

Sept. 28, 1965

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ANTENNA SUPPORT FIXTURE WITH QUICK RELEASE
FEATURE TO ENABLE LOWERING AND RAISING

3,208,702

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2 Sheets-Sheet 1

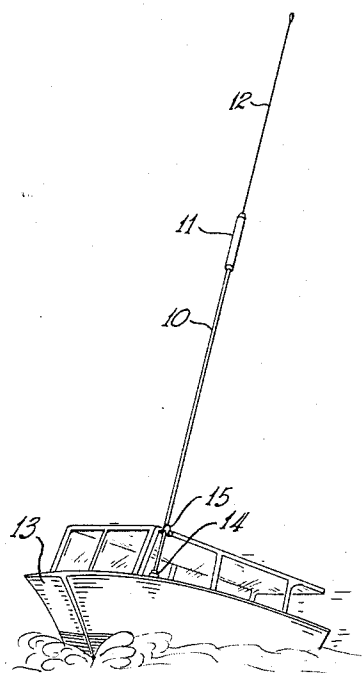


Fig. 1

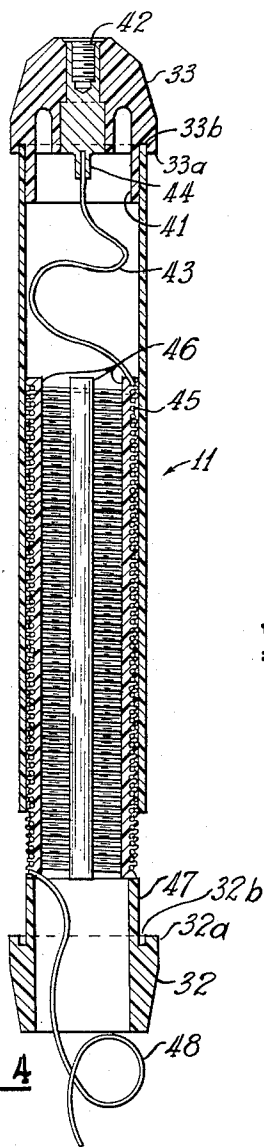


Fig. 4

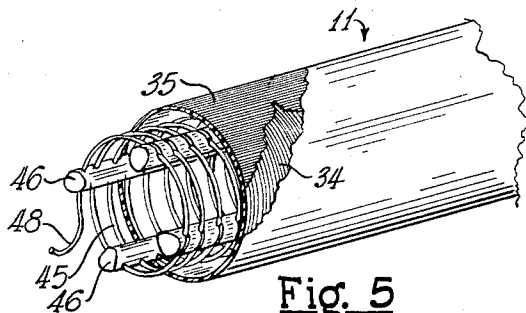


Fig. 5

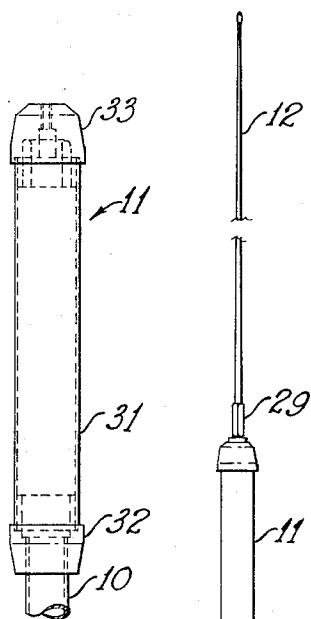


Fig. 3

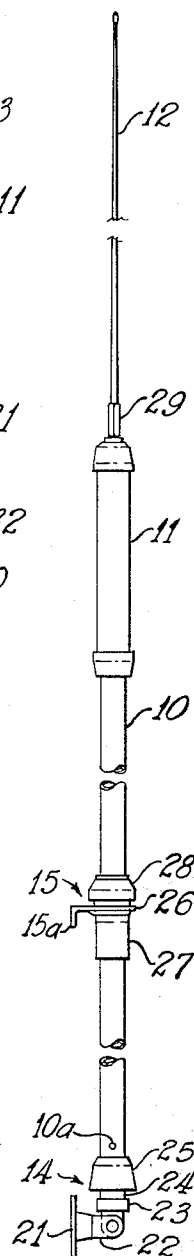


Fig. 2

