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Sept. 19, 1939. J. F. BYRNE 2,173,095

TELESCOPING VERTICAL RADIATOR AND METHOD OF ERECTING THE SAME

Filed April 14, 1938 2 Sheets-Sheet 1

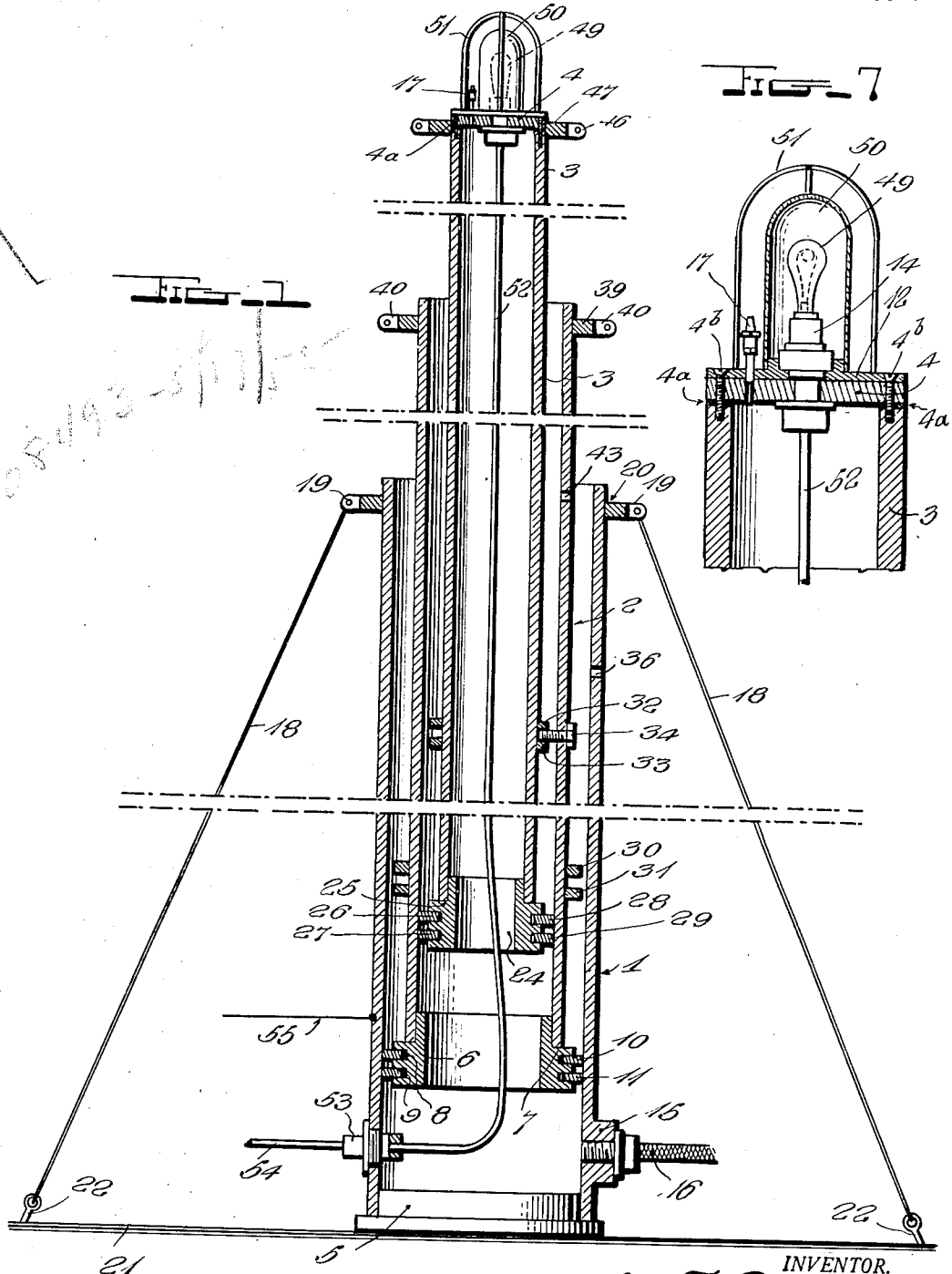


FIG. 7

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FIG. 2

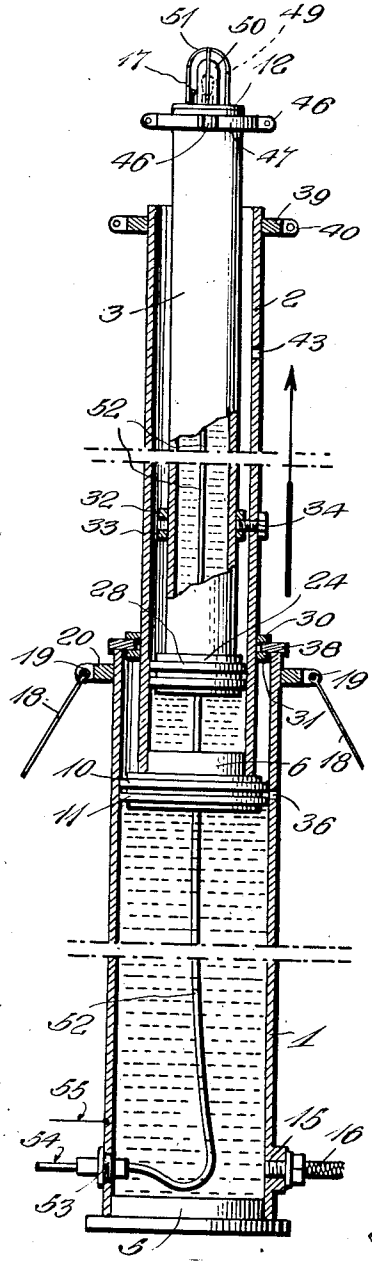


FIG. 3

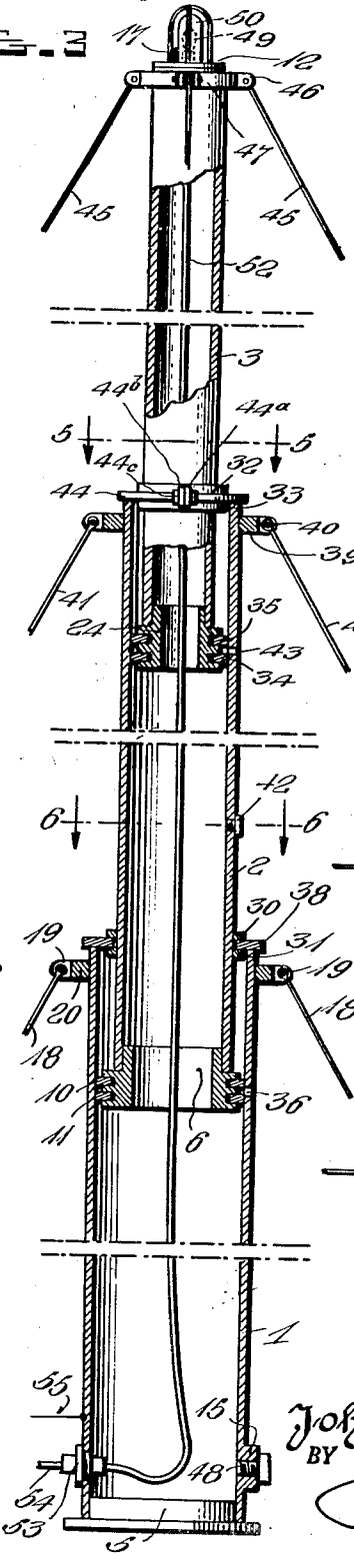


FIG. 4

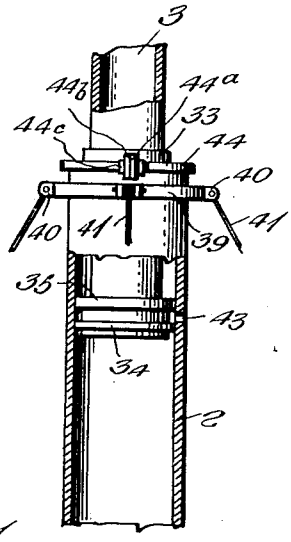


FIG. 5

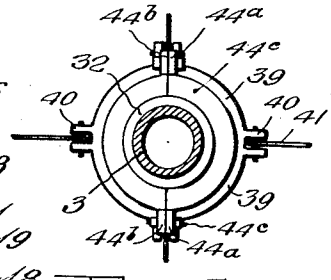
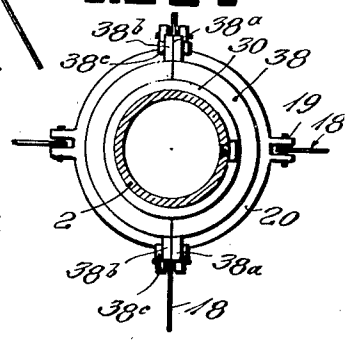


FIG. 6



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TELESCOPING VERTICAL RADIATOR AND METHOD OF ERECTING THE SAME

John F. Byrne, Cedar Rapids, Iowa, assignor to Collins Radio Company, Cedar Rapids, Iowa, a corporation of Iowa

Application April 14, 1938, Serial No. 202,088

8 Claims. (Cl. 250—33)

My invention relates broadly to the art of radio transmission and more particularly to a vertical radiator for radio transmission systems and to a method of erecting the same.

