

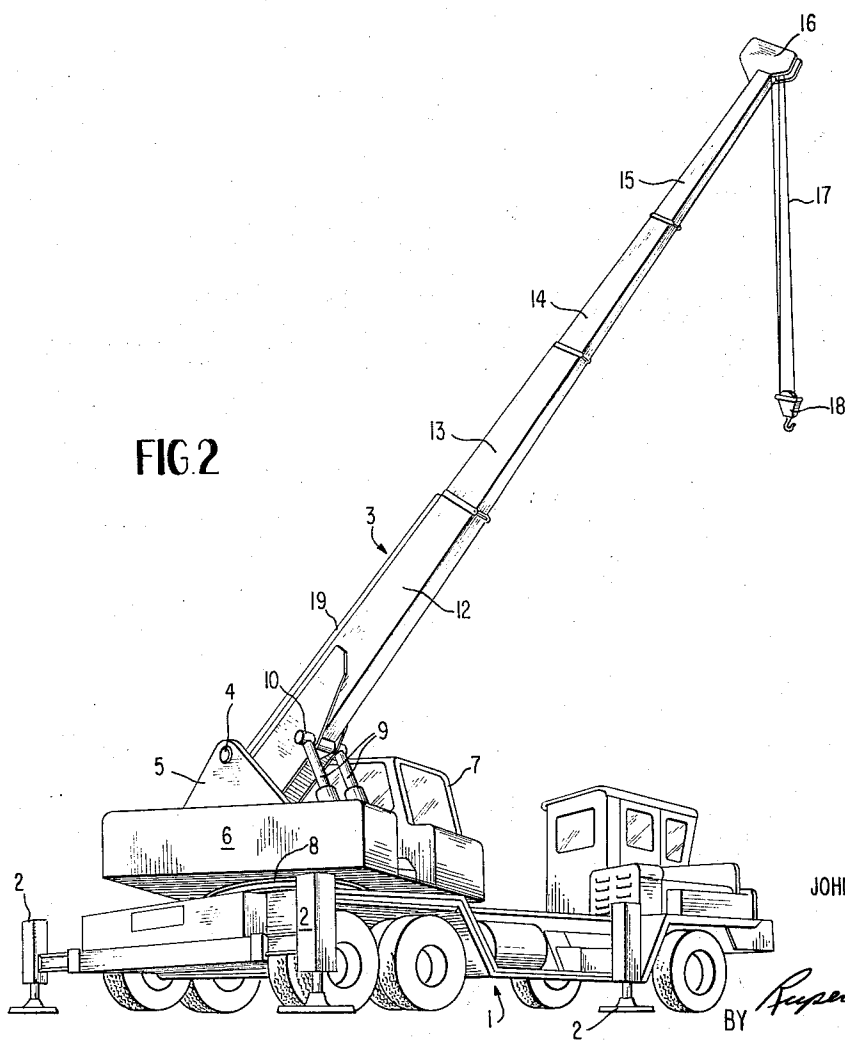
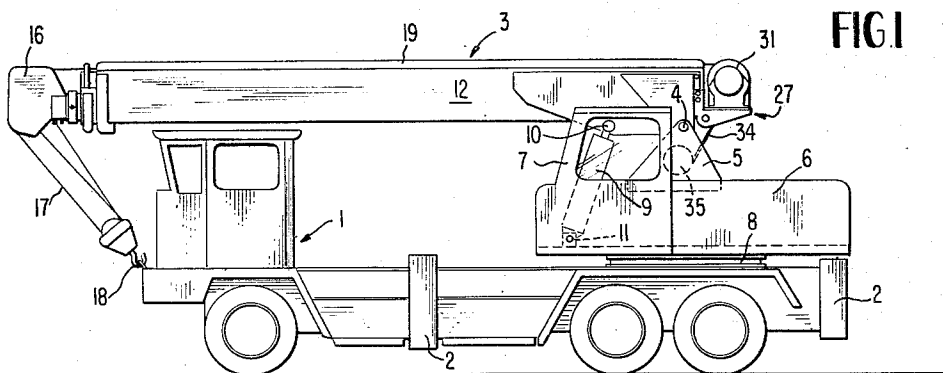
March 29, 1966

