May 24, 1949. D. JACKSON 2,471,215

RADIO ANTENNA

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FIG. 1.

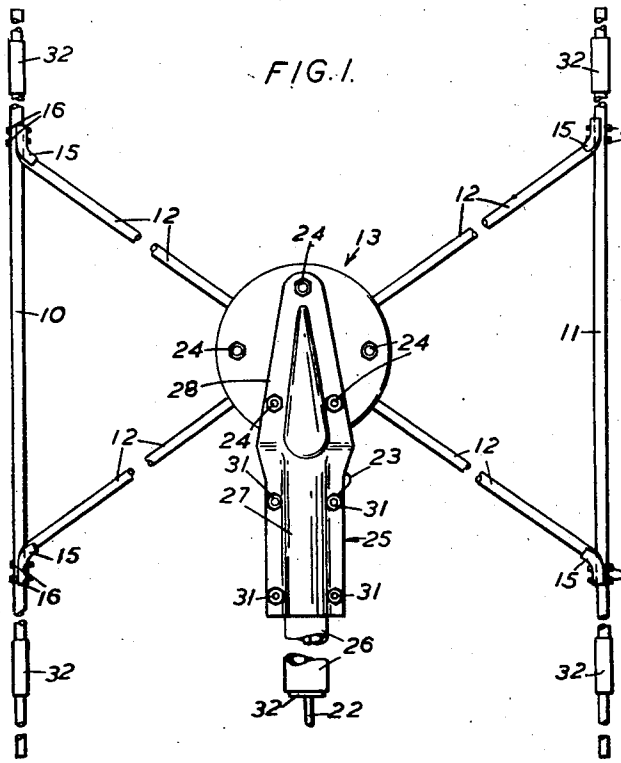


FIG. 4.

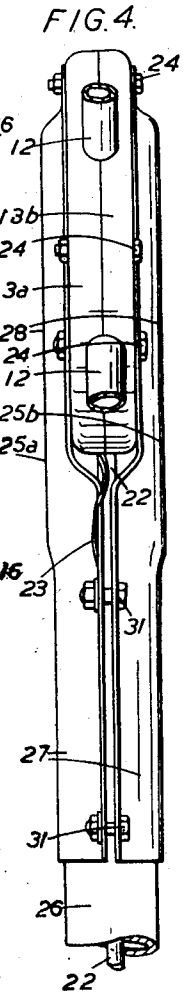


FIG. 2.

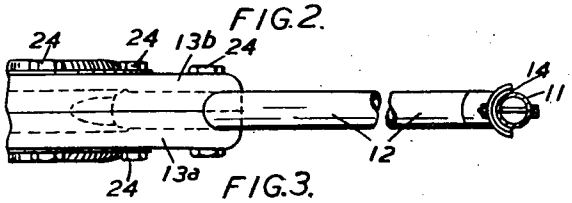


FIG. 3.

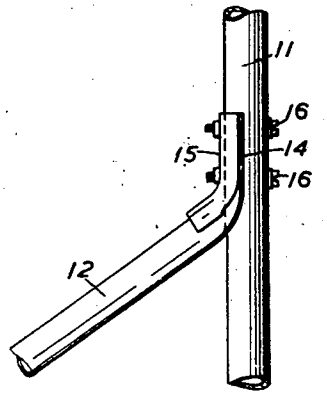
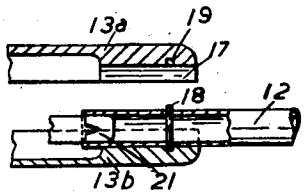


FIG. 6.



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FIG.5.

