Sept. 8, 1964 L. A. JOHNSON ETAL 3,147,829

TELESCOPING ELEVATING SUPPORT

Filed June 15, 1960 3 Sheets-Sheet 1

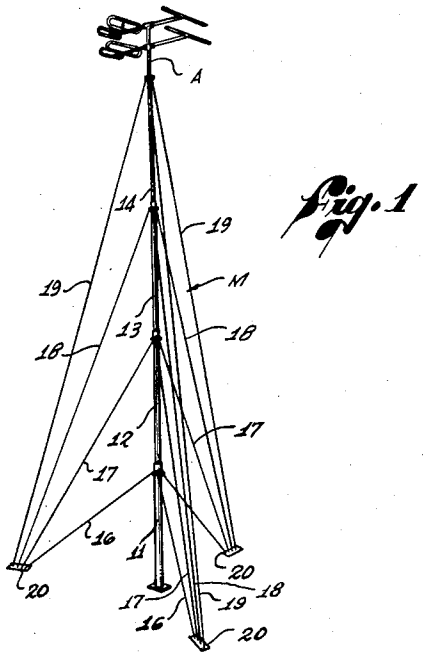

Fig. 1

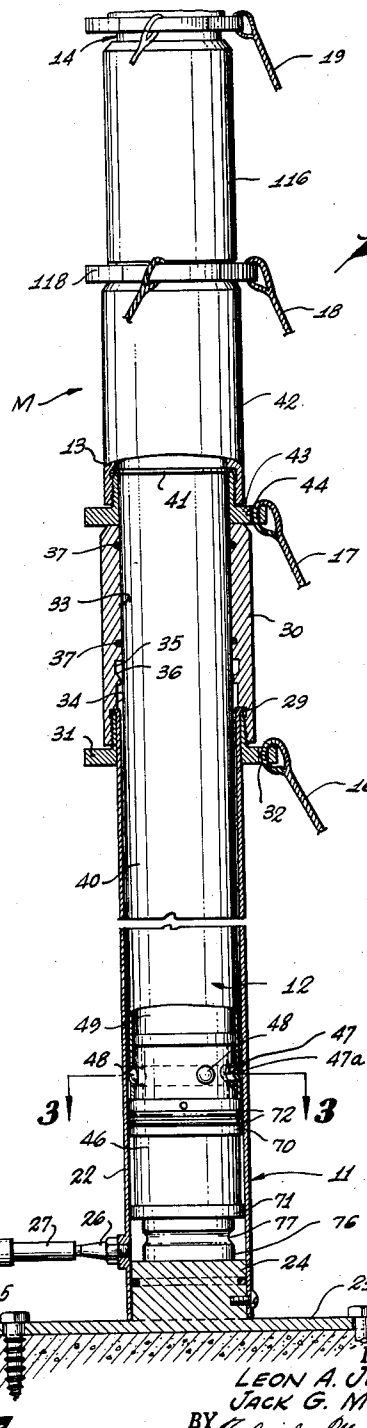

Fig. 2

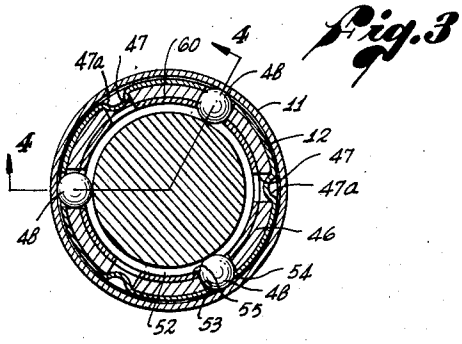

Fig. 3

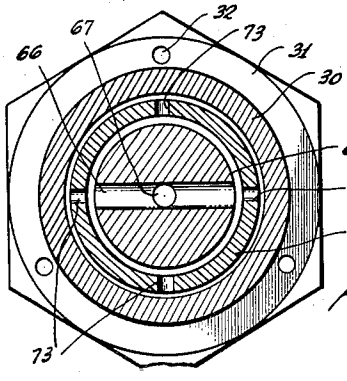

Fig. 7

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Sept. 8, 1964 L. A. JOHNSON ETAL 3,147,829

