

April 29, 1941.

H. J. HEINDEL ET AL

2,240,298

DIPOLE ANTENNA

Filed March 27, 1939

Fig. 1.

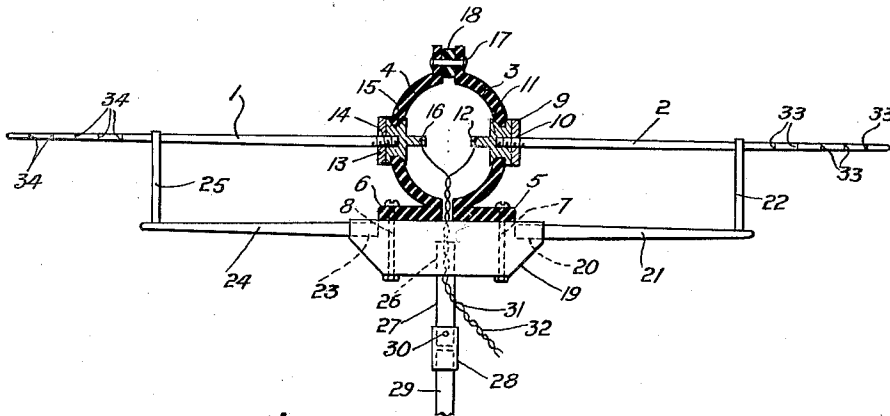


Fig. 2.

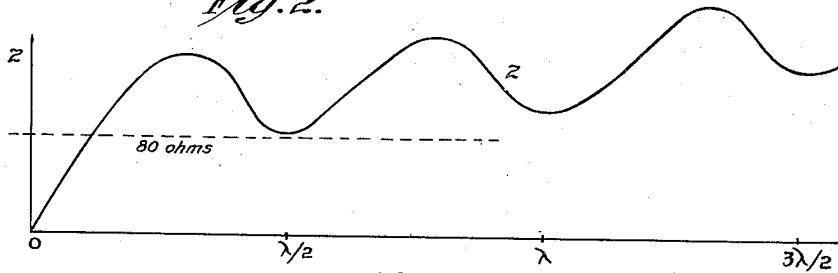


Fig. 3.

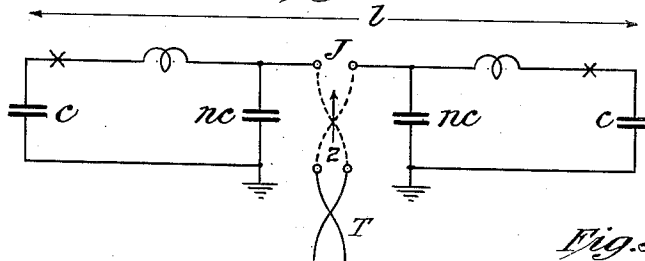


Fig. 4.

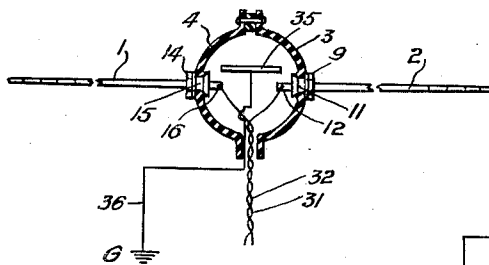
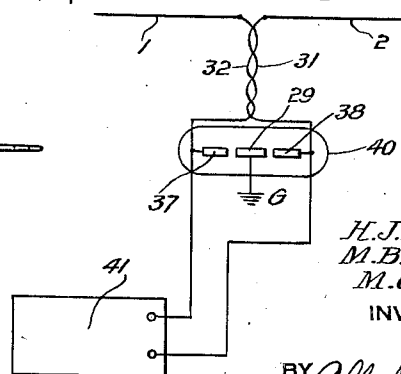


Fig. 5.



H. J. Heindel
M. B. Sleeper
M. Cawein
INVENTORS

BY *Alfred W. Barber*
ATTORNEY

UNITED STATES PATENT OFFICE

2,240,298

DIPOLE ANTENNA

Harold J. Heindel, Flushing, Milton B. Sleeper,
New York, and Madison Cawein, Manhasset,
N. Y., assignors to Andrea Radio Corp., Wood-
side, N. Y.

Application March 27, 1939, Serial No. 264,294

4 Claims. (Cl. 250—33)

The present invention concerns electro-magnetic wave antennas and in particular a novel form of dipole antenna useful at ultra high frequencies.

One object of the present invention is to provide an improved dipole antenna.

Another object is to provide a dipole antenna having improved electrical characteristics and at the same time improved mechanical characteristics.

A further object is to provide a novel dipole antenna adapted to simple adjustment for optimum directional and frequency response characteristics.