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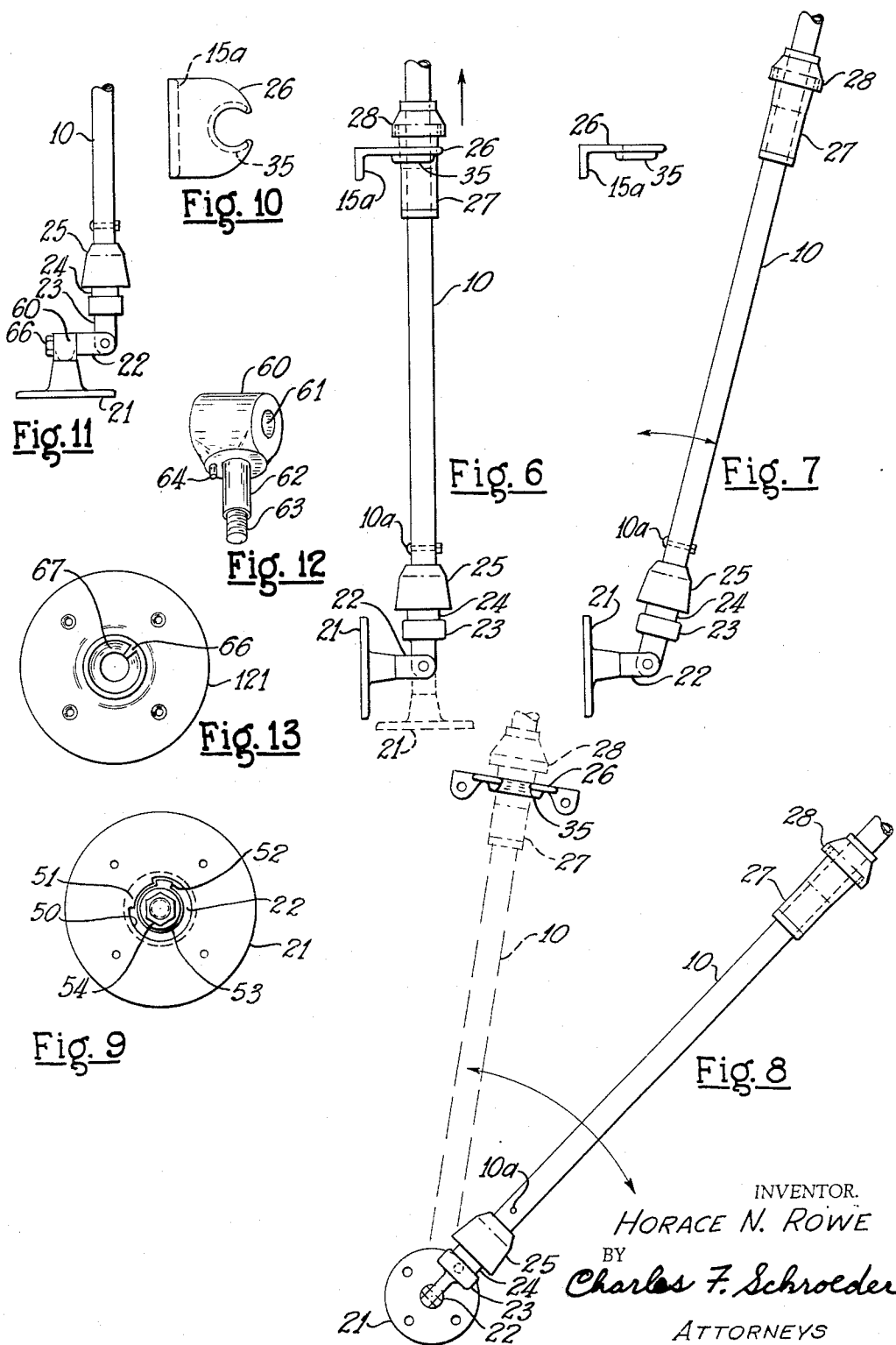
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ANTENNA SUPPORT FIXTURE WITH QUICK RELEASE FEATURE TO ENABLE LOWERING AND RAISING

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3 Claims. (Cl. 248—43)

This invention is related to coil loaded antennas and more particularly to a high strength, high Q portable marine antenna structure incorporating a fully encased loading coil.

