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ANTENNA HAVING COMBINED SUPPORT AND LEAD-IN

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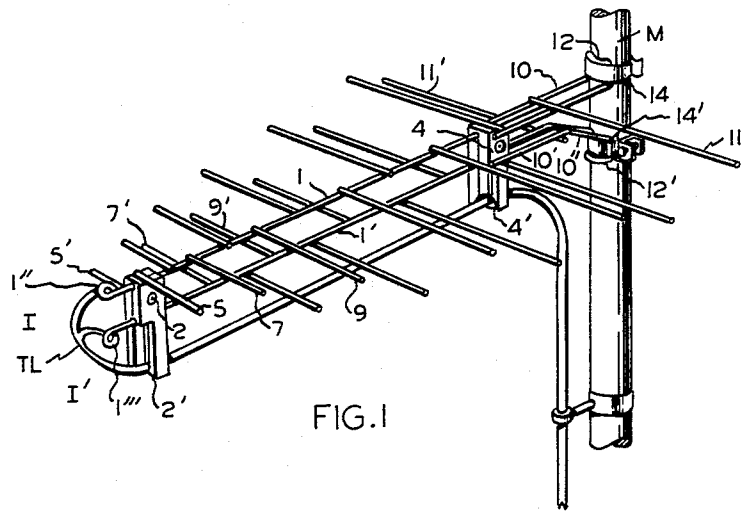


FIG. 1

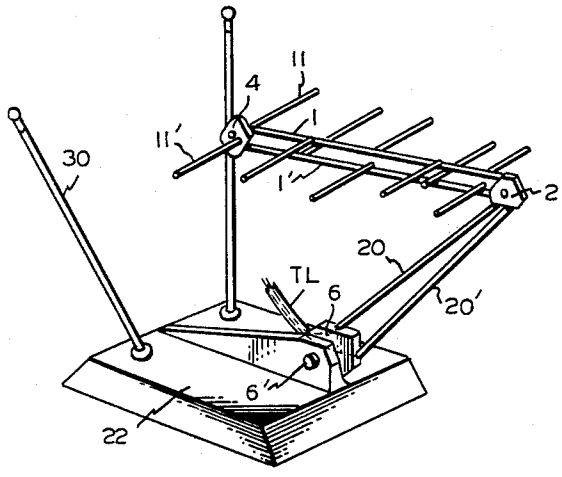


FIG. 2

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ANTENNA HAVING COMBINED SUPPORT AND LEAD-IN

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The present invention relates to directive antennas and, more specifically, to antennas adapted for receiving very high frequencies, such as the ultra-high-frequency television band.

Numerous types of antennas have been evolved for broad-band directive radio and television reception including driven arrays, Yagi-type arrays, log periodic linear and V-type antennas, helical antennas and other configurations. The problems of mounting such antennas upon masts for outdoor operation or upon portable structures adapted for directional adjustment in connection with indoor reception have, however, long plagued the art; the mounting and adjusting structures introducing "ghosts" and other deleterious electrical field-pattern aberrations over the band. It is to the improvement of such mounting structures and the minimizing of electrical interfering effects over a wide band of frequencies, including stabilizing of outdoor performance and providing for ready adjustability in indoor performance, that the present invention is primarily directed.

A further object of the invention is to provide a new and improved antenna particularly adapted for ultra-high-frequency television reception.

Still another object is to provide a novel antenna of improved performance for more general use, also.

Other objects will be made more evident hereinafter and will be particularly pointed out in the appended claims. In summary, however, the invention contemplates a pair of rigid conductors held spaced a predetermined vertical distance apart in a vertical plane, first and second pluralities of horizontal dipole elements lying in corresponding first and second vertically spaced horizontal planes containing the respective conductors, the dipole elements extending from opposite sides of each conductor at successive points therealong with dipole elements connected to one conductor extending in opposite horizontal directions to the corresponding dipole elements of the other conductor, the length of the dipole elements successively increasing from one end of the conductors towards the other end thereof, means for feeding the energy received by the antenna at the said one end of the conductors, and means for mounting the antenna comprising a further pair of rigid, preferably diverging, conductive extensions of the said conductors mechanically secured in rigid spaced-apart relation at the end thereof. Further preferred details are hereinafter set forth.