J. L. GROVE
TELESCOPIC CRANE BOOM WITH LONGITUDINALLY
EXTENDING CYLINDER CONNECTOR

3,243,052

Filed April 8, 1965

8 Sheets-Sheet 1



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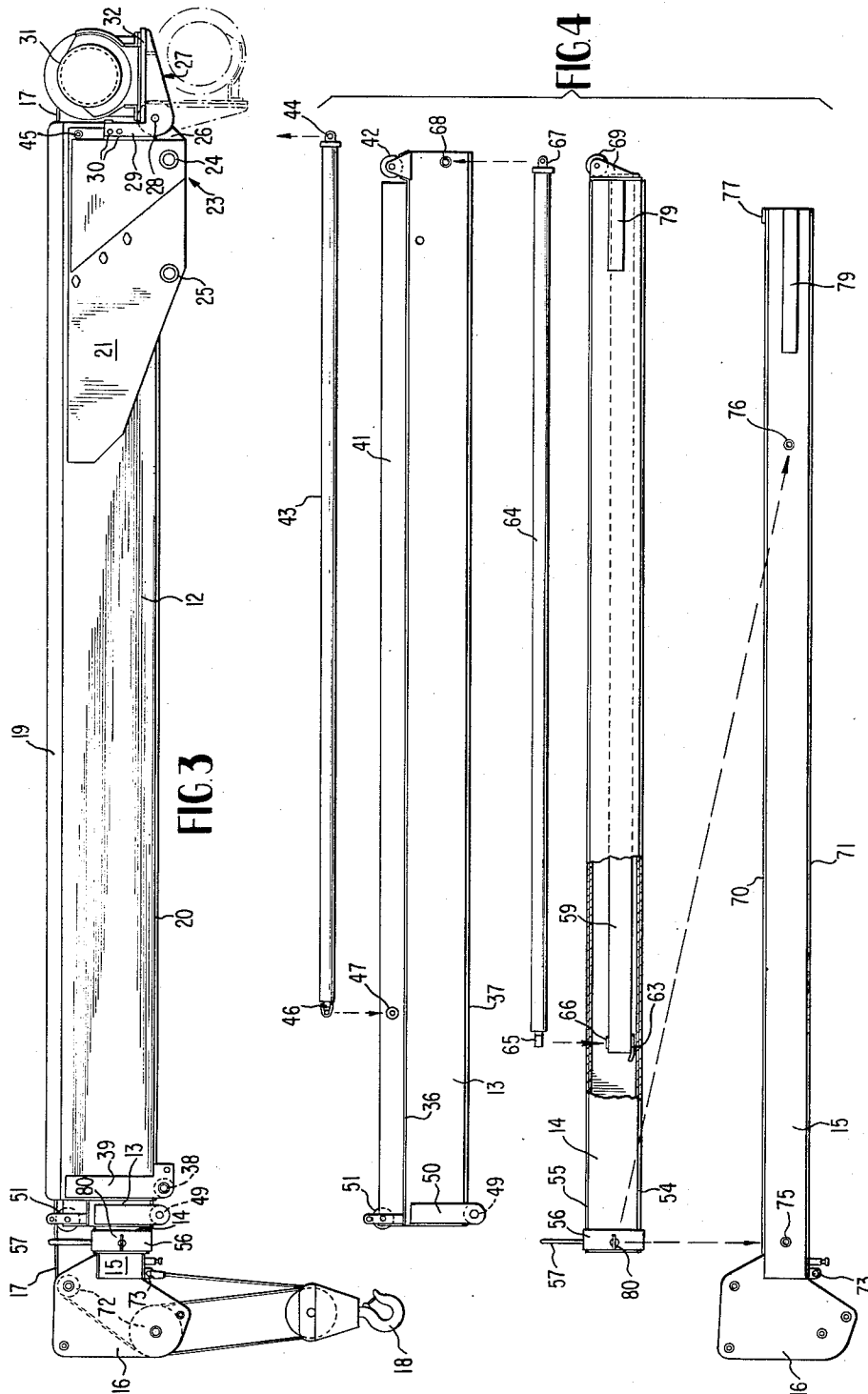
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3,243,052