Because of the high winds and weathering to which marine antenna structures are subjected, and because of the importance of limiting size and weight to embody maneuverability in tight zones, such as are confronted in passing under bridges and at dock areas, as well as the need for high efficiency of operation of such antennas at times of extreme emergency in the worst of weather conditions, they present unusually critical design criteria. In this respect, such antenna structures must incorporate a high mechanical strength and electrical efficiency while yet providing compactness and lightness in weight to permit ready manual handling in close spaces.

A portion of such antennas which present a particularly difficult problem in meeting these requirements is the loading coil. Incorporation of such a loading coil in the structure permits reduction in the height of the mast, but at the same time in meeting electrical requirements such as a high Q for the antenna, the coil dimensions are frequently such that they impart a physical cumbersomeness and a proportioning which does not lend to the incorporation of necessary structural strength, or to an arrangement which will permit enclosure against moisture, corrosion, and other damaging influences of the elements. Accordingly, it is a principal object of the present invention to provide a portable antenna structure, for use particularly in the marine band, which will provide the inductive impedance necessary for high Q properties with the maximum electrical energy loss at the frequencies at which the antenna is to radiate or receive, and at the same time which structurally incorporates a high strength so as not to offer a weak link in the elevated mast and thereby assure protection of the coil as an electrical component during even the worst of weather conditions.

Another difficulty frequently confronted in the design and use of portable marine antennas is the provision of an arrangement which will allow quick manual lowering of the structure in tight locations such as when the mast must be passed under a low bridge. Under such circumstances, the antenna must be light in weight to promote maneuverability and in particular the weight of the upper portions of this structure must be limited to reduce its inertia to movement, thereby to facilitate easy and quick movement of the upper structure into a proective position.

Accordingly, it is another object of the present invention to provide a coil-loaded antenna in which the loading coil mounted in the upper portion of the elevated mast is not only structurally strong but is also constructed with a minimum of weight while yet providing the exacting electrical parameter desired for a high Q in the range of frequencies in which the antenna is required to be operated.

In brief, these objectives are attained according to the principles of the present invention by mounting the loading coil in an upper portion of a lightweight mast interiorly of a filament reinforced cylindrical housing, rather than constructing it in the usual manner as a covered coil wound exteriorly of a core. The loading coil exemplary of the present invention is an air-core coil, mounted on the interior wall of the cylindrical housing with the coil

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being a maximum in diameter to provide a maximum of inductance within the given space. The housing can thus be made to provide a maximum in strength by reason of the physical reinforcing material being disposed a maximum distance from the axial center of the mast. Thus, the assembly lends itself to providing a maximum in strength-to-weight ratio, while at the same time providing a maximum of weathering protection to assure a high degree of physical and electrical stability as a component in a transceiver circuit.

A still further novel feature of the invention lies in the manner in which the antenna structure is mounted for ease of elevation and lowering as required. In this respect, the mast is provided with a universal type base mount on which the mast can be swung laterally about its lower end as a pivot as well as on which the mast can be rotated about its longitudinal axis. Cooperating with the base mount in support of the mast is a sleeve surrounding and slidable on the mast for snug engagement with a fixed U-shaped support bracket. This particular arrangement allows the mast to be quickly elevated and locked into a fixed position in a matter of seconds, and correspondingly, allows it to be disengaged from a fixed elevated position for quick lowering to a protective zone as required.

