June 6, 1950 A. E. LANE ET AL 2,510,287

COLLAPSIBLE MULTIPLE ARM ANTENNA

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Fig. 1

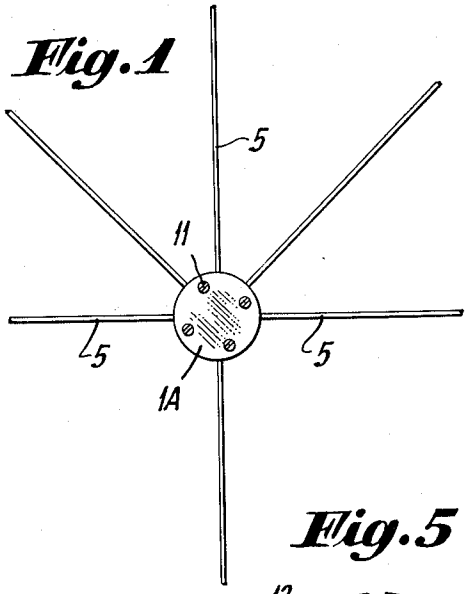


Fig. 3

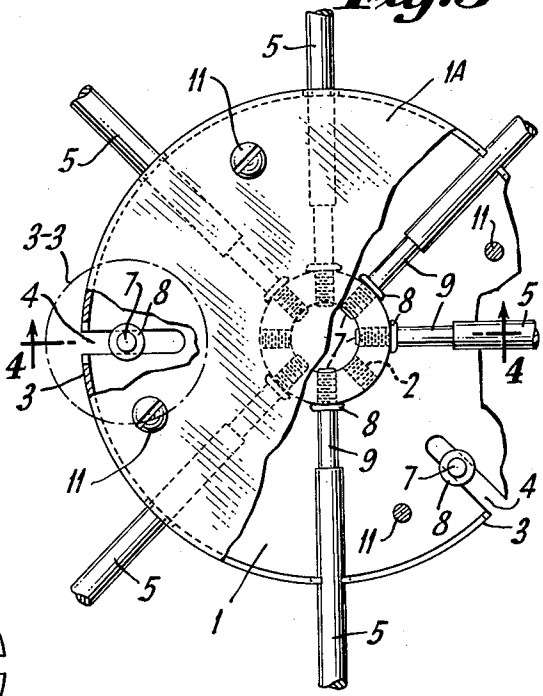


Fig. 5

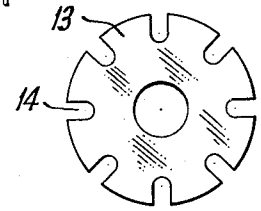


Fig. 2

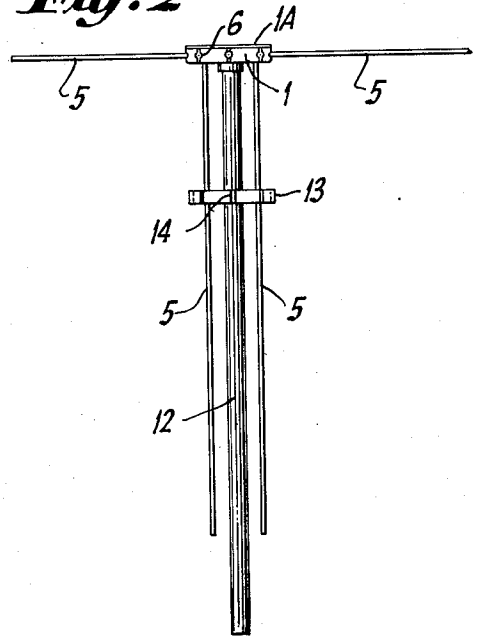
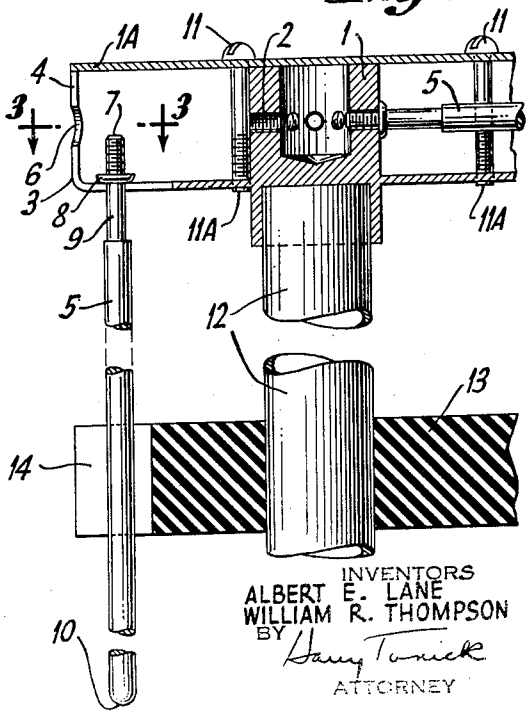