TELESCOPING ELEVATING SUPPORT

Filed June 15, 1960 3 Sheets-Sheet 2

Fig. 8

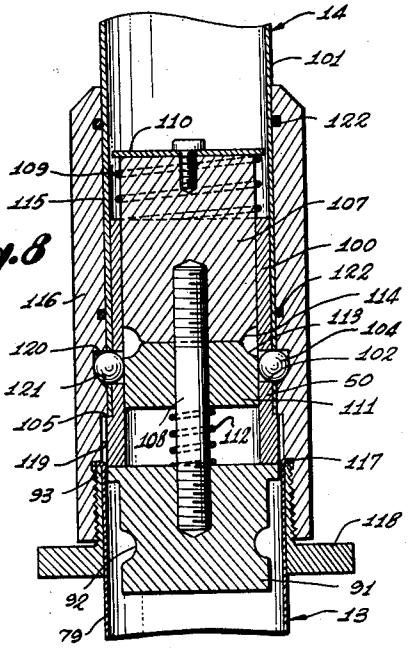


Fig. 6

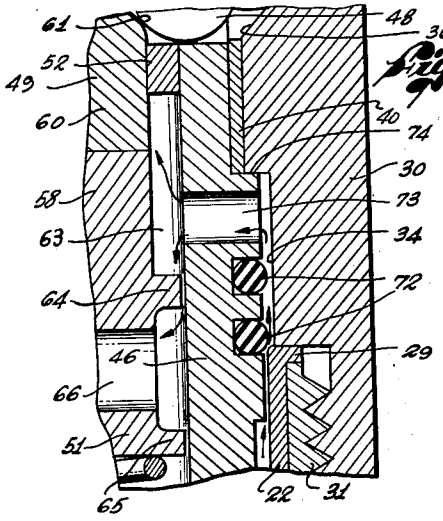


Fig. 5

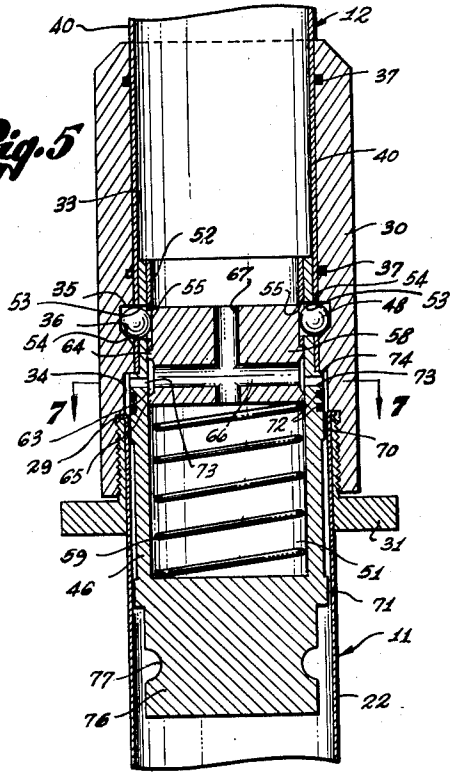
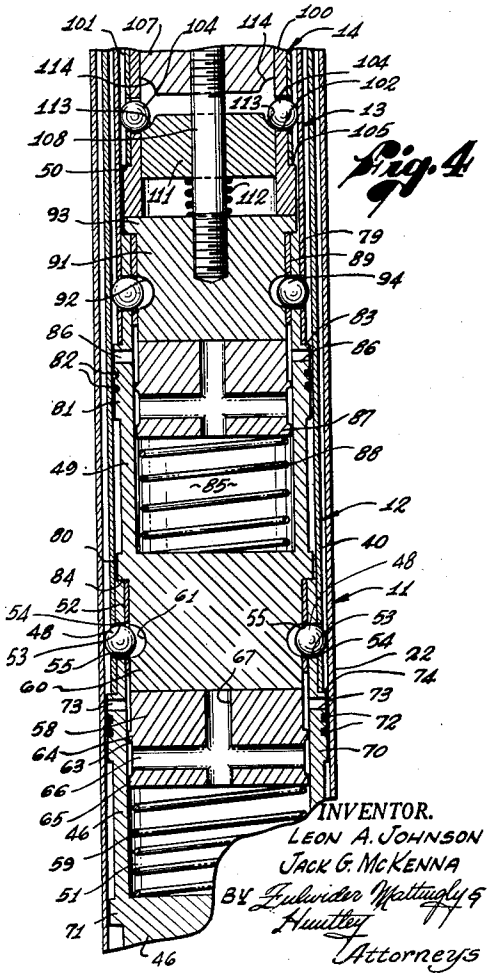


Fig. 4



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Sept. 8, 1964 L. A. JOHNSON ETAL 3,147,829

TELESCOPING ELEVATING SUPPORT

Filed June 15, 1960 3 Sheets-Sheet 3

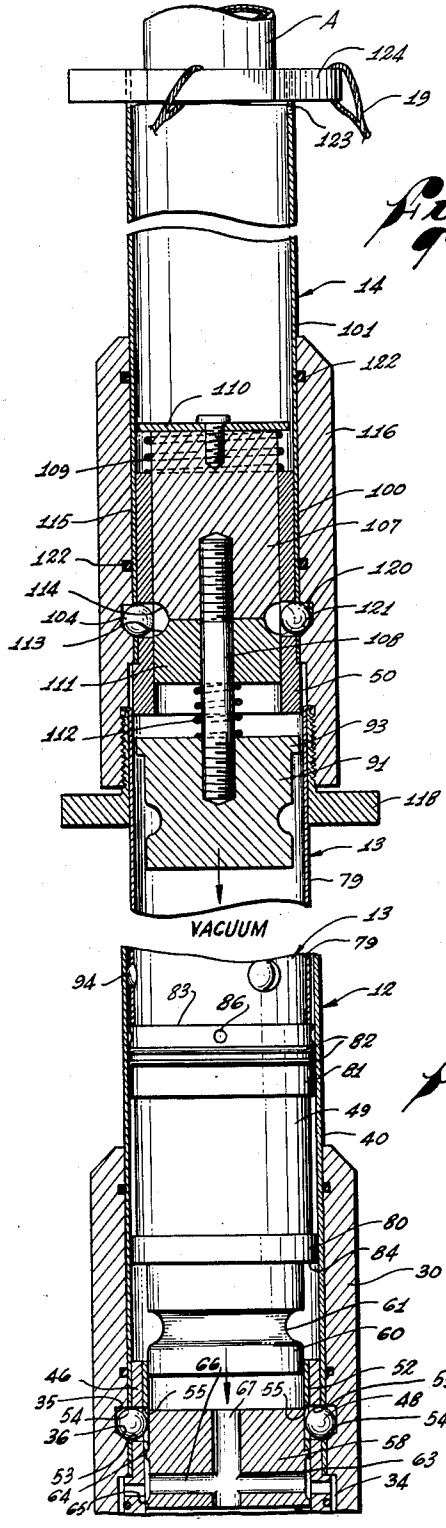

Fig. 9

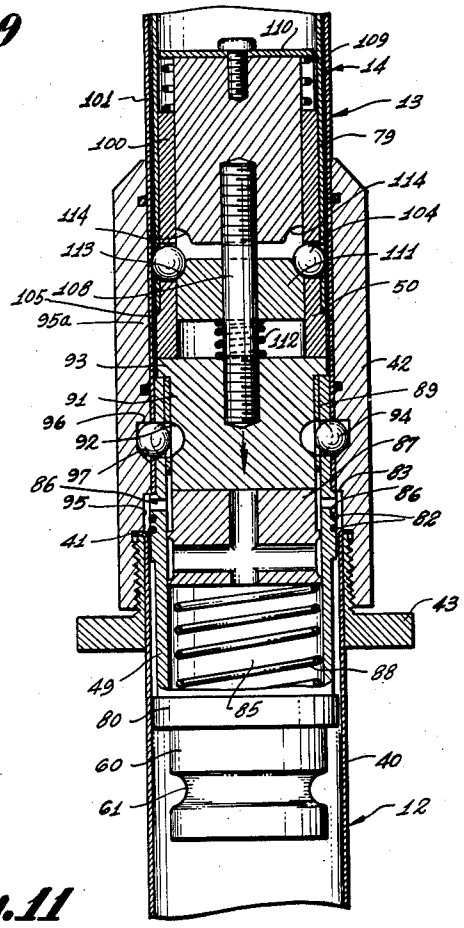

Fig. 10

Fig. 11

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United States Patent Office 3,147,829 Patented Sept. 8, 1964