One of the objects of my invention is to provide a construction of vertical radiator for the propagation of vertically polarized electric waves with a high degree of electrical efficiency.

Another object of my invention is to provide a vertical radiator formed of a number of sections in telescopic arrangement which may be conveniently erected by forcing the sections to an extended position under control of hydraulic pressure.

A further object of my invention is to provide a construction of vertical radiator for high frequency electrical energy consisting of a plurality of telescoping metallic tubes having substantially fluid tight connections therebetween and having means whereby individual sections may be hydraulically forced from a telescoped position with respect to adjacent sections to an extended position in which the sections may be locked and guyed for permanent operation as a radiator of high frequency energy.

Another object of my invention is to provide a construction of telescopically arranged sections for a vertical radiator having means for independently extending individual sections of the radiator in successive order until the entire radiator is erected.

Another object of my invention is to provide an arrangement of locking means for the successive sections of a plurality of telescopic sections of a vertical radiator when the said sections are hydraulically forced to any erected position, thus facilitating the installation of the radiator and allowing the radiator to be permanently anchored and guyed in locked and erected position.

Another object of my invention is to provide means for lighting a telescopically arranged vertical radiator to comply with regulations of the Department of Commerce for reducing hazards to aerial navigation without interfering with the erection of the vertical radiator and the locking and maintenance of the radiator in permanent erected position.

Other and further objects of my invention reside in the method of erecting a vertical radiator for the propagation of vertically polarized electric waves, as set forth more fully in the specification hereinafter following by reference to the accompanying drawings, in which:

Figure 1 illustrates a vertical radiator embodying the principles of my invention as applied to a three-section mast and showing the relative arrangement of the sections before the commencement of the erection process; Fig. 2 illustrates the first step in the erection of the vertical radiator of my invention in which the two upper sections are interlocked and simultaneously projected vertically under hydraulic pressure; Fig. 3 shows the succeeding position of the mast with all three sections projected and locked in projected position; Fig. 4 is a fragmentary view illustrating the manner of locking the sections in projected position relative to each other and the manner of guying the mast in erected position; Fig. 5 is a transverse sectional view taken on line 5—5 of Fig. 3; Fig. 6 is a transverse sectional view taken on line 6—6 of Fig. 3; and Fig. 7 is a view of the top of the vertical radiator shown partially in cross-section and illustrating parts in side elevation.

My invention is directed to a simplified construction of vertical radiator which may be manufactured at relatively small expense. The vertical radiator of my invention is designed to permit erection within a short time and with minimum labor. The vertical radiator carries lights for reducing insofar as possible hazards to aerial navigation.

The particular feature of the structure of my invention, which when erected is a guyed steel pole, is its method of construction which greatly simplifies the problem of erection. The mast essentially consists of a group of telescoping steel tubes closed at both ends, and packing glands or rings between the telescoping sections. The mast is erected by hydraulic means through a hydraulic connection at its base, after the group of telescoping tubes have been placed in a vertical position, and the outermost tube permanently guyed. Means are provided so that as the mast is extended by said hydraulic means all unguyed sections move as a group. When the outermost tube of the extended group is in its final extended location, a locking device clamps the tube in its final position, and the tube section guyed at its top. On completion of the locking and guying, the remaining group of telescoped tubes is unlocked and the hydraulic extension process repeated.

The method of erecting the vertical radiator of my invention avoids the use of cranes and expensive erection equipment. The radiator of my invention is particularly adapted as an antenna for radio broadcast stations and for other types of radio stations where speed in erection of the antenna is desirable. The structure of

my invention is particularly useful in military operations where an antenna of relatively large capacity must be erected rapidly and under adverse working conditions.