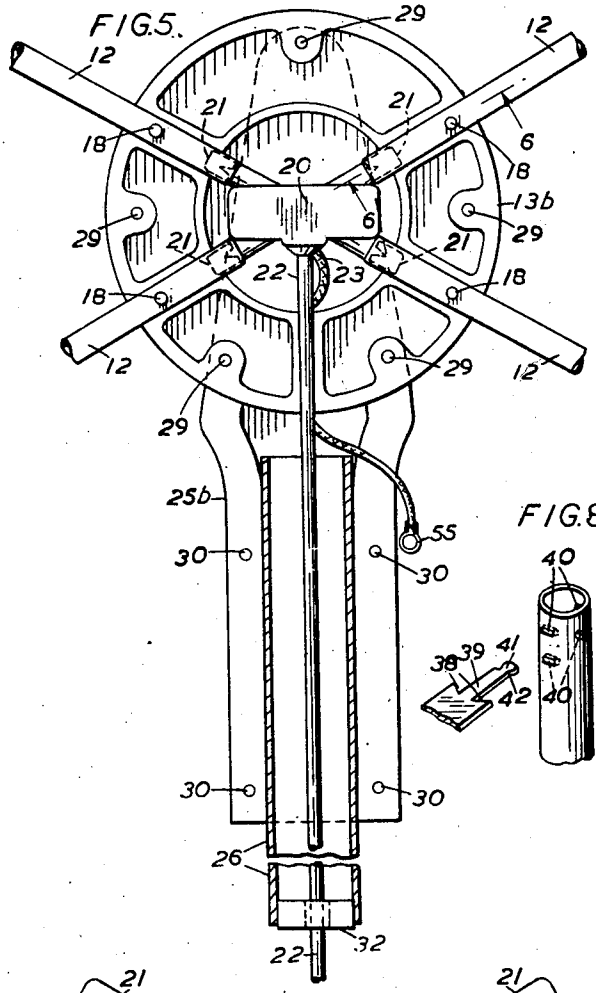
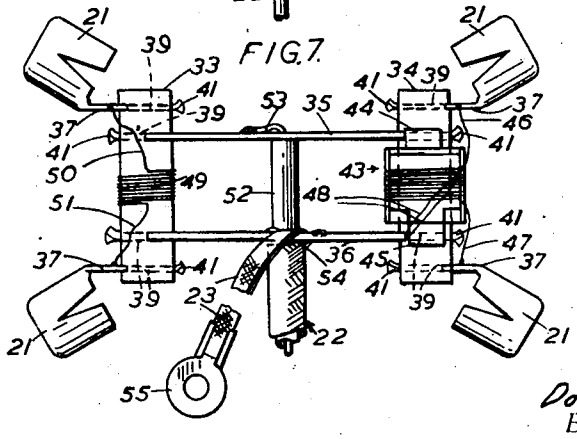


FIG.8.

FIG.7.



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RADIO ANTENNA

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8 Claims. (Cl. 250—33.65)

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This invention relates to radio antennae, and more particularly to antennae for the reception of ultra-short waves, such as television signals.

Among the objects of this invention are to provide an efficient ultra-short wave antenna; an antenna of simple and sturdy construction which is simple to erect in a desired location; an antenna comprising light but sturdy and durable parts convenient for packing and transportation but easily assembled into a sturdy and durable structure; an antenna structure incorporating improved impedance matching means for coupling the antenna to the down lead or cable leading from the antenna for connection to a receiver; and an improved impedance matching unit for ultra-short wave antennae. Other objects will be in part apparent and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts as will be exemplified in the structure to be hereinafter described and the scope of the application of which will be indicated in the appended claims.

In this specification and the accompanying drawings, I have shown and described a preferred embodiment of the invention, but it is to be understood that this is not intended to be regarded as exhaustive nor limiting of the invention but, on the contrary, is given for purposes of illustration in order that others skilled in the art may fully understand the invention and the principles thereof and the manner of applying it in practical use so that they may modify and adapt it in various forms, each as may be best suited to the conditions of a particular use.

In the drawings,

Fig. 1 is a fragmentary front elevation of the antenna.

Fig. 2 is a partially sectional plan view of part of the structure shown in Fig. 1.

Fig. 3 is a fragmentary elevation showing more clearly a detail of the structure of Fig. 1.

Fig. 4 is a fragmentary side elevation showing the housing and bracket assembly.

Fig. 5 is a fragmentary partially sectional front elevation of the assembly of Fig. 4, with one half of the housing and of the bracket removed.