Fig. 4



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Fig. 6

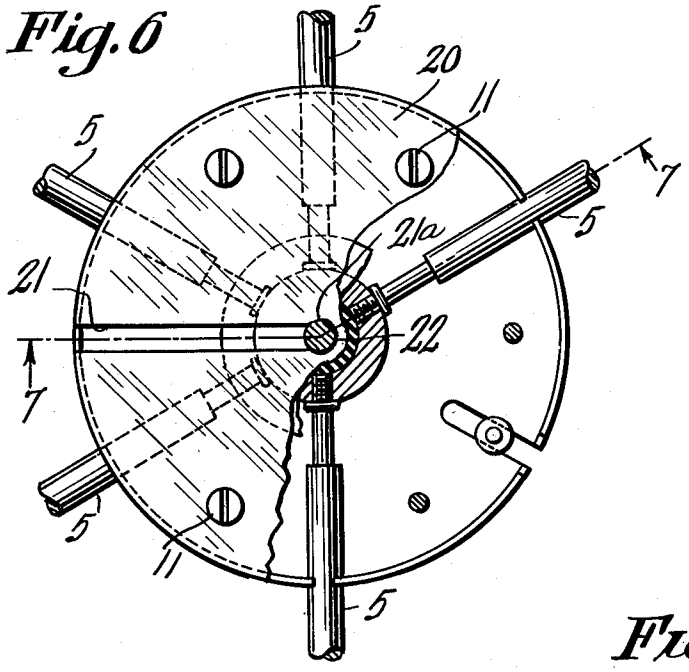


Fig. 7

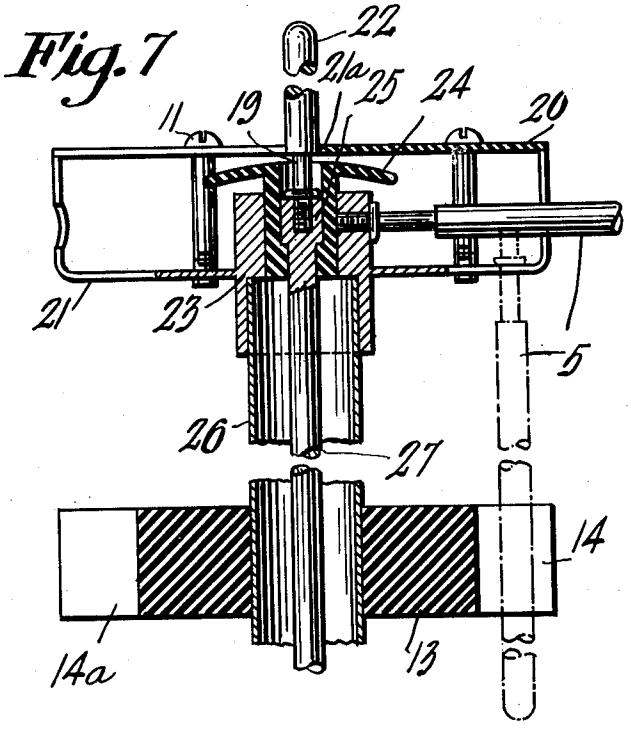
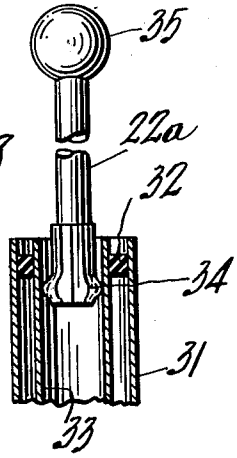


Fig. 8



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COLLAPSIBLE MULTIPLE ARM ANTENNA

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Application December 16, 1948, Serial No. 65,582

4 Claims. (Cl. 250—33)

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This invention relates to a new and useful collapsible multi-arm antenna.