3,147,829

TELESCOPING ELEVATING SUPPORT

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Filed June 15, 1960, Ser. No. 101,310
13 Claims. (Cl. 189—26)

This invention relates to extensible elevating supports and, more particularly, to supports of the telescopic-mast type. It is adapted to the use of light-weight structural members and is of a nature to be easily and safely erected or lowered.

Since a primary use for embodiments of the present invention is to support television antennas, the invention will be described in that environment; but this is not to be construed in any way as limitative on the invention.

In "fringe" areas it is often necessary or desirable that an antenna be from 100 feet to 200 feet above ground in order to receive good signals. A one-section mast of corresponding length requires the use of a crane for its erection or lowering and presents a transportation problem.

In attempts to avoid the expense of hoisting and avoid the transportation difficulties, there have been provided telescopic masts, but the complicated nature of their structural make-up often resulted in increased manufacturing cost and decreased efficiency and reliability under conditions of installation and use. Further, they often were relatively heavy and cumbersone, thus requiring a number of installation workmen.

In contradistinction to these attempts, the mast of the present invention is structurally light and uncomplicated in nature, and the installation, erection and lowering of the mast may each be accomplished with safety, ease and speed as a "one man" job. There is full assurance that the sections of the erected mast are surely locked against accidental telescoping; yet the unlocking of the sections to permit intended telescoping is accomplished with ease.

The extension and telescoping of the mast are accomplished under the control of fluid pressure, but the releasable holding of the mast parts in extended condition is accomplished by mechanical locks, as will appear.

Contributing to the efficiency and ease of erection is the arrangement whereby, during the erection operation, there is forced a certain order of extension sequence.

That is, the movable sections which, in the erected mast, are to be in a given order from the bottom to the top, are extended from their nested conditions in that same order.

Consequently, one individual, unaided by others, may accomplish the erection; for, each time he extends the mast by a section length, he may immediately anchor that added section by suitable guy wires; thus successively anchoring the "added" sections in the order of their addition. This is in contrast to a situation where, for instance, a section which is to become topmost, is extended prior to the extension of another section, in which case the guy wires of the topmost section must be individually let out under control as a second section is being extended, else the mast will, in effect, be unguyed during the period of second section extension. If the guy wires are to let out in this manner, additional manpower is required and the erection process is materially slowed down.

The sequence of telescopic movement of the mast sections is forced to be the reverse of the above order; that is, the uppermost section is the first one to be retracted, the second to uppermost is the second to be retracted, etc. It follows that the current vertical extent of unretracted sections remains guyed.

With the foregoing in mind, it is a major object of this invention to provide improved telescopic means for elevating articles.

It is a further object of this invention to provide a quickly installed telescopic mast for antennas.

A still further object of this invention is to provide a lightweight, inexpensive mast.

It is another object of this invention to provide a lightweight mast which may be quickly installed, raised, and lowered by one individual.

It is a still further object of this invention to provide a simple lightweight telescopic mast which, by fluid pressure, may be raised to the extended condition after the fluid pressure has been removed.

Still another object of this invention is to provide a generally hollow telescopic mast which will remain in the fully extended condition without the necessity of internal fluid pressure in excess of the ambient pressure, but which may be telescoped by selective control of fluid pressure within the mast.

Other and further objects of this invention will become apparent in the detailed description below in conjunction with the attached drawings, wherein:

FIGURE 1 is a pictorial view of a mast embodying the present invention.

FIGURE 2 is a partially cut away elevation of the mast in FIGURE 1 in the telescoped condition.

FIGURE 3 is a cross section along line 3—3 in FIGURE 2.

FIGURE 4 is a fragmentary cross section of the piston-like lower ends of the sections of the mast along line 4—4 in FIGURE 3.

FIGURE 5 is a cross section taken on the vertical axis of one of the intermediate joints of the mast in FIGURE 1.

FIGURE 6 is an enlarged fragmentary view of part of the joint shown in FIGURE 5, but with some parts in different relative positions.

FIGURE 7 is a cross section along line 7—7 in FIGURE 5.

FIGURE 8 is a cross section taken along the vertical axis of the top joint of the mast in latched position.

FIGURE 9 is a cross section taken along the vertical axis of the joint in FIGURE 8, as seen during the unlatching operation.

FIGURE 10 is a cross section, partly in elevation, illustrating the manner in which, during the telescoping of the mast, the piston of the top mast section releases the locking detents of the joint below the piston.

FIGURE 11 is a cross section, partly in elevation, of the mast as it is further telescoped.

Referring now to FIGURE 1, the presently disclosed mast will first be described broadly to present an overall picture of the apparatus. As illustrated, telescopic mast M has an antenna A secured at the top thereof and is held in its upright position by a series of guy wires. More particularly, the mast M comprises a plurality of sections (here four in number, though this is not limitative) of equal length, which will be referred to as first or base mast section **11**, second or lower intermediate mast section **12**, third or upper intermediate mast section **13**, and fourth or top mast section **14**. When the mast M is completely extended as shown, it is held in the upright position by sets of base guy wires **16**, lower intermediate guy wires **17**, upper intermediate guy wires **18**, and top guy wires **19**, which are respectively attached to the respective upper ends of the mast sections **11**, **12**, **13**, and **14** and are anchored to deadmen **20**.