The invention will now be described in connection with the accompanying drawing, FIG. 1 of which is an isometric view of an outdoor preferred embodiment thereof; and

FIG. 2 is a similar view of a modified indoor version.

Referring to FIG. 1, the antenna comprises a pair of rigid conductors **1, 1'** held spaced apart a predetermined vertical distance in a vertical plane by forward and rearward insulating clamps **2** and **4**. While the terms "vertical" and "horizontal" as herein employed describe the preferred orientation for ultra-high-frequency television reception, they are intended more generically to be illustrative of relative orientations without being confined to actual direction. Similarly, though the invention is described in connection with radio-wave reception, the antenna may also be used for transmission, if desired, as is well known.

Unlike prior-art arrays, including Yagi arrays, conventional log-periodic structure and the like, first and second pluralities of horizontal dipole elements **5, 7, 9 . . . 11** and **5', 7', 9' . . . 11'** are provided, lying in corresponding first and second vertically spaced horizontal planes I and I' containing the respective longitudinal conductors **1** and **1'**. The dipole elements are shown angularly extending transversely from opposite sides of each conductor at successive points therealong. The dipole elements connected to one conductor, moreover, extend in opposite horizontal directions to the corresponding dipole elements of the other conductor (such as **5** to the right **5'** to the left; **7** to the right, **7'** to the left; and so on). The length of the dipole elements preferably successively increases from one end (**5, 5'** being shortest) towards the other end (**11, 11'** being longest), as is well known, to provide directivity. A parallel-wire transmission line TL is connected at looped terminal portions **1''** and **1'''** beyond the clamp **2** that secures the connecting portions **1''** and **1'''** in spaced-apart relation, extending outside or to the left of the smallest dipole elements **5, 5'**. The line TL may be supported below the antenna by depending guides **2'** and **4'** in the respective clamps **2** and **4**, the latter being shown positioned near the largest dipole elements **11, 11'**.

The antenna of FIG. 1 is mounted upon a mast M through the use of pairs of horizontally spaced conductor-loop extensions **10** and **10'**, shown extending to the right beyond the longest dipole elements **11, 11'**. The extensions **10, 10'**, respectively, terminate in upwardly and downwardly extending vertical loops **12** and **12'** that may be transversely curved to fit the mast M, as shown, and are securely mechanically strapped at **14** and **14'** to the mast to hold the system **1–1'** in rigid spaced-apart relation at the mast end. Further to aid in mechanical stability, the extension **10'**, while in part initially extending in the lower horizontal plane I', diverges downwardly at **10''**. Fortuitously, this mechanical stability-providing diverging construction has been found minimally to affect the electrical field pattern, particularly if the length of the extension between the longest elements **11, 11'** and the mast M is made comparable to the separation along conductors **1** and **1'** of the last dipole elements **11** from the next-to-the-last element, to its left in FIG. 1. Minimal field abberations and "ghost" reflections over the complete ultra-high-frequency band, for example, has been thus attained with the above construction, together with satisfactory broad-band impedance matching, provided further that the vertical separation distance of the rigid conductors **1, 1'** is kept less than the average distance between successive dipole elements (preferably the order of an inch for UHF band operation), and which, in turn, is kept much less than the wavelengths involved, as is well known. At the UHF channel 47 frequency, for example (671 megacycles), a 20 decibel front-to-back ratio has been obtained with this construction, providing about a 36-degree half-power horizontal beam width and no detectable forward secondary lobes.

This same general type of construction has also been found admirably suited for indoor direction adjustable antennas, as shown in FIG. 2. In this embodiment, however, the small-dipole end of the antenna is used not only for the connection to the transmission line, but also for the support-providing extensions. These extensions are illustrated as rigid conductors **20** and **20'** depending at preferably an acute angle below the antenna at the insulating clamp **2** and slightly diverging for mechanical and impedance-matching purposes, being clamped at their bottom or free ends by a further insulating clamp **6**. The transmission line TL is thus connected to the conductors **1** and **1'** by these combined extension-supporting and transmission-line feed members **20, 20'**. The clamp **6** is pivoted at **6'** to a bracket carried by a base **22** so that the

members 1–1', 20–20' may be adjusted as a unit for both electrical impedance-matching purposes and appropriate pivoting action for reception-direction adjustment, the length of the preferably diverging extension lines 20, 20' is made substantially equal to the length of the rigid antenna-supporting conductors 1, 1'.

