May 4, 1954 J. W. COLLINS ET AL 2,677,764

FOLDABLE HIGH-FREQUENCY ANTENNA

Filed March 9, 1950 2 Sheets-Sheet 1

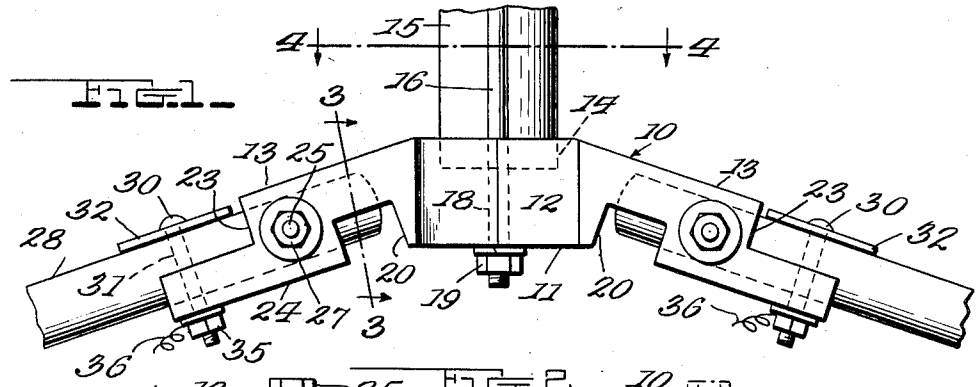


FIG. 1

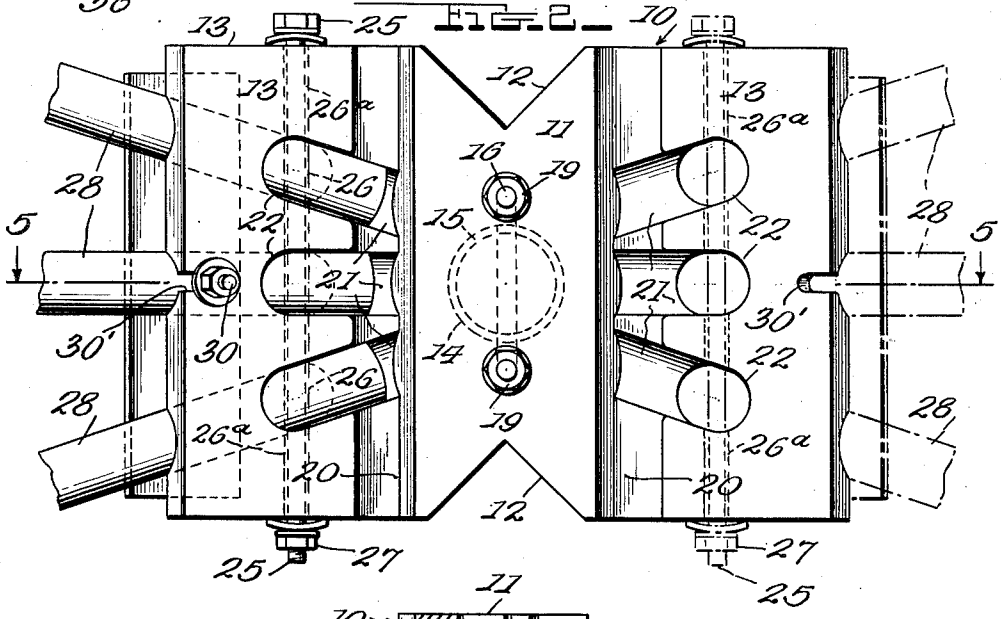


FIG. 2

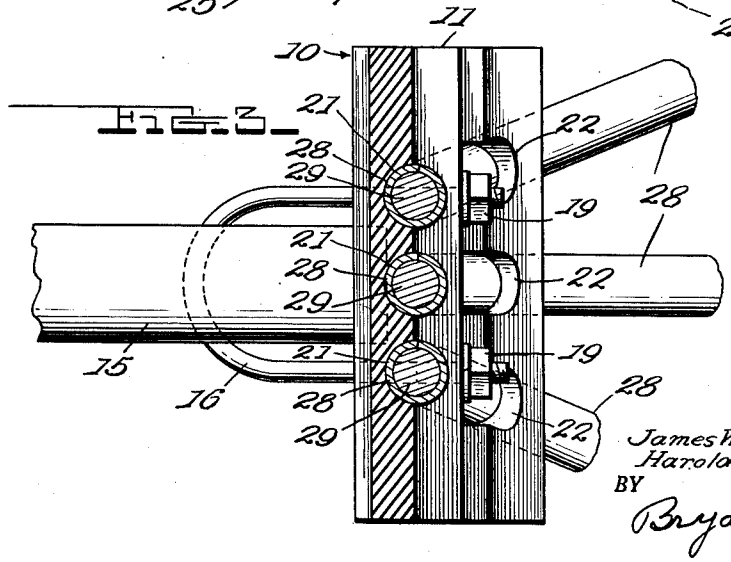


FIG. 3

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FIG. 4

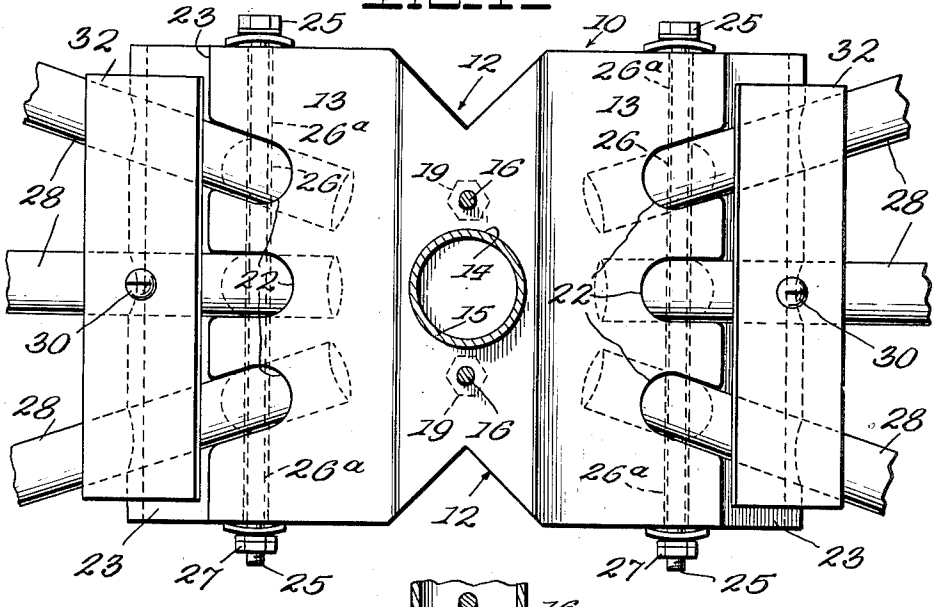


FIG. 5

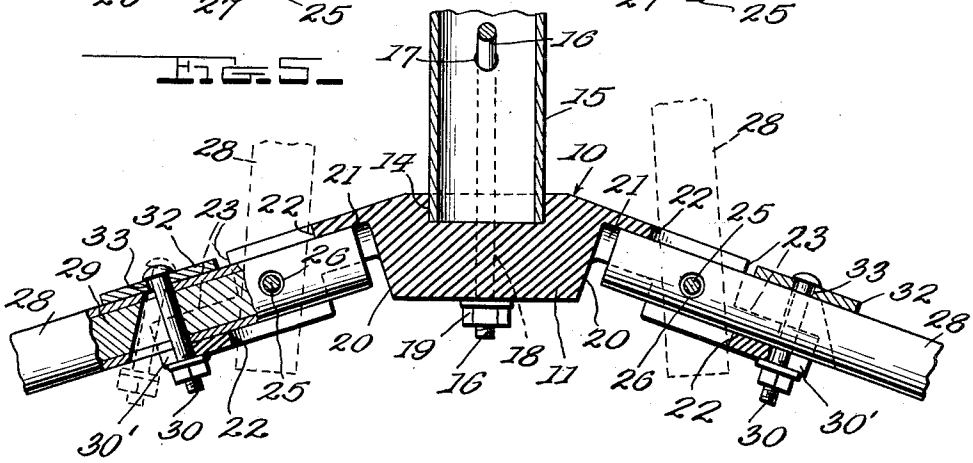


FIG. 6

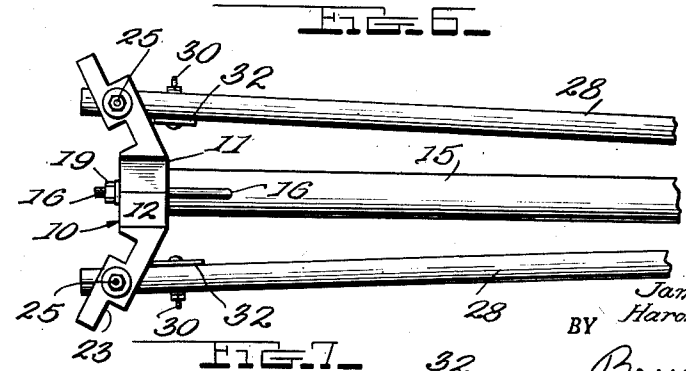
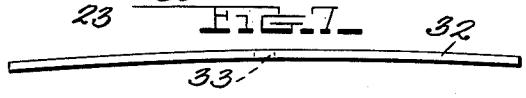


FIG. 7



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FOLDABLE HIGH-FREQUENCY ANTENNA

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Application March 9, 1950, Serial No. 148,621

1 Claim. (Cl. 250—33)

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This invention relates to improvements in antenna used in receiving high frequency radio waves and particularly those antenna designed for receiving short wave transmissions in the television, frequency modulation and ultra-short wave range.

The primary object of the invention is to provide a highly efficient but simple antenna construction, especially of the X type, which can be economically produced, assembled and mounted, and which gives maximum receiving efficiency while capable of being folded back into an extremely compact unit form for packing, shipment or storage and also capable of being readily set up for use.