Fig. 6 is a fragmentary exploded sectional view of the housing with a stay rod in position, the section being taken along the line 6—6 of Fig. 5 but with the other half of the housing shown in exploded position.

Fig. 7 is an elevation of the impedance matching assembly prior to being moulded, and

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Fig. 8 is a fragmentary perspective view showing more clearly a detail in the assembly of the structure of Fig. 7.

In the preferred form of the invention, the antenna structure comprises two rods of suitable conducting material, conveniently metal, which constitute respectively the receiving antenna proper and the reflector, each rod being supported by two stay rods from a housing which accommodates impedance matching means for coupling the antenna to the down lead or cable leading from the structure for connection to a receiver. Preferably, the stay rods not only serve as supports for the antenna and reflector rods, but are also utilised as feeders for those rods, and are accordingly secured to the antenna and reflector rods at the correct feed points thereof. The impedance matching means are preferably constructed as a unit, preferably by embedding and enclosing the components thereof in insulating material moulded therearound to seal the components in the moulding, so making the unit waterproof. The matching unit is preferably provided with terminal connectors over which the ends of the stay rods entering the housing may be fitted, means being provided for holding those ends of the stay rods captive in the housing.

Referring now to the drawings, the antenna structure shown comprises receiving antenna and reflector rods 10 and 11 each fitted with two rubber sleeves 32 and each supported by a pair of stay rods 12 from the housing 13. For strength and lightness, all the rods are preferably tubular and may be made, for example, of aluminium. The antenna shown is intended to be mounted with the rods 10 and 11 vertical for receiving certain broadcast television signals, and the receiving rod has been made approximately 10' long and the reflector rod approximately 11'3'' long. In view of the length of these rods, they may, if desired, each be made in two or more sections adapted to be joined together end to end, for example, by making each rod section of half-round cross-section at the joint and bolting the joints together. For such an antenna, the stay rods 12 may each be approximately 2'6'' long, and each being connected at its outer end to the associated vertical rod at the correct point for utilising the stay rod as a feeder. With the rod dimensions given, the outer ends of the stay rods have been secured to the vertical rods at a distance approximately 1'3'' from the midpoint of each vertical rod. For effecting a firm and secure connection, the outer ends 14 of the stay

rods 12 are bent at an appropriate angle and squashed into a concave form to snugly embrace the vertical rods (as better seen in Figs. 2 and 3), and are fitted correspondingly shaped clamping shoes 15, bolts 16 being passed through registering holes in the vertical rods, outer ends of the stay rods and the clamping shoes to bolt the rods together. The bolts 16 may be nutted, as shown, or the holes provided in the clamping shoes 15 may be extruded and tapped, into which the bolts are screwed.

The stay rods 12 are arranged at inclinations to the vertical rods so that the inner ends of the stay rods enter the housing 13 radially. The housing 13 is preferably made of insulating material, conveniently a plastic moulding, and is made in two similar matching halves 13a, 13b formed with radial matching grooves one of which is seen at 17 in Fig. 6, for accommodating the inner ends of the four stay rods. The inner end of each stay rod is provided with a pair of diametrically opposed holes through which a pin 18 is inserted and the ends of which extend into blind holes, one of which is seen at 19 in Fig. 6, formed in the housing halves at the bottoms of the grooves 17 so as to locate and hold the stay rods captive in the housing 13. The latter is formed with a hollow centre portion which accommodates a moulded impedance matching unit 20 having metallic terminal caps 21 disposed at the correct angles for insertion respectively into the inner ends of each of the four tubular stay rods, as more clearly shown in Fig. 5.

The housing halves 13a, 13b are also formed with matching grooves (not clearly seen in the drawings) through which a screened coaxial cable 22 from the matching unit 20 passes out of the housing 13, along with a flexible grounding conductor 23 from the unit.

In assembling the housing 13, the four stay rods 12 may be pressed on to the caps 21 of the matching unit 20, and the unit laid in the centre of one of the housing halves, say 13b, as shown in Fig. 5, with the inner ends of the stay rods resting in their grooves 17 and the cable 22 and grounding wire 23 laid in their groove, as shown, the arrangement being such that the locating pins 18 can be inserted in position. The other housing half is then laid on top, and the two housing halves 13a, 13b bolted by nutted bolts 24 passed through holes 29 (Fig. 5) in the housing halves, to hold all the parts in the correct assembled relation.

