March 9, 1943. G. H. BROWN 2,313,513

ANTENNA

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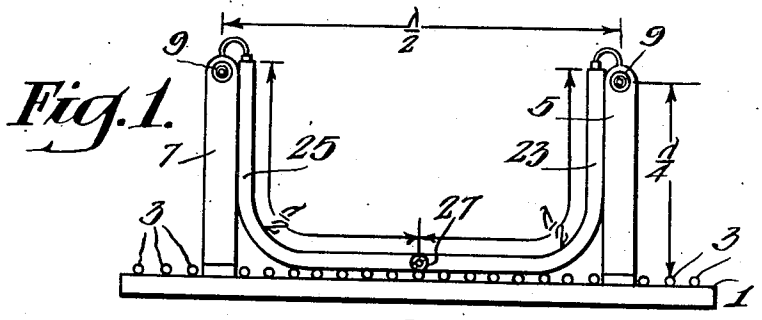


Fig. 1.

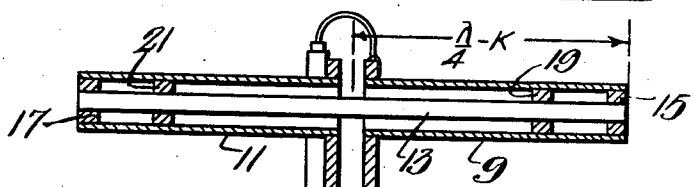
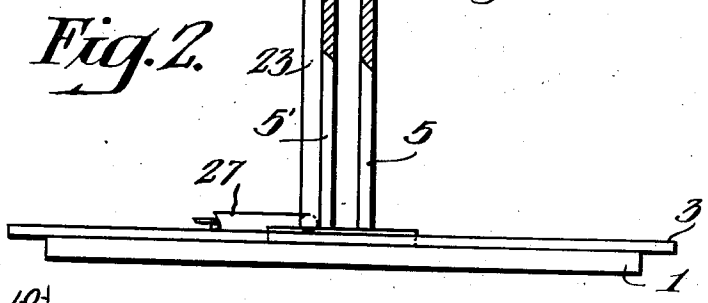


Fig. 2.



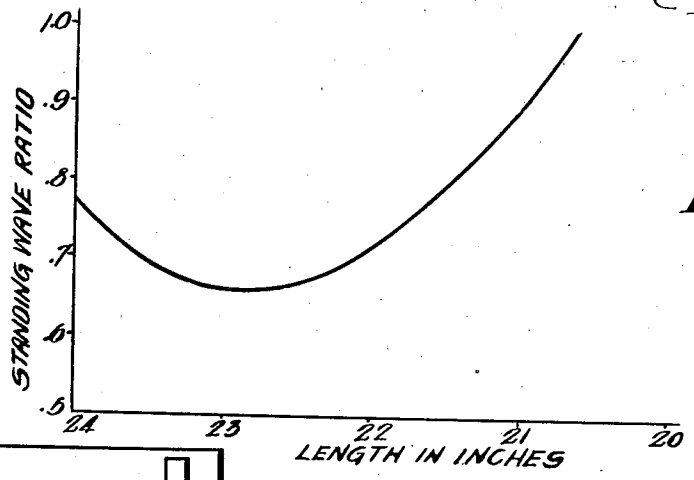


Fig. 4.

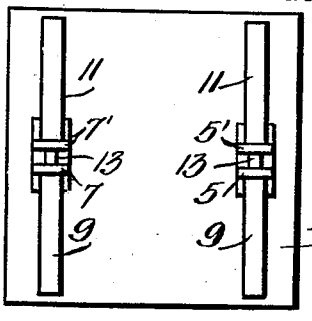


Fig. 3.

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UNITED STATES PATENT OFFICE

2,313,513

ANTENNA

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Application January 31, 1942, Serial No. 429,031

8 Claims. (Cl. 250—33)

This invention relates to improvements in antennas, and particularly to a dipole antenna in which conductive members are used to support and strengthen the antenna and to provide the required electrical characteristics.

