. Satellite program is especially applicable to UHF. The Blonder-Tongue Golden Dart (outdoor) and Golden Arrow (indoor) antennas utilize this priniciple. While they are compact, these antennas provide more gain than the large VHF yagis. What's more important, their patterns are clean, rejecting unwanted "ghost" signals. With a little extra care in selecting and installing UHF equipment, you can often provide your customers with better UHF pictures than they've been watching on VHF.

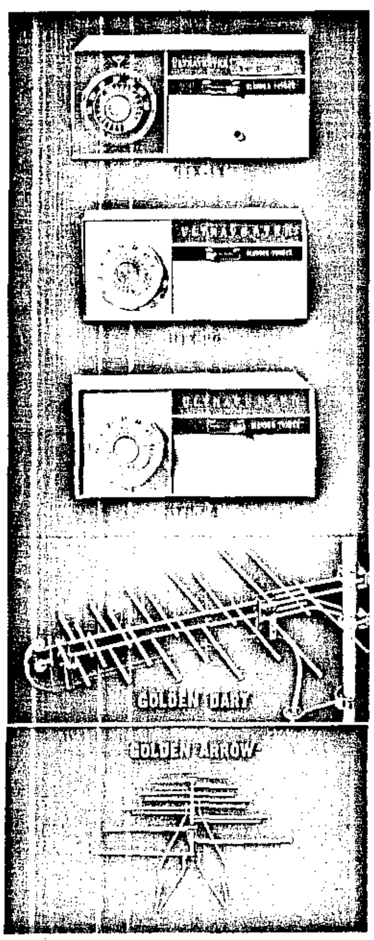
Blonder-Tongue UHF converters

These all-channel UHF converters, your best investment in TV enjoyment, add channels 14-83 to your present set. They are particularly suited to meet the critical demands of color TV. The new BTX-11 and BTX-99 converters retain traditional Blonder-Tongue features such as peak performance on all UHF channels, easy installation and reliable, long-term operation. To these well-known features have been added the advantages of all-transistor circuitry; maximum stability for drift-free performance and lower noise figure for snow-free reception. The BTD-44 employs a tunnel diode circuit for excellent, low cost battery operation.

Blonder-Tongue UHF antennas

The UHF antennas are designed to match the high performance standards on all UHF channels of our famed UHF converters. They employ the well-known Periodic principle, to provide uniform, high gain across the entire UHF spectrum for sharp, ghost-free pictures. Full bandwidth makes these UHF antennas excellent for color and black & white TV.

The Golden Dart is an outdoor UHF antenna which comes completely pre-assembled with nothing to snap out, no screws to tighten. The Golden Arrow is an indoor UHF antenna, which outperforms all other available indoor UHF antennas.



ALL-CHANNEL UHF CONVERTERS

DESCRIPTION	EFFECTIVE RECEPTION RANGE*	INPUT CHANNELS	OUTPUT CHANNELS	NET
BTX-11 — Deluxe all-channel, all-transistor UHF converter/amplifier. Adds all UHF channels to any set. Triples TV signal strength. Easiest tuning with dual-speed channel selector.	Used with an outdoor antenna anywhere up to 50 miles from station. With indoor antenna, up to 25 miles.	14-83	5 or 6	$31.20
BTX-99 — All-channel, all-transistor UHF converter. Adds all UHF channels to any set. Provides maximum signal power. Drift-free, distortion-free.	Can be used with indoor antenna for prime signal areas and outdoor antenna up to 25 miles from station.	14-83	5 or 6	$19.85
BTD-44 — All-channel, tunnel diode UHF converter. Utilizes tunnel diode for maximum reliability. Operates on ordinary flashlight battery which lasts from 6 to 9 months.	Can be used with indoor antenna for prime signal areas and outdoor antenna up to 25 miles from the station.	14-83	5 or 6	$18.20

ALL-CHANNEL UHF ANTENNAS

DESCRIPTION	EFFECTIVE RECEPTION RANGE*	FRONT-TO-BACK RATIO	NET
GOLDEN DART outdoor UHF antenna Uses Periodic principle, 11 working elements for uniform high gain across the entire UHF spectrum.	Up to 50 miles.	20db min.	$3.55
GOLDEN ARROW indoor UHF antenna Employs 10 working elements to provide constant high gain and matched impedance. Full Bandwidth — flat response.	Up to 20 miles.	20db min.	$2.70

*In weak signal areas, use a model Able-U2 UHF amplifier.