A further object is to provide an antenna comprising a simple and novel insulator so formed as to support a plurality of hinged antenna elements or aerial collecting radiators mounted in sets each capable of being simultaneously held in operative position rigid with the insulator and when so held to be arranged in conical form with the elements in spaced diverging radiating fan-like relation, and also adapted to be simultaneously released from the operative position in which held and folded in parallelism toward each other and contiguous to a mast or cross bar which may be adapted to support a reflector in association with similar antenna elements, or with the insulators and antenna elements supported in stacked or superposed relation, the construction being preferably of corrosion proof, durable elements with no loose joints in the assembly and a plurality of sets of antenna units or element sections supported on a mast one above the other to give strong and clear reception.

A still further object is to provide a novel and simple insulator for hingedly supporting the antenna elements and a reflector supporting cross bar, which insulator may be molded in one piece complete so as to generally eliminate expensive machining operations in order to receive and support said elements, and in which each set of a plurality of elements is supported to extend in opposite directions and hingedly or collapsibly and swivelly mounted on a common pivot to move to extended operative position or inoperative compactly folded position, and each set held by a single clamping plate and bolt with the elements arranged in the form of a cone silhouette maintained in two planes by the angular shape of the insulator irrespective of the number of elements employed and the plates serving to complete an electrical circuit of all elements on a given side and common take-off point for the

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transmission line from each clamping and holding means or bolt thereof.

With the above and other objects in view, as will be presently apparent, the invention consists in general of certain novel details of construction and combinations of parts hereinafter fully described, illustrated in the accompanying drawings, and particularly claimed.