As shown, certain of the bolts 24 are also utilised for clamping to the housing 13 a bracket 25 for mounting the structure on a suitable support, here shown as a tubular metal pole 26. The bracket 25 is in two similar halves 25a, 25b, each comprising a flanged part-cylindrical portion 27 for embracing the top end of the supporting pole 26 and a flanged tapered plate portion 28 for attachment to the housing. The flanges of the two bracket halves have holes therein, those in the flanges of the plate portions 28 receiving certain of the bolts 24, and the holes 30 (Fig. 5) in the flanges of the part-cylindrical portions 27 receiving nutted bolts 31 for clamping the bracket around the top of the pole.

It will be noted that there are some of the bolts 24 which are not required for assembling the bracket halves 25a, 25b on the housing 13. This provision facilitates the assembly operations by enabling the housing 13, matching unit 20 and stay rods 12 to be assembled and securely bolted up by those bolts before proceeding to assemble the bracket 25 with the aid of the remainder of the bolts 24. After bolting the bracket halves to the housing 13 and before inserting the pole 26 into the socket formed by the bracket portions 27, the cable 22 is passed through the pole, which may conveniently be done by weighting the end of the cable and dropping it down the pole, whereafter the top end of the pole is inserted into the bracket portions 27 which are then tightened about the pole by the bolts 31. The grounding conductor 23 protruding from the housing 13 is nutted to one of the bracket bolts 31, as shown. A suitable apertured plug 32, for example of wood, may be slipped over the end of the cable and pressed into the bottom end of the pole 26 in order to prevent the cable from chafing against the bottom edge of the pole. The assembled antenna may then be erected in the desired location by hoisting and clamping the pole to a wall or chimney structure, for example.

For the described antenna having a receiving rod and a reflector rod, the impedance matching unit 20 incorporates a matching transformer for the receiving rod and a balancing coil for the reflector. A preferred construction is shown in Fig. 7, this figure showing the assembly of components prior to being embedded in an insulating moulding. Two cylindrical formers 33 and 34 of insulating material are located in substantially parallel spaced relation by two substantially parallel spaced metal strips 35 and 36 which support the formers. Each former carries at its ends two of the connector caps 21 of the unit, each cap being secured to its former by a tag 37 arranged at an inclination to the cap axis so that the cap is disposed in the correct angular direction for receiving the end of the associated stray rod 12 earlier mentioned. Each cap 21 and its tag 37 may be stamped and formed in one piece from strip metal. The ends of the supporting strips 35, 36 and the tags 37 are all secured to their formers in identical fashion, which may be more clearly understood from a consideration of Fig. 8 in conjunction with Fig. 7. Fig. 8 is illustrative of the mode of attachment at either end of either former. The end of each tag 37 and each end of each of the strips 35, 36 is formed with a radiused edge 38 from which projects a narrow tongue 39 which is passed through a pair of aligned diametrically opposed slots 40 in the former, so that the radiused edge snugly abuts against and partially embraces the circumference of the former (as clearly seen in Fig. 7) and a portion 41 at the extremity of the tongue protrudes through the former. The portion 41 is then twisted out of alignment with the main body of the tongue and with the adjacent slot 40, thereby securing the strip 35 or 36 or tag 37, as the case may be, to the former. To facilitate such twisting, the tongue 39 is reduced in width at 42, immediately behind its extremity portion 41.

On one former 34 is wound the matching transformer denoted generally by 43. First applied is the secondary which may consist of copper foil strip wound with interleaved insulating strip, the copper being next to the former. The copper strip may have its ends of reduced width and bent at right angles to the main body of the strip and winding so as to provide tags 44, 45 which are respectively connected by soldering to the two metal supporting strips 35, 36. On this secondary winding is wound the primary winding which may consist of a number of double turns of enamelled copper wire, one end 46, 47 of each of the two coils of wire serving as the ends of the pri-

mary winding and being connected by soldering respectively to the tags 37 of the two connector caps 21 mounted on the former 34, and the other ends 48 of the two coils being twisted or otherwise connected together to form a centre tap for the primary winding which is connected by soldering to the lower supporting strip 36.