Referring to the drawings in detail, I have illustrated my invention as comprising a three-section mast, including sections 1, 2 and 3, arranged in telescopic relation. A plate 4 closes the top of section 3 and a base member 5 closes the bottom of section 1 of the mast. In each instance a fluid tight connection is provided by the employment of suitable gasket means such as indicated in Fig. 7 at 4a. As illustrated, the plate 4 is suitably secured in position with respect to the end of tubular section 3 by means of screws 4b which pass through the supporting plate 12 of the light support 14, through plate 4 and gasket 4a into the end of tubular section 3. Fig. 2 of the mast which telescopes into section 1, carries a sleeve member 6 in the end thereof. The sleeve member 6 is provided with an annular seat 7 which engages the lower end of tubular section 2. Annular seats 8 and 9 are provided in sleeve 6 for receiving packing rings 10 and 11 respectively. Packing rings 10 and 11 are split metallic rings operative to slidably engage the internal bore of tubular section 1 and form a fluid tight but yieldable connection therewith. The plate 4 at the top of section 3 and the base member 5 in association with the packing rings 10 and 11 insure a closed and tight hydraulic section. A supply connection 15 is provided at one side of the lower section 1 and is connected through pipe line 16 to a suitable hydraulic pumping system. The relationship of the telescopic sections has been shown generally in Fig. 1 with the sections in position to be extended. A valve 17 is mounted in top plate 4 and permits air which may be trapped in the several telescopic tubular sections to easily escape as the fluid is forced into the telescopic sections. Valve 9 is closed as soon as the lifting fluid reaches the top of the top section 3 in the arrangement of sections illustrated in Fig. 1. It will be understood that the tubular sections which I have shown are of substantial length in order that a mast of substantial height may be secured. For this reason, I have shown each section and the guy wires for the telescoped sections foreshortened, as indicated by the original breaks in the continuity of the several sections and guy wires.

In erecting the vertical radiator, the telescoped sections are raised to the position shown in Fig. 1 by conventional methods and the guy wires 18 which connect with sets of radially extending lugs 19 on collar 20 properly anchored in position for maintaining the telescoped sections of the mast in vertical position. For purposes of explaining my invention, I have indicated the guy wires 18 as anchored to foundation or base 21 by means of securing means indicated at 22.

Telescopic sections 2 and 3 of the mast are interconnected by a fluid tight but slidable coupling similar to the coupling heretofore described between tubular section 1 and tubular section 2. That is to say, tubular section 3 carries a sleeve 24 having an annular shoulder thereon indicated at 25 providing a seat for the lower end of tubular section 3. Sleeve 24 is provided with annular grooves indicated at 26 and 27 which receive the yieldable rings 28, 29. The yieldable rings 28, 29 serve as packing means and provide a fluid tight joint.

Each of the slidable tubular sections 2 and 3 carries sets of annular projections 30 and 31; and 32 and 33 respectively. These annular projections serve as securing means for the tubular sections when the sections have been extended and serve as abutments to prevent the collapsing of the telescopic sections. As illustrated in Fig. 1, a locking screw 34 projects through tubular member 2 and between the annular projections 32 and 33 on tubular section 3. This arrangement locks sections 2 and 3 together as a unit so that when hydraulic pressure is applied by opening valves connected with the supply system to which pipe line 16 connects, the fluid pressure enters tubular section 1, passes through the lower end of tubular section 2 and fills tubular section 3 to the limit of the top thereof. Air which may be trapped in the tubular portions of the mast is driven out and the fluid fills the sections 1, 2 and 3 as shown in Fig. 2. Sections 2 and 3 are driven upwardly as a unit under the effect of the hydraulic pressure as indicated in Fig. 2. Tubular units 2 and 3 are raised simultaneously by virtue of the locking screw 34 engaged between the annular projections 32 and 33 on tubular section 3.

Over extension of the tubular sections 2 and 3 with respect to tubular section 1 is prevented by reason of the fact that when tubular section 2 passes the position illustrated in Fig. 2, the packing rings 10 and 11 carried by section 2 uncover the port 36 thus allowing the hydraulic pressure medium to be released, preventing any further projection of the tubular sections 2 and 3.

When tubular sections 2 and 3 are in their extended position with the projections 30 and 31 slightly beyond the upper end of tubular member 1, a split clamping ring 38 clamps between annular projections 30 and 31 and forms an abutment against the upper end of tubular section 1, preventing the retraction of tubular section 2 with respect to tubular section 1. That is to say, the mass of tubular sections 2 and 3 is supported by split clamping ring 38 disposed between annular projections 30 and 31 and resting against the upper end of lower tubular section 1.