One object of the invention is to provide a simple dipole antenna. Another object is to provide a dipole antenna, supporting means, and a reflector, all of which are composed of metallic elements having lengths which exhibit the required electrical characteristics. A further object is to provide a pair of dipole antennas, together with a reflector and connecting transmission lines so arranged that the antenna impedances can be made to match a standard transmission line.

The invention will be described by referring to the accompanying drawing, in which Fig. 1 is a side view of one embodiment of the invention; Fig. 2 is an end view partly in section; Fig. 3 is a top plan view of the dipole antennas and their supports; and Fig. 4 is a graph illustrating an electrical characteristic of the antenna. Similar reference characters will be applied to similar elements in the drawing.

Referring to Figs. 1, 2 and 3, on a base plate 1 are fastened a number of conductive rods 3 which serve as reflectors. Pairs of conductive supporting members, 5, 5', 7 and 7', are secured to the frame 1 and are spaced apart a distance corresponding to one-half of the operating wave length. The effective distance from the base 1 to the points at which the dipole antennas are supported is made equal to one-quarter of the operating wave length, thereby to obtain a high impedance at the high potential points without introducing a dielectric in the field.

The radiating elements consist of a pair of hollow conductive members 9, 11 which are secured at their inner ends to the supporting pairs 5, 5', respectively. The hollow members 9, 11 may be secured to the supporting members 5, 5' by mechanical means, by brazing, or the like. The effective length of each of the radiator arms is made slightly under one-quarter of the operating wave length so that the dipole formed by the two arms 9, 11 exhibits a capacitive reactance at the operating frequency. To neutralize the capacitive reactance and at the same time to impart mechanical strength to the antenna, an inner conductor 13 is disposed within the hollow arms 9, 11 and conductively coupled to the remote ends thereof. The conductive member 13 may be concentrically secured within the radiator arms by means of plugs 15, 17 which may be soldered or brazed to the radiator arms after a pair of shorting plugs 19, 21 have been located within the radiator arms at a distance at which the conductive element length provides the required inductive reactance.

Power is applied to or abstracted from the radiators by means of a pair of half wave concentric lines 23, 25, which are connected so that their inner conductors respectively terminate in one of the supporting elements of the pairs of supporting elements and their outer conductors are secured and connected respectively to the remaining supporting elements. One such connection is shown in Fig. 2, in which the outer conductor of the transmission line 23 is connected to the supporting element 5' and the inner conductor of the transmission line is connected to the other supporting element 15. In a similar manner the other transmission line 25 is connected to the supports 7, 7' which are shown in Fig. 3. Since the concentric transmission lines are of a half wave in length, the impedances of the radiating members or arms will be transferred without change to the junction of the two transmission lines 23, 25. Inasmuch as the lines are connected in parallel, the common termination will have an impedance equal to one-half of the impedance of one of the antennas. The common junction of the lines 23, 25 is connected to a transmission line 27 which may be terminated at the transmitter or the receiver to be used with the antenna.

By way of example, an antenna operating on a frequency of 116.5 megacycles was constructed as follows: The metal frame 1 was approximately 6 feet on a side and the conductive elements 3 were formed using horizontal wires 0.125 inch in diameter and spaced on 3-inch centers. The radiator arms 9, 11 were made of ¾ inch inside diameter copper tubing each 20⅝ inches long. The conductive supporting elements 5, 5', 7 and 7' were made of brass members ⅜ inch thick, 2 inches wide and 24¼ inches long, the length being measured to the center of the radiators. The elements 5, 5' forming a supporting pair were spaced apart ⅝ of an inch. The inductive conductor 13 consisted of a brass tube having an outside diameter of ⅜ inch. The shorting plugs 19, 21 were located six inches from the remote ends of the radiator arms. The transmission lines 23, 25 were made of ⅜-inch concentric transmission line. At the point where the inner conductors of the transmission lines emerged from the outer conductors, insulating end seals were used.

The graph of Fig. 4 shows the relation between the length of the radiator arms and the standing

wave ratio which appeared on the main feed line. The standing wave ratio is the minimum voltage measured at one point on a transmission line to the voltage measured at a point one quarter wave length along the line. The thus described antenna exhibited a unidirectional radiation pattern which had subtended an angle of approximately 80° at the point where the signal was 50 percent of the maximum signal.