On the other former 33 is wound the balancing coil 49 for the reflector, consisting, for example, of a number of turns of enamelled copper wire. The ends 50, 51 of the coil 49 are respectively connected by soldering to the tags 37 of the two connector caps 21 mounted on the former 33.

The end of the screened coaxial cable 22 to be connected to the matching unit has its sheathing metal braid (constituting its outer conductor) stripped back, and the lower supporting strip 36 is provided with a hole therein through which the stripped end portion 52 of the cable is passed, the upper supporting strip 35 also having a hole therein through which the centre conductor 53 of the cable is passed and connected by soldering to the upper supporting strip 35. The outer conductor braid 54 of the cable is connected by soldering to the lower supporting strip 36. The grounding conductor 23, which may be a length of tinned copper braid provided with a terminal tag 55 at one end is also connected by soldering to the lower supporting strip 36.

The impedance matching assembly described and shown in Fig. 7 is then placed in a die and a suitable insulating material, such as a polythene plastic, moulded therearound to form the moulded unit 20 having the matching assembly embedded therein, with the connector caps 21 exposed and positioned for insertion in the ends of the stay rods 12.

For some purposes, the reflector rod may not be necessary and may be omitted, in which case the antenna may comprise the aerial rod and its associated stay and feeder rods, together with the housing and the impedance matching unit, which need not in that case incorporate a balancing coil. Further, for the reception of some signals, the rods which have herein been called "vertical rods" would have to be disposed in a horizontal or some other non-vertical position.

I claim:

1. An ultra-short wave antenna comprising an antenna rod, a reflector rod spaced from said antenna rod, a housing between said antenna and reflector rods, a coaxial cable having one end thereof within said housing and extending from said housing, impedance matching means within said housing for coupling said antenna rod to said cable, said matching means being conductively connected to said end of said cable, means for supporting said housing, a pair of metallic stay rods supporting said antenna rod from said housing, said stay rods being conductively secured at one end thereof to said antenna rod at spaced feed points therealong and the other ends of said stay rods extending into and being secured within said housing in conductive connection with said matching means for the purpose and with the effect that said stay rods function also as feeders connecting said spaced points of said antenna rod to its said matching means, impedance matching means within said housing for said reflector rod, a second pair of metallic stay rods supporting said reflector rod from said housing, said second pair of stay rods being conductively secured at one end thereof to said reflector rod at spaced feed points therealong and the other ends of said second pair of stay rods extending into and being

secured within said housing in conductive connection with said matching means for said reflector rod for the purpose and with the effect that said second pair of stay rods function also as feeders connecting said spaced points of said reflector rod to its said matching means.

2. An ultra-short wave antenna comprising an antenna rod, an insulating housing, a coaxial cable extending from said housing with one end of said cable within said housing, an impedance matching unit within said housing including an insulating moulding having exposed terminal connectors thereon and impedance matching means for coupling said antenna rod to said cable embedded and sealed within said moulding and conductively connected to said terminal connectors, said end of said cable being embedded and sealed in said moulding in conductive connection with said matching means, means for supporting said housing, a pair of metallic stay rods supporting said antenna rod from said housing, said stay rods being conductively secured at one end thereof to said antenna rod at spaced feed points therealong and said stay rods extending at the other ends thereof into said housing, said other ends of said stay rods being tubular and respectively fitting over said terminal connectors of said matching unit to conductively connect said stay rods with said matching means for the purpose and with the effect that said stay rods function also as feeders connecting said feed points of said antenna rod to its said matching means, and means for holding said tubular ends of said stay rods captive in said housing.

3. An antenna as defined in claim 2, said housing comprising two recessed matching halves forming a chamber to accommodate said impedance matching unit and having matching grooves forming apertures through which said stay rods respectively enter said housing, cross pins respectively passing transversely through said tubular ends of said stay rods and having the extremities of said pins received in recesses in said housing halves to locate and hold said stay rods captive in said housing, and means for securing said housing halves together.