Other objects and features characteristic of the invention are set forth with particularity in the appended claims. The invention, however, both in organization and manner of construction together with further objects and advantages thereof may be best understood by reference to the following description taken in connection with the accompanying drawings in which:

FIGURE 1 illustrates a marine band transmitting and receiving antenna structure of the present invention in elevated position on board a boat;

FIGURE 2 is an enlarged partly broken away illustration of the antenna structure shown in FIGURE 1;

FIGURE 3 is an enlarged illustration of the loading coil section of the present invention showing in dotted lines the assembly of components therein;

FIGURE 4 is another illustration of the loading coil section of the antenna structure shown in FIGURE 2 disclosing in cross-section the internal parts of the coil and illustrating in greater detail the manner in which such parts are assembled;

FIGURE 5 is a broken-away isometric view of the loading coil structure of FIGURES 1 to 4 showing structural details of the housing and the coil conductor;

FIGURES 6, 7 and 8 show in greater detail various positions of the antenna structure illustrating the manner in which it can be disengaged from or secured in its elevated position;

FIGURE 6 illustrates the manner in which the mast is secured in its upper zone as well as its base mounting arrangement, while FIGURE 7 shows the antenna structure as it appears swung from its upper secured position, and FIGURE 8 showing a front elevational view of the structure illustrating the manner in which the mast can be swung in a direction at right angles to that shown in FIGURE 7;

FIGURE 9 shows in greater detail the internal under portion of the universal base mount about which the mast can be swung;

FIGURE 10 illustrates the general shape of the fixed mounting bracket in which the upper portion of the mast can be disengageably secured;

FIGURE 11 shows another universal mounting arrangement by which the mast of the present invention can be mounted eccentrically with respect to its base;

FIGURE 12 illustrates the eccentric support member used in the assembly of FIGURE 11; and

FIGURE 13 shows the under internal portion of the base member for the arrangement of FIGURE 11.

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Turning to drawings in greater detail, FIGURE 1 illustrates an antenna structure of the present invention mounted on the deck of a small boat 13. The structure incorporates a light weight mast such as an aircraft type tubular aluminum mast supporting a loading coil section 11 on the upper end of which is mounted an antenna whip 12. The lower end of the mast is supported on board the boat 13 by a base mount assembly 14 fixedly secured to either the deck or to the side of the cabin. A bracket support assembly 15 is located above the base mount assembly a sufficient distance to hold the antenna structure securely against the lateral forces and strains to which it is likely to be subjected in use.

FIGURE 2 illustrates in greater detail the assembly of parts in the antenna structure showing that the mast tube 10 is supported upon an insulator 24 which is made of suitable dielectric material of high strength such as a glass fiber reinforced synthetic resin. The insulator is designed to incorporate a projecting portion which extends into the open bottom end of the hollow mast in snug fit relation therewith and is rigidly locked thereto by a terminal bolt 10a extending through the mast. The terminal bolt 10a is thus located in a position for convenient electrical connection to radio telephone equipment. The insulator is provided with an outwardly flaring flange 25 extending to a greater diameter than that of the mast to increase the electrical leakage path from the mast to ground, thereby reducing the magnitude and tendency for R.F. losses to occur. The insulator 24 is mounted upon a kunckle type support 23 which is pivotally mounted on a swivel base 22. The swivel member 22 in turn is rotatably mounted on the base mount 21 to complete the base mount assembly 14.

The support assembly 15, includes a support bracket 26 generally of horseshoe shape, or in other words, U-shaped having right angular securing projections 15a which allows the bracket to be positively secured to a vertical surface such as the side of a cabin. Associated with the bracket for support of the mast 10 is a snug fitting cylindrical locking sleeve 27 having an interior diameter such that it may be readily slid along the length of the mast 10 into snug relationship therewith and has an external dimension such that it fits snugly into the horseshoe shaped portion of the support bracket 26. The locking sleeve has a radially extending flange or collar 28 suitably shaped to provide a hand grip at its upper end. The sleeve 27 has a slight inwardly extending taper in leading downward along its length from the collar 28 so that the sleeve can be readily wedged into the arcuate U-shaped opening in the support bracket 26. In order to establish a snug relationship and a smooth action for the sleeve within the U-shaped mating portion, the support bracket 26 is provided with smooth resinous retaining inserts 35 which lends to reducing tendencies for the sleeve to vibrate or unwedge therefrom.

The entire loading coil assembly 11 is mounted on top of the main mast portion 10, while the antenna whip 12 is mounted on top of the loading coil by way of threadably secured base stem 29. As indicated above, the mast is made of light weight electrical conducting material such as aluminum, while the whip 12 is a flexible electrical conducting material such as copper embedded in resin to form a rod for which it in turn provides structural reinforcement.