In the drawings, like characters of reference indicate like parts in the several views, and

Figure 1 is a plan view of a television receiving antenna in accordance with the present invention;

Figure 2 is a front side view;

Figure 3 is a vertical sectional elevation taken on the section line 3—3 of Figure 1;

Figure 4 is an inside vertical sectional elevation taken on the line 4—4 of Figure 1;

Figure 5 is a sectional elevation taken on the section line 5—5 of Figure 2, with the hinged elements extended, and showing said elements folded in dotted lines;

Figure 6 is a side elevation of the device folded; and

Figure 7 is an edge view of one of the flexible, resilient, arched or curvilinear metal clamping plates used for holding a plurality of antenna elements of each set in extended operative position.

Referring to the drawings in detail, the television receiving antenna improvement of the present invention consists of an insulator 10 of suitable electrical insulating or dielectric material, such as "Bakelite," a phenolic condensation product or synthetic resin, hard rubber, porcelain, or the like, but, preferably, the former. The insulator is preferably molded in one piece complete, or integral member, but may be otherwise formed in obtuse angular shape looking from the side and rectangular in plan. It has a flat central body portion 11 of substantially rectangular and oblong shape which may be provided with V notches or recesses 12 at the sides of the insulator or ends of said body portion 11 to facilitate fabrication and handling as well as to save or economize in the use of material and lighten the weight. The ends of the insulator comprise flat wings or plate portions 13 formed on and extending from the long sides of the central body portion 11 in obtuse angled relation thereto and each other, on two planes intersecting at the center of portion 11 toward which they converge and diverging from each other at acute angles to the plane of portion 11 and an intervening angle of about 120° to each other, but any other angles less than a straight angle, or 180°, may be used.

Body portion 11 may be counterbored centrally in one face such as the one from which end portions 13 diverge for arrangement vertically or horizontally, to form a depressed seat or socket 14 to receive one end of a perpendicularly disposed cross bar 15 preferably of tubular metal. Bar 15 is rigidly held to the insulator 10 at portion 11 or vice versa, that is, an insulator so mounted on one or both ends of the bar by snugly fitting or engaging the same at the socket 14. They are rigidly held connected by any suitable means, such as a U-bolt 16 disposed transversely of the insulator 10 and lengthwise of the central body portion 11 with its bight extending diametrically of bar 15 through opposite aligned holes 17 therein and its legs running spaced externally along the end portion of the bar parallel to its axis and through bores 18 in portion 11 at opposite sides of seat 14 and bar 15 therein with nuts 19 and interposed lock washers on the threaded bolt ends to draw the same tight and clamp the bar and insulator rigidly together.

Portions 13 are each formed at the inner face opposite bar 15 with a transverse recess or groove 20 across the same with spaced radiating or divergent semi-circular inner bottom grooves 21 extending from the inner wall of groove 20 and communicating with aligned bores 22 extending through the thickness of the portions 13 from the front of the groove 20. The outer face of portion 13 is provided with a transverse corner groove, recess or rabbet 23 across the same with spaced radiating or divergent semi-circular outer top grooves 24 in alignment and concentric with grooves 21 and bores 22 through which they extend the same as if formed of bores extending into the wall portions 13 from their outer edges and exposed and opening through the opposite faces at the groove 20 and recess 23. A transverse pivot bolt 25 extends through aligned openings 26 in radiators and collector elements forming arms 28 and also through aligned openings 26a formed in portions 13 of the insulator body during the molding thereof intermediate its wall thickness at grooves 21 and 24 and bores 22 and is held by its head at one end and a nut 27 at the opposite end with interposed lock washers.