4. An antenna as defined in claim 3, and further comprising a pair of bracket members positioned at opposite sides of said housing, means for securing said members together to clamp said housing between them, said members having matching portions extending beyond said housing and forming a socket for receiving a supporting pole for the antenna.

5. An ultra-short wave antenna comprising an antenna rod, a reflector rod spaced from said antenna rod, an insulating housing between said antenna and reflector rods, a coaxial cable extending from said housing with one end of said cable within said housing, an impedance matching unit within said housing including an insulating moulding having two pairs of exposed terminal connectors thereon, impedance matching means for coupling said antenna rod to said cable embedded and sealed within said moulding and conductively connected to a first pair of said terminal connectors, and impedance matching means for said reflector rod embedded and sealed within said moulding and conductively connected to the second pair of said connectors, said end of said cable being embedded and sealed in said moulding in conductive connection with said matching means for said antenna rod, means for supporting said housing, a first pair of metallic stay rods supporting said antenna rod from said housing,

said stay rods being conductively secured at one end thereof to said antenna rod at spaced feed points therealong and said stay rods extending at the other ends thereof into said housing, said other ends of said stay rods being tubular and respectively fitting over said first pair of terminal connectors to conductively connect said first pair of stay rods with said matching means for said antenna rod, whereby said stay rods function also as feeders connecting the said feed points of said antenna rod to its said matching means, a second pair of metallic stay rods supporting said reflector rod from said housing, said second pair of stay rods being conductively secured at one end thereof to said reflector rod at spaced feed points therealong and extending at the other ends thereof into said housing, said other ends of said second pair of stay rods being tubular and respectively fitting over said second pair of terminal connectors to conductively connect said second pair of stay rods with said matching means for said reflector rod, whereby said second pair of stay rods function also as feeders connecting the said feed points of said reflector rod to its said matching means, and means for holding said tubular ends of all said stay rods captive in said housing.

6. An antenna as defined in claim 5, said housing comprising two recessed matching halves forming a chamber to accommodate said impedance matching unit and having matching grooves forming apertures through which said stay rods respectively enter said housing, cross pins respectively passing transversely through said tubular ends of said stay rods and having the extremities of said pins received in recesses in said housing halves to locate and hold said stay rods captive in said housing, and means for securing said housing halves together.

7. An antenna as defined in claim 6, and further comprising a pair of bracket members positioned at opposite sides of said housing, means for securing said members together to clamp said housing between them, said members having matching portions extending beyond said housing and forming a socket for receiving a supporting pole for the antenna.

8. An ultra-short wave antenna comprising an antenna rod, a reflector rod spaced from said antenna rod and sustantially parallel thereto, an insulating housing between said antenna and reflector rods, a coaxial cable extending from said housing with one end thereof within said housing, two pairs of metallic stay rods radiating from said housing and having inner tubular ends secured within said housing, the outer ends of a first pair of said stay rods being conductively attached to said antenna rod at spaced feed points therealong substantially equidistant from the midpoint of said antenna rod, the outer ends of the second pair of said stay rods being conductively attached to said reflector rod at spaced feed points therealong substantially equidistant from the midpoint of said reflector rod, an impedance matching unit within said housing including an insulating moulding having said end of said cable embedded and sealed therein and having two pairs of terminal connectors radiating therefrom respectively aligned with and fitting within said tubular inner ends of said stay rods so that a first pair of said connectors is conductively connected respectively to said first pair of stay rods and the second pair of said connectors is conductively connected respectively to said second pair of stay rods, an impedance matching transformer for coupling said antenna rod to said cable embedded and sealed within said moulding and having a primary winding conductively connected to said first pair of connectors and having a secondary winding connected to the conductors of said cable, said matching unit also including an impedance balancing coil for said reflector rod embedded and sealed within said moulding and conductively connected to said second pair of connectors, whereby said pairs of stay rods respectively function also as feeders connecting said feed points of said antenna rod to said transformer and said feed points of said reflector rod to said balancing coil.

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