The procedure of installing and raising the mast is as follows. First, the operator places the mast, in the telescoped condition with the guy wires **16**, **17**, **18**, and **19** secured to the upper ends of the respective mast sections,

vertically on its base to be hereinafter described. Because of its relatively short length, as telescoped, the mast will remain vertical while the guy wires 16 are anchored.

Then, the operator supplies compressed air to a fitting at the lower end of base section 11 and causes the second section 12, with the third and fourth sections 13 and 14 telescoped within it, to be pushed upwardly until the section 12 is fully extended. Because of the construction described below, at that time, and not before, compressed air is supplied to the area between the second and third sections 12 and 13 and causing the section 13 to move upwardly out of the section 12. This displacement of the third section 13 causes detents carried in the lower end of the second section 12 to be moved into latching position in a collar attached at the upper end of the base section 11. And then, the guy wires 17 are tied to the deadmen 20 securing the section 12 properly.

After the guy wires 17 have been secured, sufficient air pressure is supplied to the interior of the mast to extend the third section 13 in the same manner as the second section 12. At that time, the detents carried by the third section 13 latch that section to second section 12, and the guy wires 18 are anchored. Then, continued air pressure supplied to the mast M raises the top section 14 to its fully extended position at which time movable detents carried by the top section move into engagement with the latching collar attached to the upper end of the third section 13. At this point, the guy wires 19 are secured to the deadmen 20 and the supply of compressed air is removed from the mast's interior.

Although the compressed air pressure is removed, the mast M will remain in its fully extended position, because the mast sections 11 to 14 are latched together at the respective joints of adjacent sections. Then, when it is desired to lower the mast M, the operator merely draws a vacuum in the interior of the mast, which vacuum causes the detents latching the sections 13 and 14 to be released whereupon the top section 14 telescopes downwardly into the third section 13. Then, because of the structure provided, the lower end of the top section 14 will release the detents latching the sections 12 and 13 in their extended position, whereupon the third and top sections 13 and 14 telescope into the second section 12. Then, as the third section 13 reaches its fully retracted or telescoped position within the second section 12, the third section releases the detents latching the base and second sections 11 and 12 together and the latter section, with the sections 13 and 14, telescopes into the base section 11.

Having described broadly the manner in which the disclosed embodiment of the invention operates, attention will now be directed to the details of the embodiment which enable it to function as described. FIGURE 2 discloses the mast M in the fully telescoped condition. Here, the base section 11 has been cut away so that it may be seen that it comprises a thin walled tube 22 (preferably aluminum) secured to a base plate 23 by attachment to integrally formed disk 24. Preferably, the base plate 23 is screwed to a concrete block 25 which is set in the ground in order to insure sufficient stability at the initial stage of installation described above. Further, an air connector 26 extends through the left side of the tube 22 at the lower end thereof in order that air may be supplied in the interior of the mast M through air supply fitting 27.

Located at the upper end of the base section 11 is latching collar 30 with which the detents carried by the lower end of the second section 12 cooperate to hold the latter in the extended position. This collar is attached to the upper end of the tube 22 by being clamped to flange 29 by means of an annular bushing 31. As may be seen, the bushing 31 has a plurality of holes 32 by which the guy wires 16 may be fastened to the upper end of the section 11. Turning back to the collar 30, in the wall of its barrel 33 is a recess 34 at the upper

end of the tube 22, as well as a detent receiving channel 35 which has a tapered lower edge 36. The functions of the recess 34 and the channel 35 will be described in detail below, as well as the office of O-ring seals 37 which are carried by the collar 30.

FIGURE 2 also illustrates from an overall standpoint the structure of second section 12 which is substantially the same as third section 13, except the former has the larger diameter. In the embodiment of the invention disclosed, there are only two of these substantially identical sections, however, as is apparent, many more sections of the proper diameters could be used. For example, in the 200 feet antenna masts presently being sold, there are eight 20 feet intermediate mast sections like sections 12 and 13.

The second section 12 comprises a thin walled tube 40 with a latching collar 42 at its upper end and a piston 46 at its lower end. The tube 40 extends through the barrel 33 of the collar 30 in sealing relation with the O-rings 37 and through the tube 22. Therefore, the former tube has an outside diameter of approximatley ⅛" smaller than the inside diameter of the tube 22. At its upper end, the tube 40 has an annular flange 41, whereby the latching collar 42 is attached with the use of bushing 43 in the same manner that collar 30 is attached to tube 22. Similarly to the bushing 31, the bushing 43 also has a plurality of holes 44 by which the guy wires 17 are secured.

Referring now to the lower end of the tube 40, the piston 46 receives the tube 40 partially down over it and is attached thereto by means of dimples 47*a* in the tube extending into bores 47 in the piston (see FIGURE 3). The tube 40 and the piston 46 also carry a plurality of latching detents or balls 48 which are received into the previously mentioned detent receiving channel 35 after the second section 12 has been raised or extended.

Further details of the manner of mounting and use of the detents 48 and details of the piston 46 may be seen in FIGURES 3 to 5 of which FIGURE 4 discloses the manner of nesting the piston 46, middle piston 49 of the third section 13, and top piston assembly 50 of top section 14. For a purpose to be described below, the piston 46 has a cylindrical cavity 51 and is formed therein with a sleeve 52 shrunk fit into the upper end of the cavity. The detents 48 are carried in a plurality of bores 53 in the piston 46 and extend through apertures 54 in the tube 40, as well as holes 55 in the sleeve 52. Therefore, the detents may move radially from an inward released position, such as shown in FIGURE 4, outwardly to a latched position, such as shown in FIGURE 5. The apertures 54 are slightly smaller than the diameter of the balls 48 to facilitate the manufacture of the section 12.