Grooves 21 and 24 form seats for antenna elements, aerial collecting rods or radiators 28 constituting the subject matter of a separate application, but which are shown as comprising metal conductor tubes with wood or like cores 29. These elements are extended into the grooves 21 and 24 at the recesses or grooves 20 and 23 across the intersecting bores 22, and all the elements of each set of a plurality, shown as three in number without restriction thereto, are engaged transversely and diametrically by the common pivot bolt 25 to swing or pivot thereon into outwardly divergent relation in operative position in line with the portions 13 of the insulator 10. The elements extend in opposite directions from the ends of the insulator arranged in the shape of a cone silhouette or fan maintained in two divergent planes by the angular shape of the insulator as described. The elements 28 are thus collapsibly hinged to fold inwardly or backwardly on the pivots 25 in compact form as shown in Figure 6 of the drawings, with the inner ends swinging inwardly from the grooves 21 and recess or grooves 20 and into the recesses or cavities formed by the bores 22, and their portions outwardly or at the other side of the pivot swinging upwardly or inwardly from the groove or recesses 24 and recess 23 to positions intersecting portions 13 in angular relation

thereto folded substantially in parallelism toward each other contiguous to mast or cross bar 15 to occupy a minimum of space for packing, shipment or storage.

In order to releasably hold the elements in operative receiving positions rigidly in line with the portions 13, each set thereof has one of the elements, preferably the center one, engaged by a screw 30 through a diametrical bore 31 at right angles to its length and of the portion 13 when receiving the element in operative collecting position. A flexible or resilient arched or curvilinear elongated rectangular metallic clamping plate 32 is apertured centrally at 33 to receive screw 30 beneath the head thereof to contact elements 28 and normal wall of recess 23, if desired, and the screw is adapted to detachably and releasably engage a recess or notch 30' in the free end edge of the wall of portion 13 at the bottom of the central concaved recess 24 thereof and free end edge, and has a nut 35 threaded thereon with an interposed lock washer to engage the inner or bottom face of the wall straddling the notch to draw the screw tight to clamp the elements tight in position. By having the plate slightly arched up at the center and flexible, it contacts the end or outer elements 28 first and is drawn up tightly by the center screw 30 to contact the center element also whereby all are simultaneously held. By turning the nut loose, the screw may be slipped from the notch and allow the elements 28 and clamping plate carried thereby to fold or swing on pivots 25 and in parallel relation toward each other and mast or cross bar 15 in compact form to occupy a minimum of space for compact packing, storage or shipment. The screws 30 may serve as terminal binding posts for connection of lead in or take off wires 36 to electrically connect the elements 28 of each set due to contact with plates 32 which thereby serves as a connector therefor.

With the construction described, the antenna of X type with a cone or fan silhouette may be suitably fastened to a mast at cross bar 15, preferably centrally of its length, or the cross bar may support an antenna or receiving member at each end or stacked, i. e., arranged one above the other on a mast and any number of elements can be accommodated by varying the number of receiving pockets or recesses and bores receiving them, but each set still on a single pivot. A single nut for each set and two nuts for the two sets as described is required for each antenna with efficient receiving and transmitting capacity, especially in the conical diverging arrangement of the antenna elements as shown and described. The insulator may be molded complete with the bores or holes therein and no further machining is necessary. By mounting and holding the foldable antenna elements or tubes as described, no flattening of the tubes or ends thereof is necessary and loss of strength due to flattening is avoided. The device may be readily assembled and compactly folded, all elements folding back into substantially the same plane and in parallel relation, forming a compact unit and minimizing dimensions of packing carton and storage space required.

While there is herein shown and described the preferred embodiment of the invention, it is nevertheless to be understood that minor changes may be made therein without departing from the spirit and scope of the invention as claimed.

What is claimed as new is:

A cone-type antenna structure including an insulating bracket having outwardly extending,

oppositely disposed, substantially planar wings, each of said wings having a plurality of rod-like antenna arms pivotally attached thereto, the arms of said wing when in normal operative arrangement being positioned in a common plane and in diverging fan-like relation each relative to the other, each of said arms being pivotally movable transversely of the plane of said wing about a first axis within the plane of said wing and further pivotally movable about a second axis at right angles to said first axis, a plurality of radiating grooves formed in said wing having their longitudinal axes in a common plane and adapted to receive said antenna arms and retain them in said diverging fan-like relation each to the other when said arms are in fully extended operative position, and releasable clamping means normally holding said arms in said grooves, said arms when released from said grooves being movable about said first axis into

a position transversely of said bracket and about said second axis into parallelism with each other.

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