An object of this invention is to provide a multi-arm top loading skirt antenna. Any one, all or various combinations of radiating arms may be collapsed.

Another object of this invention is to provide a simple, improved multi-arm antenna which will provide a ground plane radiation pattern to produce a low vertical angle of radiation.

A feature of this invention is the provision of a central retaining member in the form of a slotted metallic hub serving as a support. The radiating members extend outward from the central retaining member in a horizontal direction and are spaced apart radially.

This invention will be best understood by referring to the accompanying drawing in which:

Figure 1 is a plan view of the antenna of this invention;

Figure 2 is a side elevation of Figure 1;

Figure 3 is an enlarged portion partly in section of the antenna radiating element;

Figure 4 is a cross sectional view of Figure 3;

Figure 5 is a detail plan view of a slotted retaining member;

Figure 6 is a plan view of a modification of Fig. 3;

Figure 7 is a cross sectional view taken on line 7—7 of Fig. 6 and;

Figure 8 is a cross sectional view of a modification of Fig. 7.

Referring now in detail to the drawing, the antenna of this invention consists of a central cupped shaped metallic hub 1 which is provided with eight holes (more or less as required) tapped horizontally at 2, the tapped holes being radially extending outward to a rim portion 3 which is provided with a plurality of slots 4 arranged to register in line with the tapped holes 2. A plurality of radiating elements 5 are arranged to pass through slots 4 and to be screwed into the tapped holes 2 for making electrical contact therewith and receiving mechanical support. The arms or radiating elements 5 pass through a circular hole 6 in the solts 4 to permit the assembly of the arms and to retain them in operative position. The slots 4 permit the elements 5 to fold when detached. The arms 5 consist of a threaded end 7, a retaining collar 8, a neck portion 9 and a rounded end portion 10. The arms when unscrewed from the central hub portion are first pulled clear of the rim hole 6 and are held captive by the lower slotted portion 4 formed in the rim and the collar 8. The central hub 1 is

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covered by a metallic disc 1A, which is placed over the hub after assembly and prevents detachment of the radiating arms. The disc 1A is secured in place by a plurality of round head screws 11 which are tapped in the lower portion of the rim at 11A. A tubular support 12 extends downward from the hub portion 1 and has located thereon a retaining collar 13 which has slots corresponding with the radial slots 3 member 1. The radiating arms 5 when collapsed are retained by spring clips, rubber clasps or other suitable devices 14 located in the slots of the retaining member 13. The feed connections are made to the metallic support tube 12 and hub 1 as they serve as common conductors of the antenna. Although eight radiating members are shown by example only, there may be provided a lesser or greater number of arms equally or unequally spaced according to the desired number and placing of such arms.

The modification shown by Figs. 6 and 7 is somewhat similar to that shown in Figs. 1, 2, 3 and 4 except the cover 20 is of insulation material and slotted at 21 to permit the passage of an additional vertical radiating member 22. A circular aperture 21*a* retains member 22 in its operative position. The hub member 23 is open at the center to receive an insulator and rain shield 24 constructed of high grade insulating material. A metal insert 25 is located within insulator 24. The insert being threaded at one end to receive the threaded end of the vertical radiator 22 and at the other end to connect to an inner conductor. The neck portion 19 is made slightly smaller than slot 21 so as to pass freely in it. The slot 21 continues around to the side and along a part of the under portion of the metal housing 23 in order that the vertical radiator may be collapsed in the same manner as the radiators 5. With this construction it will be necessary to have an additional slot 14*a* intermediate the slots 14 in member 13 to retain the vertical radiator 22. In this modification the feed connections are made to the metal support tube 26 which serves as the outer conductor of a coaxial transmission line and to the tube 27 which acts as the inner conductor and is also connected to insert 25. This modification makes an improved type of collapsible ground plane antenna.

Fig. 8 illustrates a coaxial conductor having an outer conductor 31. An insulator 32 which concentrically locates an inner conductor 33. Inner conductor 33 is shown slightly enlarged to more clearly show a slotted spring contact brush 34 for making good electrical contact between the

inside wall of conductor 33 and a vertical radiator 22*a*. A metallic ball 35 is secured to the end of radiator 22 and is larger in diameter than tube 33. The ball 35 serves as a stop and also a knob to hold onto when elevating the radiator 22*a* to a desired height. With this construction the slot 21 can be omitted. Improved results can be obtained by the selection of different elevations of the vertical radiator above the plane of the radial radiators 5.