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8 Sheets-Sheet 2



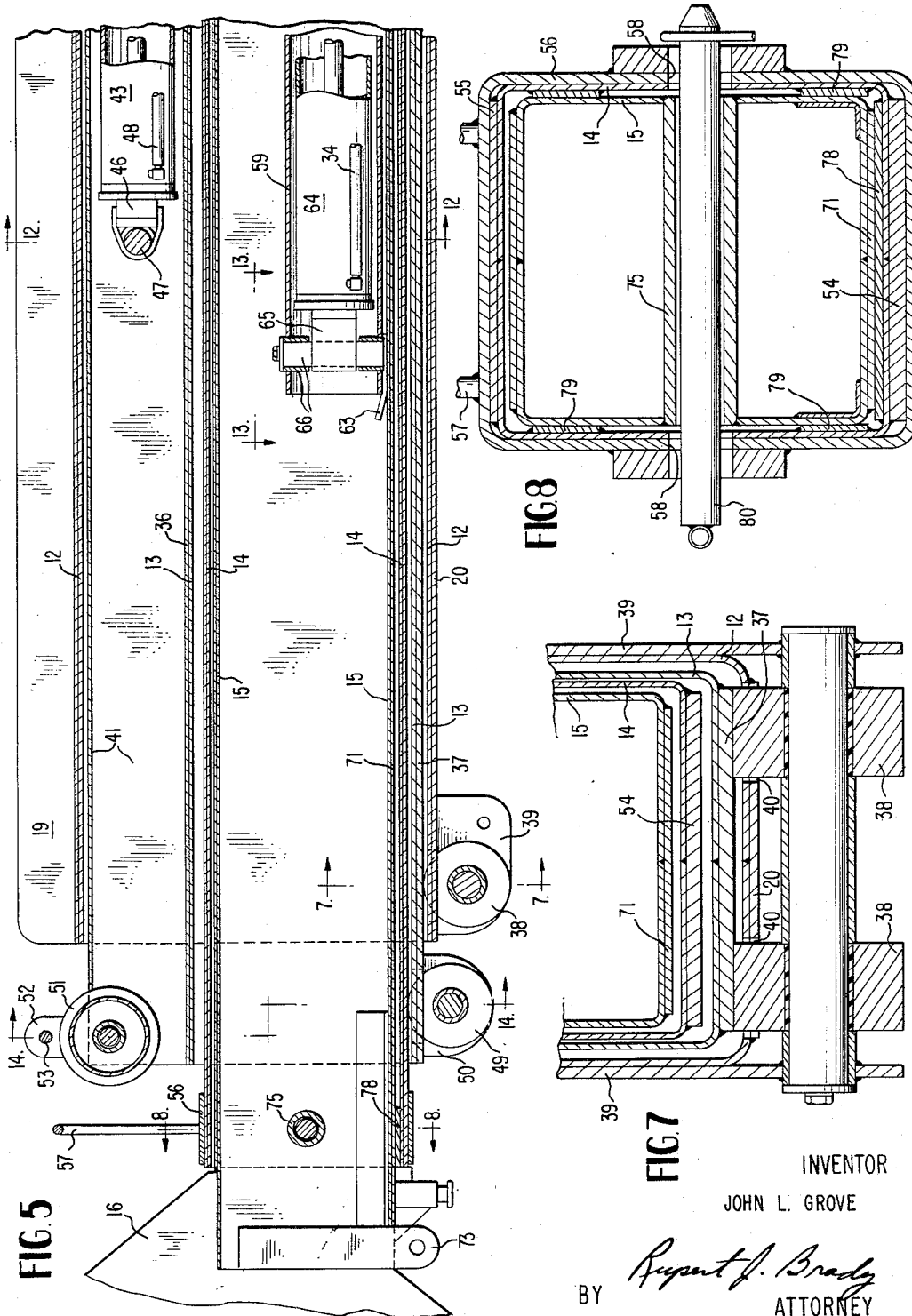
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8 Sheets-Sheet 3