Slidably mounted in a loose fit within the cavity 51 is a locking plunger 58 which is normally urged upwardly by a spring 59. As illustrated in FIGURE 4, when the third section 13 is telescoped into the second section 12, detent unlocking means formed by reduced portion 60 of the piston 49 displaces the locking plunger 58 downwardly in order that detent receiving recess 61 may be oriented with and release the detents 48. The plunger 58 has a peripheral channel 63 with an upper section above a rib 64 and a lower section formed between ribs 64 and 65 and, in addition, horizontal passage 66 and vertical passage 67 extending through the plunger 58. As will become apparent, these passages are used to conduct air at the proper time to displace the piston 49 and, therefore, the third section 13 upwardly relative to the piston 46.

The outside of the piston 46 is formed with a pair of spaced lands 70 and 71 with the upper land 70 carrying a pair of O-ring seals 72. The upper land 70 is further defined by a plurality of ports 73 communicating with the interior cavity 51 of the piston and, in addition, the land extends radially beyond the tube 40 sufficiently to provide an upwardly facing shoulder 74 which engages

with the upper edge of the recess 34 in the collar 30 (see FIGURE 5).

At the lower end of the piston 46 is a reduced portion 76 having an annular recess 77 formed therein. The portion 76 and recess 77 are the equivalent of the reduced portion 60 and recess 61 on the piston 49 which function to unlock the detents 48. However in the embodiment disclosed, the section 12 is the next to the bottom section and, therefore, the reduced portion 76 does not function to unlock any detents, as in the case of reduced portion 60. The piston 46 is merely made substantially the same as piston 49 to reduce the number of parts which must be kept in inventory.

Since the third section 13 is substantially the same as the second section 12 (except that the former has a slightly smaller diameter), the former will be described before discussing the operation of the latter. The section 13 comprises a thin walled tube 79 fastened at its lower end to the piston 49 in the same manner as the tube 40 is attached to the piston 46. The piston has a lower land 80 and an upper land 81 with the latter carrying a pair of O-rings 82 and extending slightly outwardly of the tube 79 to form an upwardly facing shoulder 83. The shoulder 83 engages a detent receiving channel on the latching collar 42 of the second section 12, as will be described below. As in the case of piston 46, the piston 49 has a cylindrical cavity 85 communicating with the exterior of the piston through a series of ports 86 and a locking plunger 87 is located in loose sliding fit within the cavity 85. The plunger 87 is resiliently urged upwardly by a spring 88 and, therefore, a sleeve 89 is shrunk fit into the upper end of the cavity 85 to limit the upward movement of the plunger. In FIGURE 4, the locking plunger 87 is held in its lower position by the weight of the top section 14 acting on latch unlocking portion 91 of the top piston assembly 50. Therefore, because of the space orientation of annular detent receiving recess 92 and flange 93 of the portion 91, detents 94, carried in suitable bores in the piston 49, the sleeve 89, and the tube 79, are located in their released position.

Because of the identity of the way in which the pistons 46 and 49 operate to latch the respective sections 12 and 13 in their extended positions, the latching operation will be described before the further details of the top piston assembly 50 and its operation is discussed. When air is supplied through valve 26 (FIGURE 2), the second section 12 is raised, with the third and top sections 13 and 14 in the telescoped position shown in FIGURE 4, until the second section reaches its fully extended position shown in FIGURE 5, at which time the shoulder 74 engages the upper edge of the detent receiving channel 34 of the collar 30, and the lower O-ring 72 clears the upper end of the tube 22. At this point, since the O-rings 72 no longer seal with tube 22, the air may pass as shown by the flow arrows in FIGURE 6 around the piston 46 through the recess 34 and the ports 73 into the upper section of channel 63. Then, because of the loose fit of the locking plunger 58, the compressed air forces on the lower side of the piston 49 of the third section 13 moving it upwardly, whereupon the lower edge of the recess 61 moves the detents 48 into the channel 35, latching the second section 12 to the base section 11. As the piston 49 continues its upward movement, the locking plunger 58 is moved by spring 59 to its locking position shown in FIGURE 5. After the third section 13 has been raised a few inches to insure that second section 12 is fully extended and latched, the operator anchors guy wires 17, as previously mentioned.

It is important to note that during the extension of the second section 12, no air is supplied to the area between the third section 13 and the second section before the latter has reached its fully extended position in relation to the base section 11. This is important because the third and fourth sections 13 and 14 should not move toward their extended positions relative to the second section 12 until the operator has a chance to secure the second section by means of the guy wires 17. It is true that, in their released position, the detents 48 cooperate with the recess 61 to physically prevent such premature separation. However, the detent camming surface formed by the recess 61 is placed on the reduced portion 60 rather than on the locking plunger 58 only to restrain any small premature separation forces caused by accidental leakage past the O-rings 72. If the air were freely allowed to leak past the piston 46, the full brunt of the pressurized fluid on the piston 49 would cause the recess 61 to cam the detents into the inner surface of the tube 22 so hard as to sometimes score the tube surface or jam the relative movement of the sections. The same is true as to the third section 13.

Turning back to the extension of section 13, after the guy wires 17 are anchored, the operator supplies further compressed air to raise the third section to its fully extended position, shown in FIGURE 10, where the shoulder 83 engages the upper edge of recess 95 formed in the wall of barrel 95*a* of the collar 42. Although FIGURE 10 illustrates the manner in which the top piston assembly 50 unlocks the detents 94 from detent receiving channel 96 as the mast is lowered, it can be seen that the relation of piston 49 to the collar 42 is the same, whether the detents 94 are about to be locked in their latched position or to be about to be cammed off lower tapered edge 97 into their released position.

It also can be seen that, as in the case of the piston 46, it is not until after the lower O-ring 82 clears the top edge of the tube 40 that compressed air may pass into the recess 95 and through the ports 86. Therefore, it is not until such time that the air may push the top piston assembly 50 upwardly causing the lower edge of the recess 92 to cam the detents 94 into their latched position. At that point, the locking plunger 87, through action of the spring 88 would follow the portion 91 upward to the plunger's locking position after which the joint between the second section 12 and the third section 13 would look exactly like the joint between the base and second sections 11 and 12, as shown in FIGURE 5.