A still further object is to provide a novel lightning arrester in conjunction with the impedance matching means of a dipole antenna.

These and other objects of the invention will be evident from the detailed description of the various figures of the drawing.

A dipole antenna of the type utilized in the present invention comprises two equal, oppositely directed, horizontal antenna elements. The two antenna elements are mounted coaxially and spaced apart by a small distance. Lead-in wires are connected to the inner ends of the two elements.

The present antenna embodies a number of novel features. The two antenna elements are mounted on a central weather-proof housing containing preadjusted impedance matching elements, the connections to the lead-in wires and a lightning arrester. The housing is mounted on a coupling block adapted to fit over the end of an antenna pole. The two antenna elements are further supported by means of stream-lined arms mounted in the coupling block and supporting the antenna near its outer ends. A coupling section is provided in the pole allowing the antenna to be rotated to an optimum receiving angle after which it may be permanently fastened in position. The outer ends of the antenna elements are scored at points at which they may be cut-off to provide shifting of the optimum or average frequency response point of the antenna. We prefer to call our novel antenna a teleceptor.

In the drawing:

Fig. 1 shows a complete teleceptor antenna constructed according to the present invention.

Fig. 2 shows a curve of impedance of the present teleceptor antenna.

Fig. 3 shows an equivalent circuit of the present teleceptor antenna.

Fig. 4 shows one form of lightning arrester incorporated in the present teleceptor system.

Fig. 5 shows an alternative lightning arrester in the teleceptor antenna system.

In Fig. 1 is shown a dipole teleceptor antenna according to the present invention. The two dipole elements 1 and 2 are mounted on insulators

3 and 4. Insulators 3 and 4 are symmetrical hemispherical shaped and enclose a weather-proof space by clamping together with a bolt 17, block 19 by means of bolts 7 and 8 and an annular weather-proofing washer 18. In opposite ends of insulators 3 and 4 are mounted the metal fittings 11 and 15 which are spun over on the outside to provide a water-proof seal. Fittings 11 and 15 are provided with blind tapped holes 19 and 14 adapted to receive the threaded ends of antenna elements 2 and 1. Securely mounted on elements 1 and 2 are flanges 13 and 9 adapted to press against fittings 15 and 11 providing a good electrical contact between the antenna elements and the fittings and providing mechanical stability and locking. Fitting 11 and 15 are provided with inwardly directed projections 12 and 16 such that the separation between the ends of projections 12 and 16 provides a predetermined electrical impedance over the high frequency operating range. Projections 12 and 16 also provide terminations for a transmission line 31—32 to a television or other receiver. The transmission line ends are soldered to projections 12 and 16 to provide low resistance connections. The weatherproof housing provided by insulators 3—4 protects these connections from deterioration.

Insulator housing 3—4 is mounted on a mounting block 19 by means of bolts 7 and 8 passing thru feet 5 and 6. Block 19 is provided with two horizontally directed holes 20 and 23 and a downwardly directed hole 26. Wooden support rods 21 and 24 tapered at their outer ends to reduce wind resistance are fitted into holes 20 and 23. Near the outer ends of supports 21 and 24 are mounted vertical insulators 22 and 25 adapted to engage antenna elements 2 and 1 near their upper ends. The upper section 27 of a vertical supporting pole fits into hole 28. A second section 29 of the vertical pole is provided. The two vertical pole sections 27 and 29 are interconnected by means of a coupling 28. The lower end of coupling 28 is fastened to pole 29 while the upper end is initially free to allow rotation of the antenna into the most favorable directional position. When the desired position is found the upper pole is secured to coupling 28 by passing a pin or screw 30 thru the two.

The distance between supporting insulators 22 and 25 is made such that the shortest antenna elements 1 and 2 to be used project somewhat beyond them. The outer ends of elements 1 and 2 are scored or partly cut thru at points 34 and 33 to provide an easy means of removing sections of these elements as will be more fully described below.

Fig. 2 shows a plot of the impedance of the dipole antenna at the ends of fittings 12 and 16 as the sum of the lengths of elements 1 and 2 are varied plotted in terms of wavelength cor-

responding to the operating frequency. In general the region around one-half wavelength is utilized. This means that the length of the two antenna elements is made equal to one-quarter wavelength at approximately the mean frequency of the band of frequencies to be covered. While not intended to limit the invention to the particular values given below, they show a preferred arrangement for covering the various television bands shown.