March 29, 1966

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3,243,052

Filed April 8, 1965

8 Sheets-Sheet 4

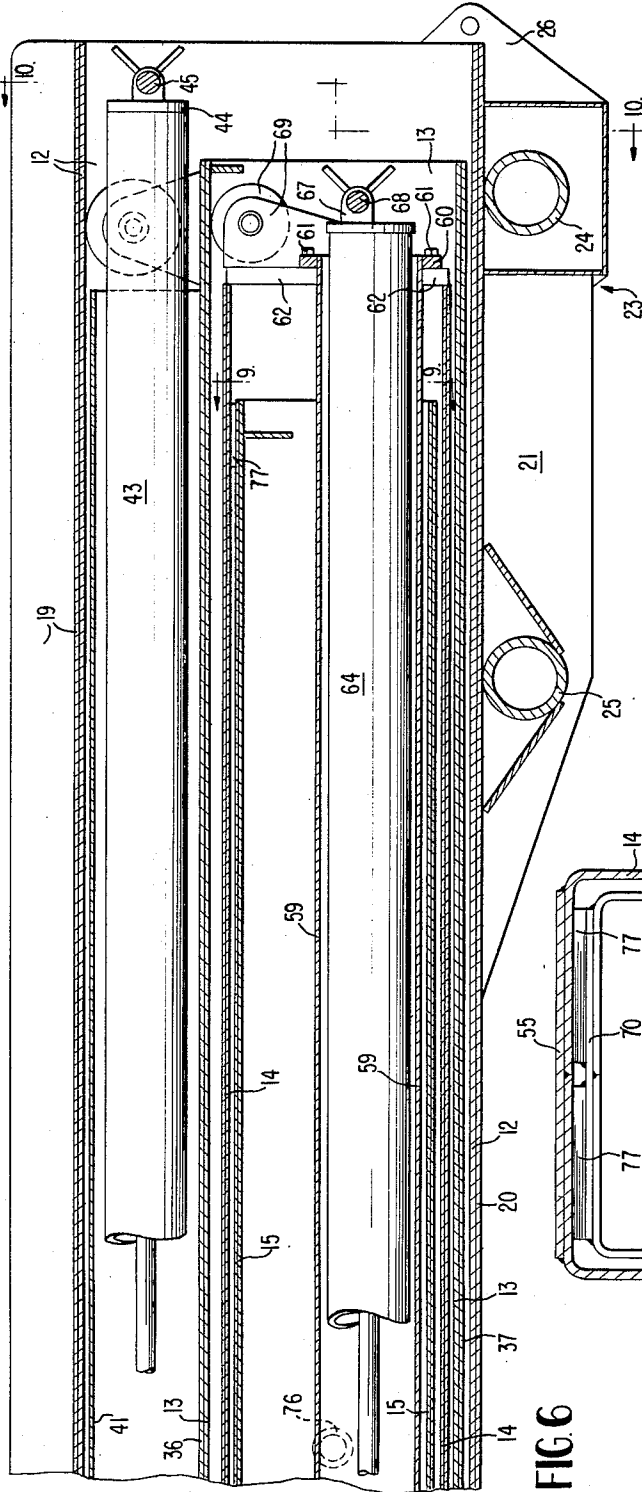


FIG 6

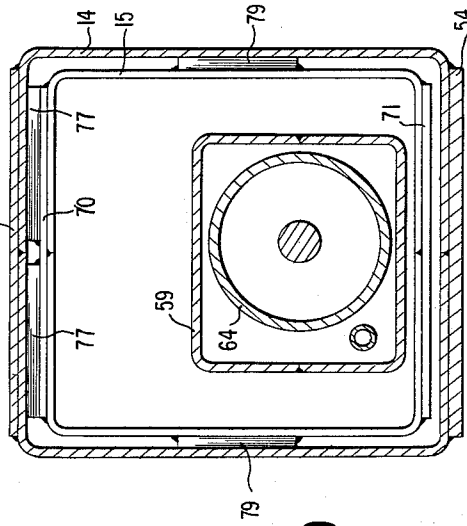


FIG 9

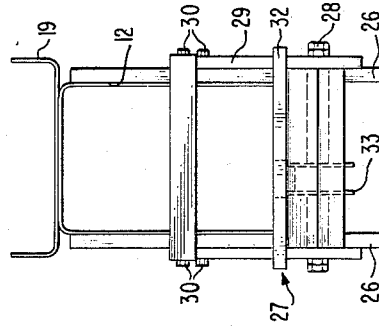