FIGURES 3, 4 and 5 illustrate in greater detail the construction of the loading coil assembly 11. FIGURE 3 shows the manner in which the coil housing 31 is assembled with the base collar 32 and the enclosing end cap 33. While the complete assembly can be seen in FIGURE 3, the component parts can be seen more clearly in FIGURES 4 and 5 which show that the cylindrical housing 31 is a thin-walled cylinder reinforced by glass fibers 34 spirally wound about the longitudinal axis of the tube. Location of the reinforcing fibers in the outermost zone of the housing imparts a maximum of beam strength thereto. Alternately or in addition, longitudinally orient-

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ed fibers 35 aligned in side-by-side relation can also be incorporated in the wall of the cylinder as the outermost layer of fibers to impart a greater lateral and flexural strength to the housing section. Because of the presence of these reinforcing fibers, the housing wall can be extremely thin and light in weight while yet providing the high strength desired. Additionally, since the reinforcement is glass, which has excellent dielectric properties, the tendency toward R.F. loss in the minimum bulk body of the housing is reduced considerably.

The loading coil itself is a single layer helically wound coil of wire 45 held in its helically wound configuration with air as a core by a series of spaced parallel support ribs 46 made of suitable resinous dielectric material, each rib embedding a small circumferential segment of successive adjacent loops of the coil for the full length thereof. Since such coil arrangement incorporates a minimum of support material, the R.F. losses due to the presence of material other than the electrical conductor are greatly reduced. The coil diameter is made such that the ribs 46 extend into close adjacency with the interior wall of the housing 31 to permit the coil to be fixedly cemented into position on the housing interior, but the loops of the coil, in having a diameter slightly less than the radial dimensions to which the ribs extend, do not make contact with the interior of the housing. Thus, although the coil is fixedly secured in close adjacent relation with the housing interior, and can be positively fixed therein by cementing one or more of the ribs 46 to the wall interior, a sufficient gap exists between the coil and the housing that additional protection against R.F. losses is provided.

The loading coil housing is provided with an annular collar 32 having a projecting base portion 47 which is dimensioned for snug fit insertion into the open upper end of the housing 31. The collar also has an overhanging lip 32a forming a recess 32b of dimension such that it accommodates the associated edge of the housing 31 in tight fit relation to permit its being readily sealed to the housing with a weatherable bonding material such as an epoxy resin. The outer open end of the collar 32 is sized for snug fit accommodation of the upper end of the mast 10 to which it is also joined in sealed relation with bonding material.

Correspondingly, the other end of the housing 31 is associated with the end cap 33 having an overhanging lip portion 33a which forms a recess 33b into which the upper edge of the housing 31 fits tightly for establishment of sealed relation with a weatherable bonding material to assure complete sealed enclosure of the loading coil conductor against external weather conditions. The end cap 33 also has a projecting base portion 48 adapted to project into the housing 31 a distance sufficient to establish rigidity against lateral stresses to which the end cap is subjected by movement of the antenna whip conductor mounted thereon. The antenna whip 12 is threadably mounted by way of its stem 29 in a threaded metal insert 42 molded in alignment with the axis of the cap 33. The metal insert 42 serves as a link in the antenna circuit and is accordingly provided with an electrical insert terminal 44 to which a lead end 33 of the coil conductor 45 can be soldered. The other end of the coil is connected by way of a lead end 48 to the interior of the aluminum antenna mast to which it is welded or otherwise suitably joined in electrically connected relation.

The length of the filament wound thin walled plastic housing 31 is arranged to accommodate the full length of the coil 45 as well as the collar and end cap securing projections 47 and 41 respectively. On the other hand, the housing length must be kept within limits which will provide the strength necessary to withstand the extreme stresses to which it is subjected in high winds, especially by the whip section 12 supported thereon. To this end, the fiber reinforcement both circumferentially and longitudinally, as well as the maximization of the housing diameter for a given coil diameter, lend to providing high

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strength for relatively long housing lengths and correspondingly permit design and use of any of a wider range of coil lengths and electrical inductance for the antenna. In this respect, the ends of the projecting edges 47 and 41 of the collar 32 and the end cap 33 respectively, can be arranged to fit in abutting relation against the ends of the support ribs 46 of the coil structure. Thus, longitudinal bracing for the coil is provided in addition to bracing against lateral coil movement within the housing interior.