After the operator has anchored the guy wires 18, further compressed air is supplied to raise the top section 14.

While the pistons of all of the intermediate sections are the same, the top piston assembly 50 is different in order that it may be unlatched by vacuum in the manner described below. Referring now to FIGURES 4, 8, 9, 10, the top piston assembly 50 includes a short cylinder 100 attached to the lower end of thin walled tube 101 in the same manner as described above in conjunction with the tube 22. Further, similarly to the pistons 46 and 49, a plurality of radial bores 102 are provided through the short cylinder 100 and the tube 101, and receive detents 104 for movement as described in conjunction with the detents 48 and 94. Also similarly, an upwardly facing shoulder 105 is located at the lower end of the tube 101 to stop the extension of the top section 14 in the same manner as the shoulder 83 on the piston 49 limits the extension of the third section 13.

Slidably located within the short cylinder 100 is a guide member 107 rigidly attached to the unlocking portion 91 by means of a threaded shaft 108. These last mentioned components are resiliently urged upward to the position shown in FIGURE 8 by means of a spring 109 acting against a plate 110 fastened to the upper end of the guide member 107. Slidably mounted on the shaft 108 is a locking plunger 111 which is resiliently urged upwardly relative to the unlocking portion 91 by means of a spring 112. This spring is just strong enough to raise the plunger 111 to its locking position abutting the guide member 107 when the detents 104 are aligned with the detent receiving channel 120. It

should be noted that quarter-round grooves 113 and 114 are produced on the plunger 111 and the guide member 107 to form an annular detent receiving recess during the unlatching process described below.

Before discussing the latching and unlatching operation of the top piston assembly 50, latching collar 116 at the top of the section 13 will be briefly described. Except for the fact that it has a smaller diameter, the collar 116 is substantially the same as the collars 30 and 42. More particularly, the collar 116 is counterbored and threaded at its lower end in order to be attached to the tube 79 by clamping flange 117 of the tube with a bushing 118. A recess 119 substantially the same as recesses 34 and 95 is located at the top of the tube 79. However, the recess 119 is not used for the same purposes as the latter recesses, since the section 14 is the uppermost section of the mast. The collar 116 also has a detent receiving channel 120 with its lower edge tapered at 121 and carries a pair of O-ring seals 122 to seal the sliding fit of the tube 101 and barrel 115 of the collar 116.

The condition of the top piston assembly 50 before it reaches its fully extended and latched position, is best shown in FIGURES 4 and 10. Although the latter figure illustrates the manner of unlatching of the detents 94, the condition or relation of the parts of the piston assembly 50 at that are the same, whether the top section 14 is being moved upward or downward. In FIGURE 10 it may be seen that, because of the weakness of the spring 112, the detents 104 have forced the locking plunger 111 downwardly relative to the shaft 108. Therefore, as the piston assembly 50 is raised, the quarter-round groove 113 urges the detents outwardly against the inner surface of the tube 79. However, due to the weakness of the spring 112, the walls of the tube 79 are not scored.

Since there are no seals in the top piston assembly 50 to insure freedom of movement of its parts, air leaks between the guide member 107, the locking plunger 111, and the short cylinder 100, as the assembly is moved upwardly through the tube 79. However, this does not matter, since the amount of leakage is insignificant as compared to the amount of air supplied. Further, since section 14 is the uppermost section, such leakage does not cause any detents to be cammed outwardly and, therefore, any air leakage through the piston assembly 50 is merely vented through a port 123 in the upper end of the tube 101 (FIGURE 9).

When the top section 14 reaches its fully extended position, the detents 104 may be moved outwardly into the latched position, shown in FIGURE 8, whereupon the locking plunger may rise to its locking position abutting the underside of the guide member 107. At that time, the operator removes the supply of compressed air from the interior of the mast M and anchors the top guy wires 19 previously secured to cap 124. Then, although the compressed air will leak out of the interior of the mast, the mast will remain in its extended position, because the different mast sections are latched together and will remain that way.

When it is desired to lower the mast, the operator merely connects a vacuum source to the connector 26 and draws a vacuum within the mast. Since the interior of the tube 101 of the top section 14 is, because of port 123, at atmospheric pressure, the guide member 107, the locking plunger 111, and the unlocking portion 91 will be moved downwardly relative to the short cylinder 100 to the position shown in FIGURE 9. When the recess formed by the quarter-round grooves 113 a nd 114 are aligned with the detents 104, the top section 14 moves downwardly and the detents are cammed by tapered edge 121 to the released position shown in phantom lines, whereupon the top section 14 may telescope into the third section 13 immediately below it. At this time, the vacuum may be removed and the weight of the upper sections of the mast will continue the telescoping operation, however, the lowering process will be quicker if the vacuum is continued.

As the top section 14 approaches its telescoped position within the third section 13, the unlocking portion 91 engages the top of the locking plunger 87 and halts temporarily, while the weak spring 112 is compressed. This is because the spring 88 of piston 49 is stronger. During this brief time, the rest of the top section 14 continues downward and when the lower end of short cylinder 100 engages the flange 93, the unlocking portion 91 forces the locking plunger 87 downwardly until the flange 93 engages the upper end of the piston 49 (see FIGURE 10). This unlocks the detents 94 allowing the third section 13 to move downwardly causing the detents 94 to be cammed into their release position by tapered lower edge 97.

As the third section 13, carrying the top section 14, telescopes into the second section 12, the reduced portion 60 of the piston 49 enters the sleeve 52 of the piston 46 as illustrated in FIGURE 11. Then, continued downward movement of the piston 49 causes the portion 60 to engage and depress the locking plunger 58 of the piston 46 until the lower face or 84 of the land 80 engages the upper end of the piston 46. At this time, the detent receiving recess 61 will be aligned with the detents 48 and the second section 12 may move downwardly, whereupon the tapered edge 36 of the collar 30 cams the detents 48 into their released position. At that point, the upper sections 12, 13, and 14 telescope into the base section 11 and return to the telescoped position, shown in FIGURE 2.