FIG 15

March 29, 1966

J. L. GROVE
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3,243,052

Filed April 8, 1965

8 Sheets-Sheet 5

FIG 10

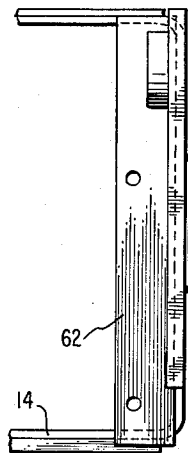
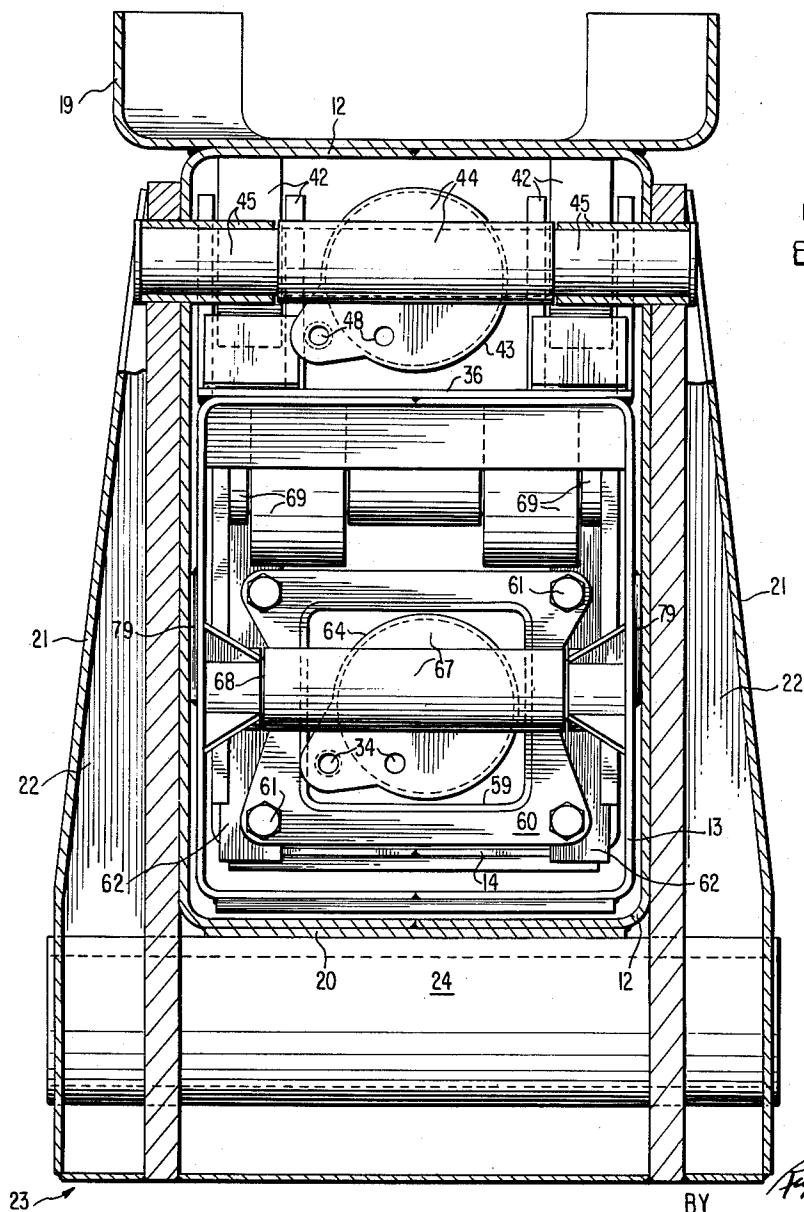