From the above, it will be seen that the loading coil structure of this invention is especially adapted to being designed for any of a wide range of electrical values, as well as a high degree of physical strength with a minimum of mass and material which would otherwise undesirably add to the weight and inefficient electrical operation of the structure.

FIGURES 6, 7 and 8 show with greater clarity the manner in which the mast 10 is disengageably secured for quick lowering of the antenna structure. The base mount 21 is shown in a position as it might be when secured to the side of a cabin with the insulator support 23 extending in a generally upward direction from rotatable swivel 22, while dashed lines illustrate in FIGURE 6, the portion of the base mount 21 when the antenna is secured for support to the horizontal deck surface of the boat. The locking sleeve 27 is shown in FIGURE 6 in locked position within the recess of the support bracket 26, which thus holds the mast securely in fixed position against tendencies toward lateral motion when subjected to forces such as a high wind. FIGURE 7 is a side elevational view of the base of the antenna structure, but with the locking sleeve 27 lifted upwardly from the support bracket 26 so that the mast can be swung outwardly in the directions indicated by the double headed arrow.

FIGURE 8 is a front elevational view of the bottom portion of the antenna structure showing in dashed lines the secured position of the structure, while the solid line portion shows how the antenna can be swung about the swivel 22 secured to the base mount 21. From these illustrations, it can be seen that the antenna structure can be quickly and readily locked securely in place when desired by reason of the quick disengageable association of the sleeve 27 with the support bracket 26. The assembly is arranged so that the antenna mast can be swung both laterally about its base as a pivot support as well as backward and forward to lower it to any angle desired. The arrangement is such therefore that the antenna need not be fully lowered if it is to be momentarily passed under an overhanging structure and then lifted again into elevated position.

FIGURE 9 illustrates another facet of the base mount assembly wherein the base mount 21 has a generally circular recess in its under portion with a projection 51 extending from the side and end of the recess wall 50 to make engagement with a stopping projection 52 on the side of the rotatable swivel 22. The pivot shaft of the swivel 22 extends into the base mount and is secured thereto by a locking nut 54 associated with a retainer member 53. By this arrangement, the angle of rotation of the swivel can be limited as determined by the width of the wall projection 51. Thus, if the base mount is secured to the horizontal deck portion of a boat as illustrated by the dashed lines of FIGURE 6, the mast can be moved both laterally as well as forward and aft, as described above. In addition, however, the mast can be locked even more securely within the bracket 26 by first inserting the sleeve into the bracket and then turning the mast within the sleeve through 90° so that the pivot axis 22a of the knuckle support 23 at the swivel 22 is at right angles to the direction in which the mast must be withdrawn from the bracket 26 to disengage it therefrom. The mast and insulator support will thus be blocked against lateral movement by the pivot member 22a on the swivel 22. The 90° limit against rotation in the mast can be assured by proper angular positioning of the base

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mount 21 so that its wall projection 51 will halt axial rotation of the mast beyond this point.

FIGURE 11 shows another arrangement for mounting the mast on a base mount 121, similar to the base mount 21, but which is adapted to preventing the swivel 22 from being rotated into a blocked position within the bracket 26 as described immediately above. In this respect, the swivel, instead of being mounted directly in the base mount 121, is secured to an eccentric forming pivot-connector 60 which in turn is rotationally assembled on the base mount 121. The pivot-connector 60 has a bore 61 into which the swivel 22 extends to permit it to be rotationally secured to the connector 60, by way of a locking nut 66. The connector has a shaft 62 which fits snugly and rotationally in the bore of the base mount 121 and is fastened in this assembled relation by way of a nut threadably secured to a threaded section 63 which projects to the under side of the base mount 121. With this arrangement for mounting the mast 10 at its base, the swivel member 22 extends at right angles to the rotational pivot axis provided by the pivot connector 60, and accordingly establishes a rotational eccentric support for the mast. A stop pin 64 on the under shoulder of the pivot-connector in combination with a stop projection 66 in a circular groove 67 on the under side of the base mount, can be made to limit the rotation of the laterally projecting pivot-connector 60 dependant upon orientation of the base mount 121, and can be positioned to stop axial rotation of the connector and is associated swivel 22 in an angular location convenient for ready lowering of the mast 10.