From the above description it may be seen that the mast's structure forces the sections to telescope in the reverse order of the order of extension. Therefore, the sets of guy wires 16 to 18 remain taut and stabilizes the mast M until the particular section to which the guy wires are attached is telescoped. Such would not be the case if, for instance, the second section 12 telescoped before either the third section 13 or the fourth section 14.

While only one mast incorporating the present invention has been shown and described in detail, it will be apparent to those skilled in the art that such is by way of illustration only and numerous changes an dmodifications may be made thereto without departing from the spirit of the present invention. Therefore, it is our intention that the present invention be limited solely by the scope of the appended claims.

We claim:

1. Elevating means including a plurality of telescoping sections each comprising a hollow tube with a latching collar at its upper end and a piston at its lower end, each of said sections being movable between a telescoped position where the pistons contact each other and an extended position where each piston is located within the collar of the outwardly adjacent section; means carried by each of said pistons movable between a released position and a latching position for latching that piston to the outwardly adjacent collar when within that collar; actuation means carried by each of said pisons for actuating said latching means, said actuation means being responsive to the separation of two adjacent pistons to move the latching means of the lower of the two adjacent pistons into said latching position and being responsive to contact between two adjacent pistons to allow the latching means of the lower of the two adjacent pistons to move into said released position, and means for raising each said section from the section outwardly adjacent thereto sequentially in an order commencing with the outermost of said sections.

2. The elevating means set forth in claim 1, wherein part of each actuation means is a locking plunger slidably mounted within a cavity in the associated piston for movement relative to that piston between an upper position and a lower position, said plunger holding the latching means carried by that piston in the latching position when the plunger is in said upper position and

being spaced from the latching means when the plunger is in said lower position; and another part of said actuation means is a reduced portion on the bottom of the piston adapted to enter the cavity of the below adjacent piston and move the plunger carried by the last mentioned piston to that plunger's lower position.

3. The elevating means set forth in claim 2, wherein said actuation means includes a camming surface provided on one of said reduced portions and plunger to move the latching means to said latching position as two adjacent pistons move apart.

4. A vertical telescoping mast including a plurality of tubular telescoping sections each having a piston at its lower end with a latching collar at its upper end, said sections being movable between a telescoped position where said pistons contact each other and an extended position where each piston abuts the collar of the outwardly adjacent section; latching means carried by each of said pistons movable between an outward latched position engaging the outwardly adjacent collar when the section of which the particular piston is a part is in the extended position and an inward released position; actuating means for actuating said latching means, said actuating means being responsive to separation of two adjacent pistons to move said latching means to said latching position and being responsive to the approach and engagement of two adjacent pistons to allow the latching means to move to said released position; means on each piston cooperating with means on the outwardly adjacent collar when the piston abuts that collar for conducting pressurized fluid to the underside of the above adjacent piston; means on each piston for preventing flow of pressurized fluid upwardly past that piston until that piston has reached its extended position abutting the outwardly adjacent collar; and means for supplying pressurized fluid to the lower end of the bottom one of said sections.

5. A telescoping mast comprising: a substantially identical upper section and lower section with said upper section telescoping into said lower section, said upper section including a thin walled hollow tube closed at its lower end; detents mounted in said lower end for movement between an inward released position and an outward latching position; locking means in said lower end, said locking means being movable between a locking position where it engages and holds said detents in their latching position and a release position spaced from said detents, said locking means being normally urged toward said locking position; unlocking means on said lower end for cooperating with a locking means of the lower section and holding the last mentioned means in said release position when said upper section is telescoped into said lower section; said lower section having at its upper end detent receiving means adapted to receive said upper section detents in their latching position when said upper section is fully extended relative to said lower section, whereby the sections may be latched and mechanically held in the extended relation.

6. The telescoping mast set forth in claim 5, wherein a top mast section is provided in telescoping relation with said upper section and a piston assembly is secured to the lower end of said top section, said piston assembly comprising: a plurality of detents mounted for movement between an inward released position and an outward latching position; locking plunger means for moving said last mentioned detents into said latching position and locking them in that position, said locking plunger means being responsive to a selective fluid pressure below said piston assembly to unlock said last mentioned detents and allow the top section to telescope into said upper section; and unlocking means on the lower end of said piston assembly for cooperating with the upper section locking means and holding said last mentioned means in said released position when the top section is telescoped into said upper section, whereby when said top section reaches its telescoped position in said upper section, said upper section is released and may telescope into said lower section.

7. A vertical telescoping mast including a plurality of telescoping sections, each comprising a tube having a piston at its lower end with a latching collar at its upper end, said sections being movable between a telescoped position where said pistons contact and nest with each other and an extended position where each piston abuts the collar of the outwardly adjacent section; a plurality of detents carried by each of said pistons movable between an outward position engaging the outwardly adjacent collar when the section of which the particular piston is a part is in the extended position and an inward released position; a plunger mounted to each of said pistons for movement between an upper position and a lower position, said plunger holding the latching detents carried by that piston in the latching position when the plunger is in the upper position and being spaced from the latching detents when the plunger is in the lower position; a detent unlocking portion depending sufficiently to engage and move the plunger of the below adjacent piston to said lower position of that plunger when the two respective pistons are nested, said unlocking portion having a peripheral recess aligned with the detents carried by the below adjacent piston when the two respective pistons are nested and thereby allow those detents to move into their inward released position; sealing means carried by each piston circumferentially sealing that piston with the inner surface of the tube of the outwardly adjacent section; passage means in each collar, said passage means spanning the sealing means of the piston of the inwardly adjacent section when that section is in the extended position for allowing pressurized fluid to flow upwardly past the spanned sealing means; port means in each piston for conducting pressurized fluid from a point above the sealing means carried by that piston to the underside of the above adjacent piston; and means for supplying pressurized fluid to the lower end of the bottom one of said sections.