FIG 11

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March 29, 1966

Filed April 8, 1965

J. L. GROVE
TELESCOPIC CRANE BOOM WITH LONGITUDINALLY
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3,243,052

8 Sheets-Sheet 6

FIG. 12

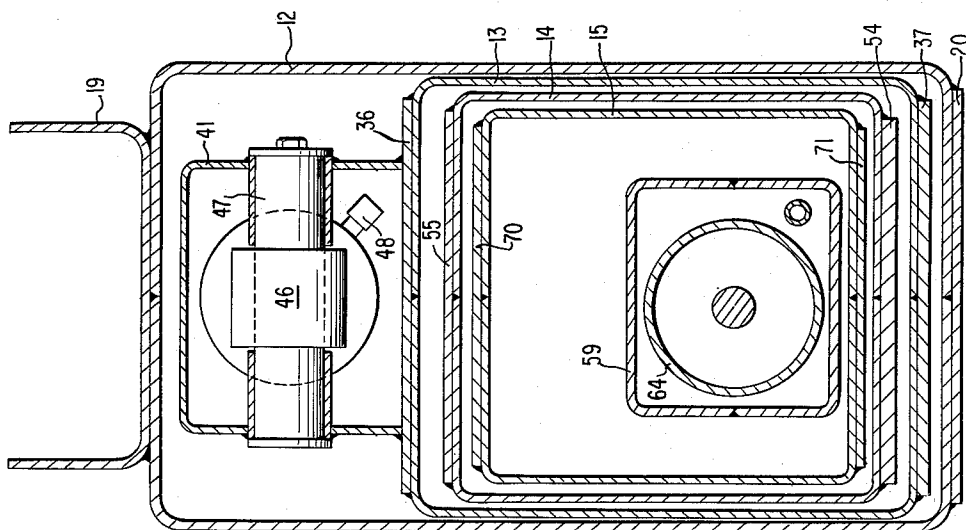


FIG. 13

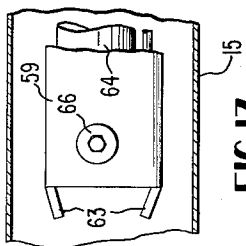
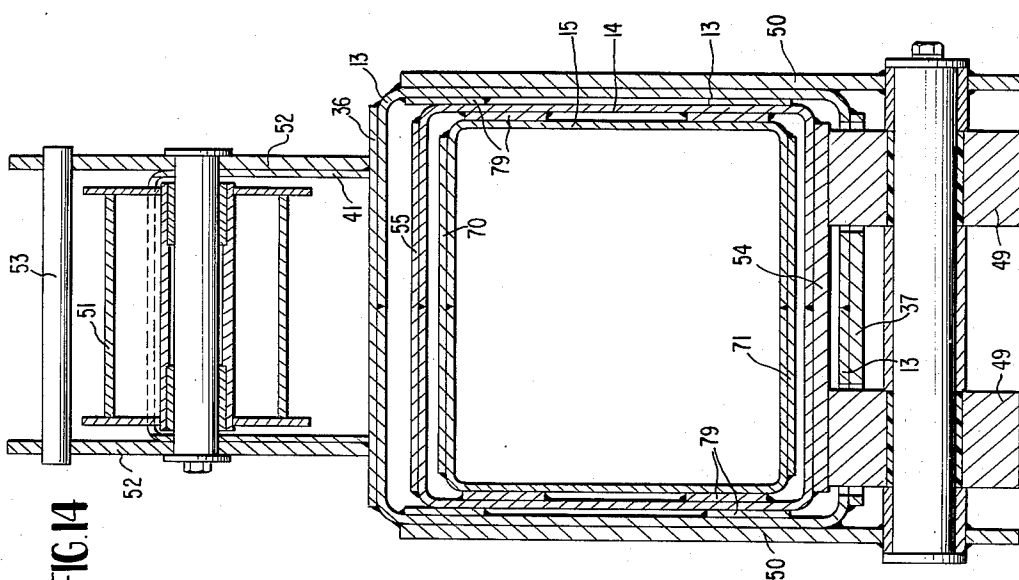