With the base mounting arrangement installed as thus described, the mast can be locked in the bracket 26 in the same manner as illustrated in FIGURE 6, but it cannot be positioned in such a way that it will block lateral withdrawal of the mast from the bracket. This functional relationship is established by securing the bracket 21 to the horizontal deck surface in those instances where it is desired that the mast be free to be withdrawn from the bracket at all times. In other words, the blocking action caused by rotation of the mast through 90° within the bracket in arrangements where the mast 10 is connected directly to a base mount 21 fixed to a horizontal deck surface without using the pivot connector 60, is eliminated by reason of the fact that rotation of the mast 10 on the base mount 121 must be done through the connector 60 which establishes an eccentric about which the mast is always free to move on the base mount 121 when the mast is withdrawn from the bracket 26. In still another sense, the mast cannot be positionable directly on the base mount 121 in such a way that withdrawal from the bracket 26 would be at right angles to the pivot axis of the swivel member 22, thereby assuring freedom of movement of the mast for disengagement from the bracket 26 at all times.

While certain particular forms of the invention have been shown and described herein, it will be understood that the invention is not limited in all details thereto since many modifications may be made within the concepts of the invention and it is therefore contemplated by the appended claims to cover all such modifications which fall within the true spirit and scope of the invention.

I claim:

1. An antenna structure for marine use comprising in combination a mast, means supporting the bottom end of said mast in axially rotatable relation and providing a transverse pivot axis on which said mast can be moved laterally, a U-shaped bracket fixedly mounted above said supporting means, a longitudinal cylindrical sleeve snugly surrounding said mast and slidable along the length thereof, said U-shaped bracket having its end opening of size to accommodate said sleeve in tight fit secured relation, said sleeve having an external tapered shape extending along its length adapted to permit its being

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wedged into the opening in said bracket subject to its being moved along said mast into engagement with the sides of said bracket, whereby said mast is quickly and disengageably secured in a fixed mounted position by said sleeve in association with said bracket.

2. An antenna structure for marine use comprising in combination, a base mount, a base mount, a swivel rotatably secured to said base mount, a longitudinal mast mounted in pivoted relation on said swivel as well as in rotatable relation therewith, a U-shaped bracket above said base mount fixedly mounted in a position lateral to said mast when said mast is aligned generally vertically, a longitudinal sleeve snugly surrounding said mast and slidable along the length thereof, said U-shaped bracket being of size such as to accommodate said sleeve in tight fit secured relation, said sleeve having an external longitudinal tapered shank adapted to permit its being wedged into the opening in said bracket subject to longitudinal movement into engagement between the opposing sides of said bracket, whereby said mast is quickly and disengageably secured in a fixed mounted position by said sleeve in association with said bracket.

3. An antenna structure for marine use comprising in combination, a base mount, a swivel on said base mount in rotatable relation therewith about a substantially vertical axis, a longitudinal mast, a longitudinal mast support member secured to said swivel member in laterally extended relation and in rotatable relation therewith about a laterally extending axis, one end of said mast being sup-

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ported in pivoted relation on the laterally extended end of said longitudinal mast support member, a U-shaped bracket above said base mount fixedly secured to means in a position lateral to said mast when said mast is generally vertically aligned, a longitudinal sleeve snugly surrounding said mast and slidable along the length thereof, said U-shaped bracket being of size such as to accommodate said sleeve in tight fit secured relation, said sleeve having an external longitudinal tapered shank adapted to permit its being wedged into the opening in said bracket subject to longitudinal movement into engagement between the confronting sides of said bracket, whereby said mast is quickly and disengageably secured in a fixed mounted position by said sleeve within said bracket.

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