If VHF reception is also to be provided, it has been found that minimal interference is caused by the antenna of the present invention if V-type VHF dipoles 30 are mounted on the base forward of the pivoted clamp 6 and with a sufficient included angle in the V to contain the array of the invention.

Further modifications will occur to those skilled in the art and all such are considered to fall within the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. An antenna for ultra-high-frequency operation and the like, having, in combination, a pair of rigid conductors held spaced a predetermined vertical distance apart in a vertical plane, first and second pluralities of horizontal dipole elements lying in corresponding first and second vertically spaced horizontal planes containing the respective conductors, the dipole elements extending from opposite sides of each conductor at successive points therealong with dipole elements connected to one conductor extending in opposite horizontal directions to the corresponding dipole elements of the other conductor, the length of the dipole elements successively increasing from one end of the conductors towards the other end thereof, means for connecting a parallel-wire transmission line to the said one end of the conductors and means for mounting the antenna comprising a further pair of rigid diverging conductive extensions of said conductors mechanically secured in rigid spaced-apart relation at an end thereof, the said diverging conductive extensions being provided at the said other end of the pair of rigid conductors and each comprising a pair of horizontally spaced conductors terminally provided with a vertical loop, and the said mechanical securing means comprising mast-strapping means for strapping the said vertical loops, and the distance of the said mast-strapping loops from the said other end being comparable to the distance between the longest and next-to-longest pairs of dipole elements of the antenna.

2. An antenna for ultra-high-frequency operation and the like, having, in combination, a pair of rigid conductors held spaced a predetermined vertical distance apart in a vertical plane, first and second pluralities of horizontal dipole elements lying in corresponding first and second vertically spaced horizontal planes containing the respective conductors, the dipole elements extending from opposite sides of each conductor at successive points therealong with dipole elements connected to one conductor extending in opposite horizontal directions to the corresponding dipole elements of the other conductor, the length of the dipole elements successively increasing from one end of the conductors towards the other end thereof, means for connecting a parallel-wire transmission line to the said one end of the conductors and means for mounting the antenna comprising a further pair of rigid diverging conductive extensions of said conductors mechanically secured in rigid spaced-apart relation at an end thereof, the transmission-line connecting means and the diverging conductive extensions being combined and extending downward from the said one end to include an acute angle between the dipole carrying conductors and their extensions.

3. An antenna as claimed in claim 2 and in which the conductive extensions are clamped at their free ends against relative movement with the clamp being pivotally mounted upon a base to permit adjustment, as a unit, of the dipole-carrying conductors and their extensions.

4. An antenna as claimed in claim 3 and in which a pair of V-type dipole elements for different frequency reception, are mounted on the said base forward of the pivotal clamp, with the said horizontal dipole elements contained within the V.

5. An antenna for operation over a predetermined frequency band, having, in combination, a pair of rigid longitudinal conductors held spaced a predetermined vertical distance apart in a vertical plane, first and second pluralities of dipole elements lying in corresponding first and second vertically spaced horizontal planes containing the respective conductors, the dipole elements extending from opposite sides of and transversely at an angle to each conductor at successive points therealong with dipole elements connected to one conductor extending in opposite direction to the corresponding dipole elements of the other conductor, the length of the dipole elements successively increasing from one end of the conductors towards the other end thereof, means for connecting a parallel-wire transmission line to the said one end of the conductors, rigid insulating means securing the said connecting means mechanically in spaced-apart relation and connected with means for supporting the transmission line near the said one end, and means for mounting the antenna at a region of the said conductors remote from the said one end, further rigid insulating means being provided for securing the said longitudinal conductors mechanically in rigid spaced-apart relation near the said region, the said vertical distance being less than the distances between the said successive points and less than the wavelengths of the said band.

6. An antenna as claimed in claim 2 and in which the lengths of the said conductors and of their extensions are substantially equal.

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