8. The telescoping mast set forth in claim 7, wherein said previously recited sections are intermediate sections and a top mast section is provided in telescoping relation with the uppermost intermediate section with a piston assembly secured to the lower end of said top section, said piston assembly comprising: a plurality of detents mounted for movement between an inner released position and an outward latching position; locking plunger means for moving said last mentioned detents into said latching position and locking them in that position, said locking plunger means being responsive to a selective fluid pressure below said piston assembly to unlock said last mentioned detents and allow the top section to telescope into said uppermost section; and unlocking means on the lower end of said piston assembly for cooperating with the plunger of said uppermost secton and holding said last mentioned plunger in said lower position, when the top section is telescoped into said upper section, whereby when said top section reaches its telescoped position in said upper section, said upper section is released and may telescope into said lower section.

9. A telescoping elevating support comprising: first, second, third, and top telescoping sections, each of said first, second, and third sections including a thin walled tube having at its upper end a latching collar having a barrel formed therethrough receiving the inwardly adjacent section in close sliding fit, each of said latching collars having a detent receiving channel formed in the wall of the said barrel, the lower edge of each channel being tapered, each of said latching collars having a recess formed in the wall of the barrel spaced just below said channel; each of said second and third sections having a piston attached to the lower end of its respective thin walled tube, each of said pistons having a plurality of detents mounted for radial movement between an outward latching position adapted to enter one of said detent

receiving channels when the particular piston is in its most elevated position and an inward released position, each piston having a land spaced just below said detents and carrying means for sealing the piston to the surface of the outwardly adjacent tube, said sealing means being positioned so as to become aligned with said recess of the outwardly adjacent collar when the respective piston reached its most elevated position, each piston having a cavity therein opening through the upper end thereof and passages communicating said cavity with the exterior of the piston at a point above the respective sealing means, each piston having locking means carried in the cavity thereof and being resiliently urged upward to a locking position where the locking means holds the respective detents in their latched position; a reduced portion on the bottom of the third section piston adapted to be received within the cavity of the second section piston and depress the locking means of the last mentioned piston when said third section is fully telescoped into said second section, said reduced portion being shaped to allow the detents of the second section piston to move to their released position when said third section is fully telescoped into said second section; and means to supply pressurized fluid to the lower end of said first section, whereby said second section is fully extended before fluid is supplied to the lower end of said third section and the detents carried by the second section piston will be moved to their latched position after the second section is raised to its fully extended position.

10. The elevating support set forth in claim 9, wherein a piston assembly is attached to the lower end of the top section and forming an effective seal between the area above the piston assembly and the area below it, said piston assembly including: a hollow cylindrical member at the lower end of the top section in fixed relation thereto; a plurality of detents mounted for radial movement between an outward latching position where they may be received into the detent receiving channel of said third section collar and an inward released position substantially within the top section; a guide member and a detent unlocking portion in fixed spaced relation being slidably mounted for vertical movement at least partially within said cylindrical member, said detent unlocking portion being at the lower end of the piston assembly and being adapted to be received into the cavity of the third section piston and depress the locking means therein to release the detents carried by the last mentioned piston; means resiliently urging said guide member upwardly relative to said cylindrical member; and a locking plunger slidably mounted between said guide member and unlocking portion, said locking plunger being resiliently urged upwardly relative to said unlocking portion, said locking plunger having a recessed camming surface formed on the peripheral edge thereof adapted to cam the top section piston detents into latching relation when they become aligned with the detent receiving channel of the third section, and then move upwardly to a latching position where the last mentioned detents are held in their latched position; and means on said top section communicating atmosphere with the upper side of said top piston assembly whereby the top piston assembly detents may be released by drawing a vacuum below the assembly, which vacuum causes the slidably mounted elements of the assembly to move downwardly sufficiently to register said locking plunger camming surface with the detents to release them, whereupon the top section may telescope down into the third section.

11. A telescoping elevating support, comprising: a plurality of mast sections including an upper section and a lower section, said sections being movable between relatively nested and relatively extended positions; first fluid pressure means associated with said sections and operable responsive to a positive fluid pressure applied adjacent the lower end of said lower section for moving said sections sequentially from relatively nested to relatively extended positions; mechanical latch means for releasably holding said sections in their relatively extended positions; and second fluid pressure means operable responsive to a negative fluid pressure applied adjacent the lower end of said lower section for initiating the sequential release of said latch means to permit the said sections to move from their relatively extended to their relatively nested positions in the reverse order of extension.

12. A telescoping elevating support, comprising: a plurality of mast sections including an upper section and a lower section and at least one intermediate section, said sections being movable between relatively nested and relatively extended positions; first fluid pressure means associated with said sections and responsive to a positive fluid pressure applied adjacent the lower end of said lower section for moving said sections sequentially from relatively nested to relatively extended positions; mechanical latch means between each pair of adjacent sections and operable in latching position to releasably hold each pair of adjacent sections in their relatively extended positions; actuating means for urging said latch means to latching position only when adjacent sections are in their relatively extended positions, said actuating means being responsive to movement of the next successive one of said sections above a pair of adjacent interlatching sections toward its relatively extended position to so urge said latch means; and means for initiating the reverse sequential release of said latch means.

13. A telescoping elevating support, comprising: a plurality of mast sections including a lower section, at least one intermediate section, and an upper section, said sections being movable between relatively telescoped positions in which said sections are nested with one another and relatively extended positions in which said sections are above one another in the recited order; first fluid pressure means associated with each said intermediate and upper sections and responsive to a positive fluid pressure applied adjacent the lower end of said lower section for moving said sections sequentially in the order recited from relatively telescoped to relatively extended positions; latch means carried by each of said intermediate and upper sections for releasably holding said sections in their relatively extended positions; and second fluid pressure means carried by said upper section and operatively associated with the latch means carried by said upper section, said second fluid pressure means being responsive to a negative fluid pressure applied adjacent the lower end of said lower section for releasing the last mentioned latch means to initiate the sequential movement of said sections from their relatively extended to their relatively telescoped positions in the reverse order of extension.

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