Below are listed various uses for the antenna.

1. To provide increased effective height thus, increasing efficiency at lower frequencies.

2. In a transmitting condition to suppress high angle radiation, thereby reducing the effect of "fading," "swinging" etc.

3. In a receiving condition to increase efficiency of collection of radio waves over broad frequency bands, and to suppress high angle radiation which tends to distort the received signals.

4. For direction finding to increase efficiency of collection of the desired waves and to enlarge the frequency spectrum over which a direction finding system is effective.

5. To provide means for improving at will the directivity of one or more vertical antennas used in combination for goniometric purposes; as for example, when four such antennas are interconnected in a phase rotated system to produce instantaneous indication of bearings on any desired radio signals.

6. In a transportable system to permit quick disassembly and stowage of one or more antennas used in a transmitting or receiving apparatus; as for example, in military use, where speed and compactness are essential.

What is claimed is:

1. A transportable unitary antenna structure comprising an elongated conductive supporting member, a conductive hub member affixed to one end of said supporting member, said hub member having a plurality of slots therein arranged in planes radiating from the axis of said hub, said slots being uniform in width for the greater part of their length and having a widened portion at a point remote from said hub member, a plurality of elongated conductive members individual to each of said slots, each of said conductive members having a collar portion near one end, and means to affix said one end of said elongated members to said hub member in conductive relationship, the transverse dimensions of said elongated conductive members permitting passage in the axial direction thereof through said slots, and the transverse dimensions of said collar portion being greater than the width of said slot whereby said elongated members are held captive in both the operating and the non-operating positions.

2. A transportable unitary antenna structure comprising an elongated conductive supporting member, a conductive hub member affixed to one end of said supporting member, said hub member having a plurality of slots therein arranged in planes radiating from the axis of said hub, said slots being uniform in width for the greater part of their length and having a widened portion at a point remote from said hub member, a plurality of elongated conductive members individual to each of said slots, each of said conductive members having a constricted portion interposed between shoulder and collar portions near one end, and means to affix said one end of said elongated members to said hub member in conductive relationship, the transverse dimensions of said elongated conductive members permitting passage in the axial direction thereof through the widened portions only of said slots, whereby each of said elongated conductive members may be supported in operating position at said hub member and at said widened portion of the slot, the transverse dimensions of said collar portion being greater than the widened portion of said slot whereby said elongated members are held captive in both the operating and the non-operating positions.

3. A transportable unitary antenna structure comprising an elongated conductive supporting member, a conductive hub member affixed to one end of said supporting member, said hub member having a plurality of slots therein arranged in planes radiating from the axis of said hub, said slots being uniform in width for the greater part of their length and having a widened portion at a point remote from said hub member, a plurality of elongated conductive members individual to each of said slots, each of said conductive members having a short undercut portion interposed between shoulder and collar portions near one end, means to affix said one end of said elongated members to said hub member in conductive relationship, the transverse dimensions of said elongated conductive members permitting passage in the axial direction thereof through the widened portions only of said slots, whereby each of said elongated conductive members may be supported in operating position at said hub member and at said widened portion of the slot, the transverse dimensions of said collar portion being greater than the widened portion of said slot whereby said elongated members are held captive in both the operating and the non-operating positions.

4. A transportable unitary antenna structure comprising a tubular conductive supporting member, a conductive hub member affixed to one end of said supporting member, said hub member having a plurality of slots therein arranged in planes radiating from the axis of said hub, said slots being uniform in width for the greater part of their length and having a widened portion at a point remote from said hub member, a plurality of elongated conductive members individual to each of said slots, each of said conductive members having a short undercut portion interposed between shoulder and collar portions near one end, means to affix said one end of said elongated members to said hub member in conductive relationship, the transverse dimensions of said elongated conductive members permitting passage in the axial direction thereof through the widened portions only of said slots, whereby each of said elongated conductive members may be supported in operating position at said hub member and at said widened portion of the slot, the transverse dimensions of said collar portion being greater than the widened portion of said slot whereby said elongated members are held captive in both the operating and the non-operating positions, a hollow inner conductor arranged concentrically within said tubular supporting member and insulated from said hub member, and a further elongated conductive member adapted to be extended from and inserted into said inner conductor in the operating and non-operating positions.

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