Television bands	Antenna elements to be broken off at score points
44-50 megacycles..... 50-56 megacycles.....	} Use full 60 inch lengths.
44-50 megacycles..... 50-56 megacycles..... 66-72 megacycles.....	
50-56 megacycles..... 66-72 megacycles.....	} Remove antenna elements beyond 52 inch score points.
50-56 megacycles..... 66-72 megacycles.....	
44-50 megacycles..... 50-56 megacycles..... 66-72 megacycles..... 78-84 megacycles..... 84-90 megacycles.....	} Remove at 50 inch score points.
44-50 megacycles..... 50-56 megacycles..... 66-72 megacycles..... 78-84 megacycles..... 84-90 megacycles.....	
44-50 megacycles..... 50-56 megacycles..... 66-72 megacycles..... 78-84 megacycles..... 84-90 megacycles.....	
44-50 megacycles..... 50-56 megacycles..... 66-72 megacycles..... 78-84 megacycles..... 84-90 megacycles.....	
44-50 megacycles..... 50-56 megacycles..... 66-72 megacycles..... 78-84 megacycles..... 84-90 megacycles.....	

Due to proximity effect the apparent impedance of the antenna will be somewhat greater than the theoretical value as shown in Fig. 2. Also there will be some unavoidable mis-matching due to operating over a band of frequencies. A good practical matching impedance for the antenna has been found to be 100 ohms. Using this impedance to terminate the receiver end of the transmission line and using a 100 ohm impedance line provides a coupling to the antenna over the bands as shown which will not introduce objectionable reflections. Large values of mis-match at either end of the transmission line will set up reflections which may be visible in the television picture as extraneous images displaced from the primary image. The inner ends of fittings 12 and 16 should be separated approximately 1 inch as greater separations will increase the impedance of the antenna as seen from the transmission line input terminals. Thus antenna elements each 60 inches long scored at 54, 50 and 45 inches may be quickly adapted to operate most efficiently over the various frequency bands given. It will be clear that many other combinations are possible. In the example given the insulators 22 and 25 may be located at approximately 42 inches along each antenna element.

Fig. 3 shows an equivalent circuit of the dipole antenna shown in the present disclosure. Each element has a series inductance L, and equivalent lumped capacity at the outer ends of C and a lumped capacity at the inner ends of πC . The signal voltage is assumed to be introduced in series with each element at points x and x. With overall length equal to L the impedance Z at J is as was shown in Fig. 2. The transmission line T is attached at J and looks into an impedance Z.

Fig. 4 shows a lightning arrester enclosed within the weather-proof housing 3-4. A conducting element 35 is located within the housing and is symmetrically located to provide equal gaps between it and fittings 12 and 16. Element 35 is connected to ground G by means of a lead 36.

Fig. 5 shows an alternative lightning arrester comprising conducting elements 37, 38 and 39

located within a housing 40 which may be sealed and evacuated or may be filled with a low pressure gas. Element 39 is connected to ground G and is spaced symmetrically with respect to elements 37 and 38 which are connected to transmission line wires 31 and 32 respectively. Transmission line 31-32 continues on to a television receiver or other utilization means 41.

While only one embodiment of the invention together with a few modifications has been shown it will be evident to one skilled in the art that many modifications are possible without departing from the invention as set forth in spirit and scope in the appended claims.

15 What is claimed is:

1. In a high frequency antenna system, the combination of, a pair of tapered conductors each threaded at one end and scored at a plurality of predetermined points near the other end, a housing comprising a pair of cup-shaped insulators each carrying a fitting at the apex and means for clamping said insulators together at their peripheries to form an enclosed space, said fittings including inwardly directed projections to form a predetermined air-gap within said housing and outwardly directed threaded sockets to receive said threaded conductors, and a two conductor transmission line terminated upon said projections.

2. In a high frequency antenna system, the combination of, a pair of linear conductors, a hemispherical housing including fittings for holding said conductors in a substantially straight line, a plurality of score marks at predetermined points near the outer ends of said conductors, a support pole, a pair of support arms, a coupling block for holding said arms in perpendicular relation to said pole, means for mounting said housing on said block, means for supporting said conductors from said arms at points between said score marks and said housing and transmission line electrically connected to said fittings within said housing.

3. In a high frequency antenna system, the combination of, a pair of linear conductors, a hemispherical housing including fittings projecting thru the sides of said housing for holding said conductors in a substantially straight line, a support pole, a pair of support arms, a coupling block for holding said arms in perpendicular relation to said pole, means for mounting said housing on said block, means for supporting said conductors from said arms, a coupling section in said pole to permit rotation of said arms, and means for clamping said coupling to prevent rotation of said arms.

4. In a high frequency antenna system, the combination of, a housing comprising a pair of cup-shaped insulators each carrying a fitting at the apex and means for clamping said insulators together at their peripheries to form an enclosed space, said fittings including inwardly directed projections to form a predetermined air-gap within said housing and outwardly directed sockets for holding a pair of linear conductors in substantially in-line relation, and a two conductor transmission line electrically terminated at said projections.

HAROLD J. HEINDEL.
MILTON B. SLEEPER.
MADISON CAWEIN.