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July 5, 1966 I. S. BLONDER ETAL 3,259,904

ANTENNA HAVING COMBINED SUPPORT AND LEAD-IN

Filed Nov. 21, 1963

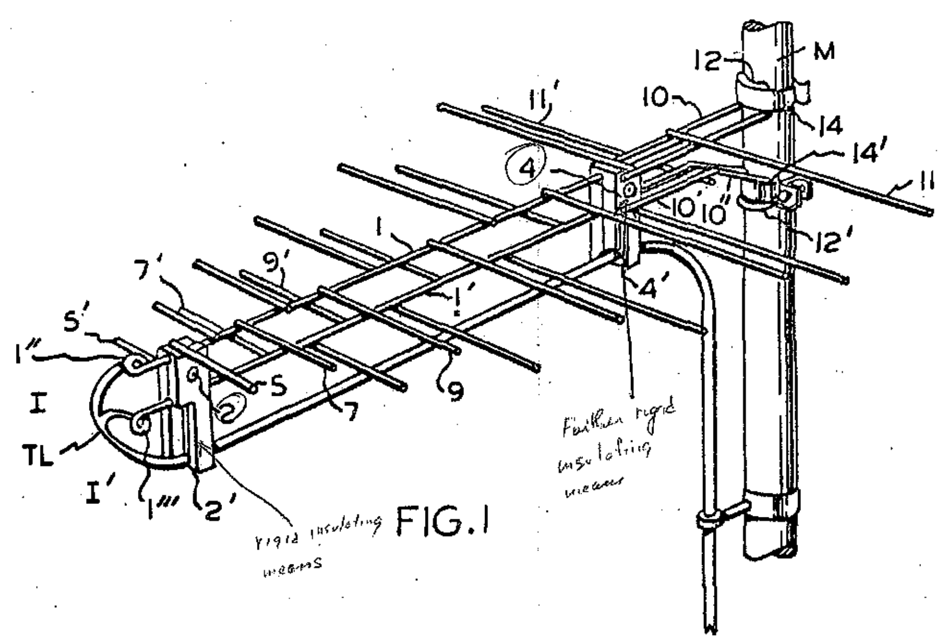

FIG. 1

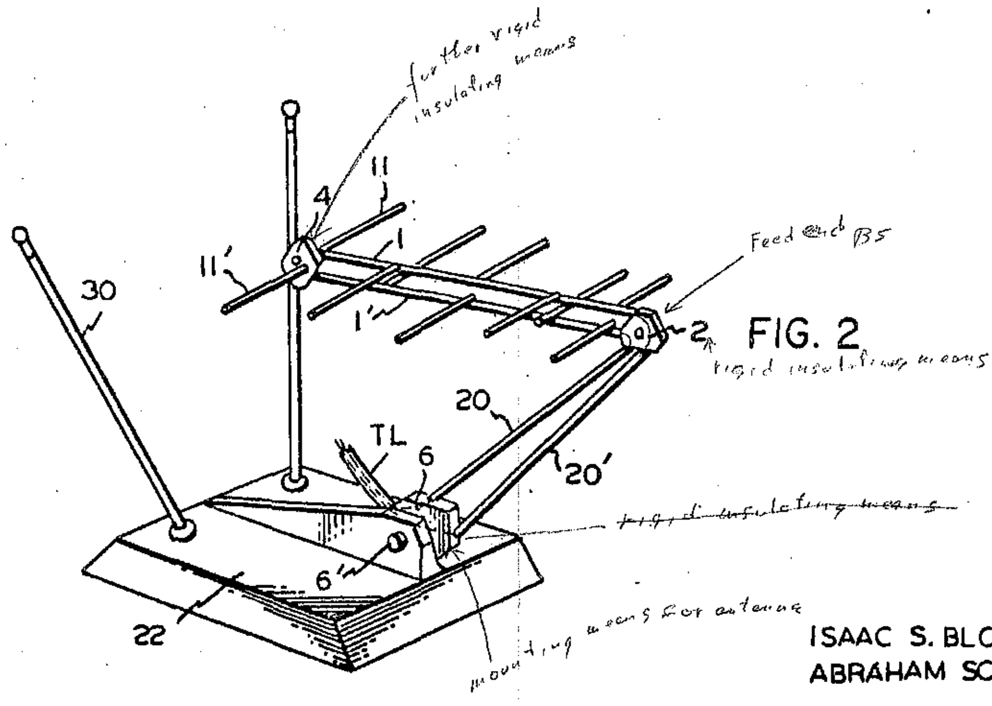

FIG. 2

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