After the clamping ring 38 is clamped in position between the annular projections 30 and 31, as represented in Fig. 6, guy wires 41 may be secured to lugs 40 of ring member 39, as shown in Fig. 5. The clamping ring 38 is formed by complementary sections having coacting lugs 38a and 38b interconnected by means of bolts 38c.

The annular projections 30 and 31 may be welded to the tubular member 2 and ring member 39 may be similarly welded to tubular section 2 in the relative positions indicated. Upon completion of the installation of clamping ring 38 between annular projections 30 and 31 for supporting section 2 with respect to section 1, the locking bolt 34 is removed from tubular section 2, illustrated in Figs. 1 and 2, and plug 42 illustrated in Fig. 3 inserted. During this time, tubular section 3 is prevented from falling downwardly through section 2 because of the abutment of the lower end of sleeve 24 with respect to the upper end of sleeve 6 and because of the fluid pressure exerted internally of tubular section 3 tending to raise tubular section 3.

The pumping process is now continued and tubular section 3 moves out of tubular section 2 into the extended position illustrated in Fig. 3 under the continuous fluid pressure supplied to the tubular sections. Over-extension is again prevented by the arrangement of port 43 in tubular section 2 which is exposed should tubular

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section 3 project beyond the intended limit whereupon port 43 serves as a pressure relief for the fluid pressure supplied through tubular section 2 and further forces tending to raise section 3 are rendered ineffective. As before, a locking ring 44 is placed between annular projections 32 and 33 and around tubular section 3. The locking ring 44 is illustrated in Fig. 5 as comprising complementary sections having lugs 44a and 44b interconnected by means of bolt members 44c. The locking ring 44 serves as an abutment for tubular member 3 against the upper end of tubular member 2. The top guy wires 45 attached to lugs 46 of ring member 47 may now be anchored and the erection of the antenna mast is complete. The ring member 47 may be welded in position adjacent the top of tubular section 3, and serves as a rigid securing means for the guy wires 45.

With the several sections of the mast in extended position and locked in such position by means of locking rings 38 and 44, the fluid may be drained from the mast and the pump connection removed. The pump connection may be closed by a suitable plug indicated at 48. Plug 42 closes the port from which bolt member 34 was removed. The relief ports 36 and 43 may be left open as these are normally closed by the packing rings 10 and 11, and 34 and 35, respectively, and must remain in operative condition prepared for the next erection of the mast.

The light support 14 at the top of the mast provides suitable sockets for incandescent lights which I have indicated generally at 49 and which may be enclosed by a suitable light diffuser shown at 50 and protected by a suitable metallic open work frame indicated at 51. The light source 14 is energized from energy supplied through flexible cable 52 which depends downwardly through the sections of the radiator and passes through insulated bushing 53 in one wall of the lower section 1 of the radiator and extends to the power supply source through connection 54.

The radio frequency connection to the vertical radiator is made with section 1 of the radiator as shown in 55. The several sections of the radiator are intimately bonded to provide low resistive paths for radio frequency currents because of the mass of the several sections exerted against the locking rings 44 and 38 which bear directly against the metallic ends of the coacting tubular sections 2 and 1 when the antenna is in erected position as illustrated in Fig. 3.

While I have shown my invention as applied to a three-section radiator, it will be understood that a multiplicity of sections may be employed and that the number thereof is immaterial so far as the principle of my invention is concerned. In each instance I interlock the number of telescopic sections above the lower section and by hydraulic pressure, project the sections above the lower section simultaneously. Subsequently one of the remaining sections is unlocked with respect to the others, allowing progressive projection or extension of the mast and the sections locked into position when they are ejected to maximum extended position. As heretofore pointed out, the mass of the different sections rests directly against adjacent sections providing an intimate metal to metal contact. Moreover, the yieldable rings 10, 11, 34 and 35 provide a bond between the slidable sections, thereby insuring a substantial electrical connection between the sections of the mast and providing a radio frequency path of low electrical resistivity.

The vertical radiator of my invention has been found very practical in its construction and capable of erection within a relatively short time. I have installed and used this mast for radio transmission and have found the radiator in accordance with the construction set forth herein highly efficient in operation.

I realize that modifications may be made in the construction of the vertical radiator of my invention and in the method of assembling and erecting the radiator and while I have described my invention in one of its preferred embodiments, I desire that it be understood that modifications may be made and that no limitations upon my invention are intended other than may be imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States, is as follows:

1. In a mast structure comprising a multiplicity of telescopic vertically slidable sections each having substantially fluid tight slidable couplings therebetween, the method of erecting the mast which comprises mounting one of said sections in a vertical position, interlocking others of said sections as a unit and projecting the interlocked sections simultaneously under the force of fluid pressure introduced into the first named section, anchoring one of the sections of said interlocked unit in projected position, removing the interlock from the anchored section of the interlocked unit, projecting the remainder of the interlocked unit to an extended position, and locking the said remainder in projected position.