Thus the invention has been described as a simple but effective dipole antenna or pair of dipole antennas which are constructed almost wholly of metal parts. The lengths of the several parts are chosen so that the elements of the antenna exhibit the required electrical characteristics. The radiating members which are designed to have a capacitive reactance are connected by an inductive element which serves to neutralize the capacitive reactance and to impart strength to the antenna array. It should be understood that a single antenna may be used in place of a pair.

I claim as my invention:

1. An antenna including a pair of conductive supporting sections, a pair of radiator arms consisting of oppositely disposed hollow sections secured at their inner ends to said supporting sections to form a dipole radiator exhibiting capacitive reactance at the operating frequency, a conducting member disposed within said hollow sections and connected to the remote ends thereof, and conducting plugs arranged within said radiator arms to short circuit said conducting member to said hollow sections at such points that said capacitive reactance is neutralized whereby said antenna is resonant at the operating frequency.

2. An antenna including a pair of quarter wave conductive supporting sections, a pair of radiator arms consisting of oppositely disposed hollow sections secured at their inner ends to said supporting sections to form a dipole radiator exhibiting capacitive reactance at the operating frequency, a conducting member disposed within said hollow sections and connected to the remote ends thereof, and conducting plugs arranged within said radiator arms to short circuit said conducting member to said hollow sections at such points that said capacitive reactance is neutralized whereby said antenna is resonant at the operating frequency.

3. An antenna including a ground screen, a pair of quarter wave conductive supporting sections secured to said ground screen, a pair of radiator arms consisting of oppositely disposed hollow sections secured at their inner ends to said supporting sections to form a dipole radiator exhibiting capacitive reactance at the operating frequency, a conducting member disposed within said hollow sections and connected to the remote ends thereof, and conducting plugs arranged within said radiator arms to short circuit said conducting member to said hollow sections at such points that said capacitive reactance is neutralized whereby said antenna is resonant at the operating frequency.

4. An antenna including a ground screen, two pairs of quarter wave conductive supporting sections secured to said ground screen and spaced apart substantially one-half of the operating wave length of said antenna, pairs of radiator arms, each of said pairs of arms consisting of oppositely disposed hollow sections secured at their inner ends to said supporting sections to form a dipole radiator exhibiting capacitive reactance at the operating frequency, two conducting members respectively disposed within said hollow sections and connected to the remote ends thereof, and conducting plugs arranged within said radiator arms to short circuit said conducting members to said hollow sections at such points that said capacitive reactance whereby said antenna is resonant at the operating frequency.

5. An antenna of the character of claim 1 including a concentric transmission line having its outer conductor connected to one of said supporting sections and its inner conductor connected to the other of said supporting sections at a point adjacent the radiator arm which is supported by said section.

6. An antenna according to claim 4 including a pair of half wave concentric transmission lines connected between said pairs of radiator arms and terminating in a common connection, and means for connecting said common connection to a radio device.

7. An antenna system including a plurality of dipoles effectively connected in paralell to a common utilization circuit, each comprising opposed tubular radiating elements and a concentric rod electrically connected at its ends to the corresponding outer ends of said radiating elements, said dipoles being of shorter than resonant length at the frequency at which the system is to operate, and short circuiting plugs positioned within said tubular elements to connect said rod to said tubular elements at points such that each of said antennas is turned to said operating frequency and presents to said utilization circuit an impedance of such value that the impedance of all of said dipoles in parallel matches the impedance of said utilization circuit.

8. An antenna including two pairs of conductive supports, pairs of radiator arms, each of said pairs of arms consisting of oppositely disposed hollow sections secured at their inner ends to said supporting sections to form a dipole of shorter than resonant length at the operating frequency, two conductive rods respectively disposed within said hollow sections and connected to the remote ends thereof, and conductive plugs arranged within said radiator arms to short circuit said conductive rods to said hollow sections at such points that said antenna is tuned to said operating frequency.

GEORGE H. BROWN.