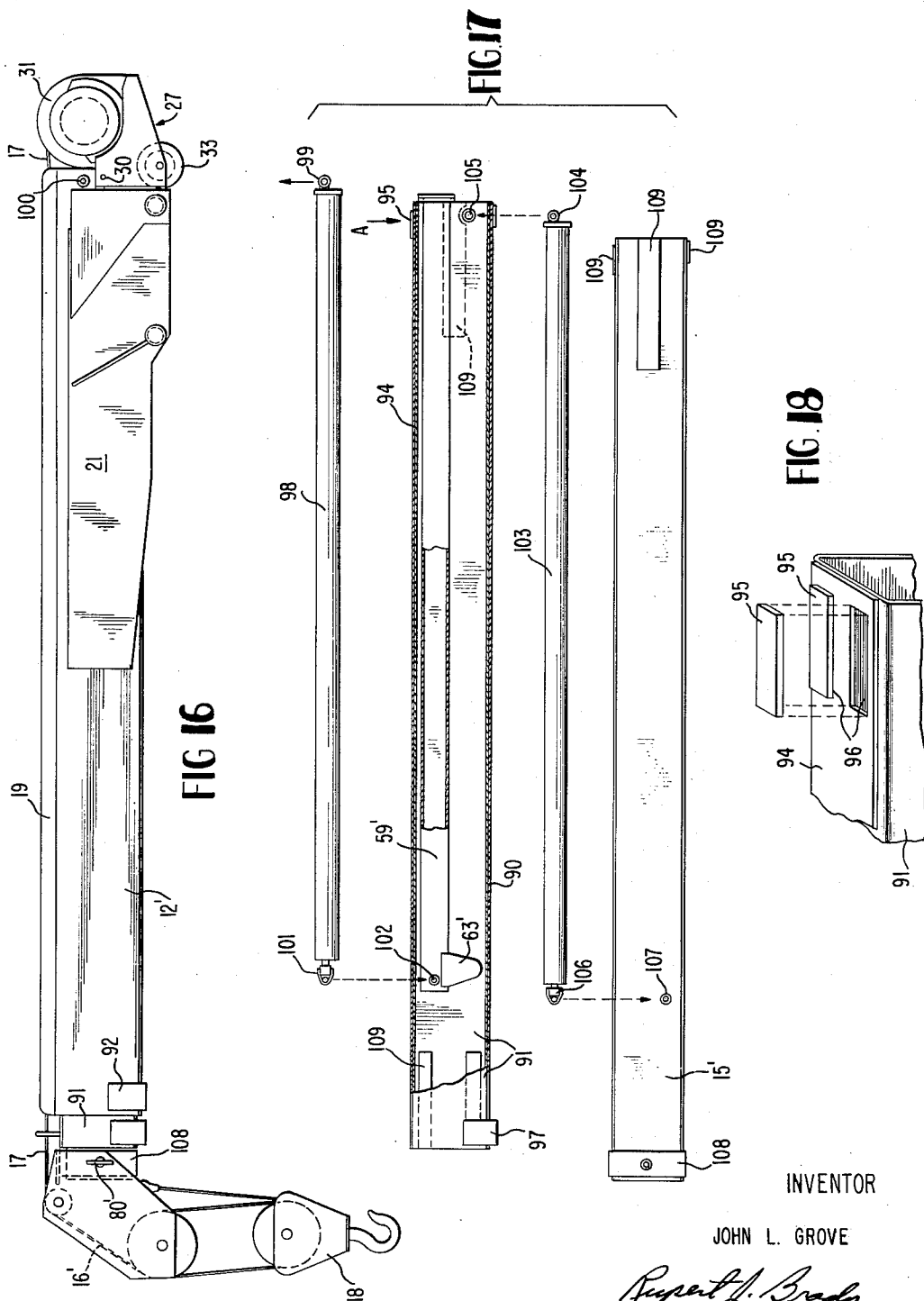
FIG. 14



Filed April 8, 1965

3,243,052

8 Sheets-Sheet 7



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3,243,052