2. In a mast structure comprising a multiplicity of vertically slidable telescopic sections, each having substantially fluid tight slidable connections therebetween, the methods of erecting the mast which consists in interlocking two of said sections for vertical movement as a unit, introducing fluid pressure into one of the sections for simultaneously projecting the other of the sections axially as a unit, securing one of the sections of the interlocked unit in projected position and removing the interlock therefrom, forcing the fluid pressure through the other sections for projecting the previously interlocked section to an extended position, and anchoring the last mentioned section in projected position.

3. In a mast structure comprising a trio of vertically slidable telescopic sections, the method of erecting the mast which consists in anchoring the first section in a vertical position, interlocking the other telescoping sections for vertical movement as a unit within the anchored section, introducing fluid pressure through the anchored section for vertically projecting the interlocked sections simultaneously as a unit to a projected position, locking one of the projected sections of the interlocked unit in a projected position, removing the interlock, applying additional fluid pressure to said sections for projecting the freed section to an extended position, and anchoring the last mentioned section in extended position.

4. In a mast structure which includes a multiplicity of vertically slidable telescopic sections having substantially fluid tight slidable connections therebetween, the method of erecting the mast which consists in anchoring one of the sections in a vertical position, interlocking the others of the sections which are slidable as a unit within the first mentioned section, introducing hydraulic pressure through the first mentioned section for projecting the others of said sections simultaneously as a unit, locking one of the projected sections in projected position, removing

the interlock from the locked section of the interlocked unit, continuing the application of hydraulic pressure through the sections for projecting the remainder of the interlocked unit to be projected position, and locking the said remainder in projected position.

5. In a mast structure comprising a plurality of nested telescopic sections in which the sections are vertically slidable from a nested position to a projected position with substantially fluid tight slidable connections therebetween, the method of erecting the mast which comprises mounting one of the sections in a vertical position, interlocking the remaining nested sections for vertical movement as a unit, introducing fluid pressure through the first mentioned section for vertically projecting the other sections as a unit, limiting the extent of projection of the interlocked unit by the release of pressure at the desired position of the unit, maintaining one of the sections of the interlocked unit in projected position, removing the interlock between the interlocked sections, continuing the application of fluid pressure through said sections for projecting the remainder of the interlocked unit, limiting the extent of projection of the said remainder by the release of pressure at the desired position of said remainder, maintaining the remainder, clamping the section thus projected in projected position, and anchoring the projected sections in vertical position.

6. Means for constructing a mast comprising a multiplicity of nested tubular telescopic sections having fluid tight slidable connections therebetween, means for interlocking the telescopic sections which are nested within one of said sections, means for introducing hydraulic pressure through said one of said sections for projecting the interlocked nested sections simultaneously as a unit, clamping means for securing one of said interlocked sections in projected position, the interlock being removable from the interlocked sections to permit projection of another of the previously interlocked sections, and means for clamping said last mentioned section in extended position.

7. Means for constructing an antenna system for the propogation of high frequency electrical energy comprising a multiplicity of telescopic concentric sections nested one with respect to another, a high frequency electrical connection with the outer section, means for interlocking the inner sections for simultaneous vertical movement as a unit, means for introducing hydraulic pressure through the outer section for vertically elevating the other sections, means for clamping the outer sections of the interlocked sections in projected position, the interlock between said interlocked sections being removable to allow subsequent projection of the innermost section under continued application of hydraulic pressure to an extended position, and means for clamping said last mentioned section in extended position.

8. Means for constructing an antenna system for the propagation of high frequency electrical energy comprising a multiplicity of telescopic concentric sections nested one with respect to another, a high frequency electrical connection with the outer section, means for interlocking the inner sections for simultaneous vertical movement as a unit, means for introducing hydraulic pressure through the outer section for vertically elevating the other sections, means for clamping the outer section of the interlocked sections in projected position, the interlock between said interlocked sections being removable to allow subsequent projection of the innermost section under continued application of hydraulic pressure to an extended position, and means for clamping said last mentioned section in extended position, said respective outer sections having pressure relief ports at predetermined positions thereon for limiting the extent of projection of the adjacent inner extensible sections.

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