Filed April 8, 1965

8 Sheets-Sheet 8

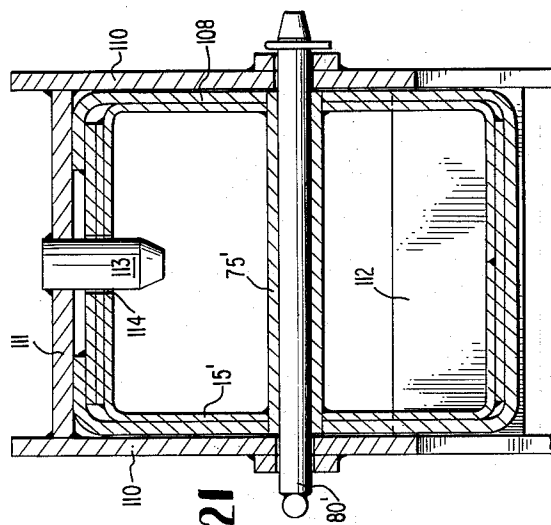
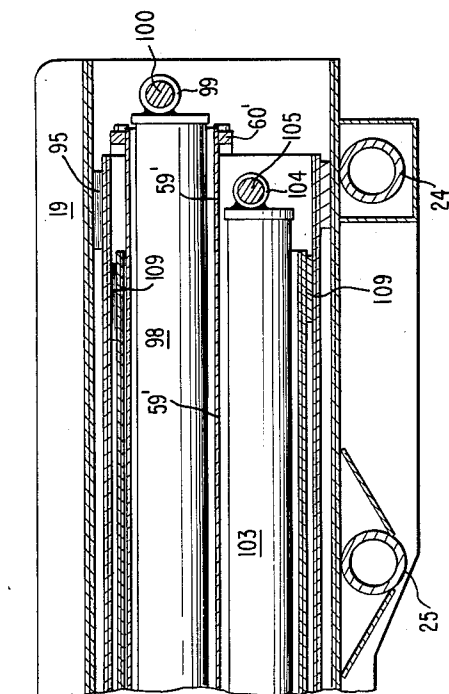


FIG. 21

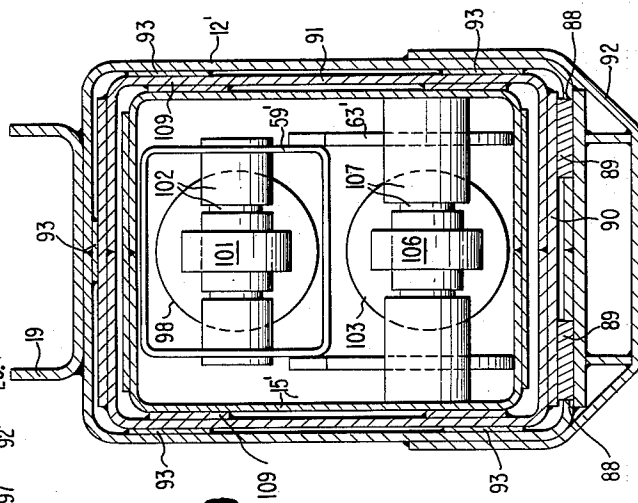
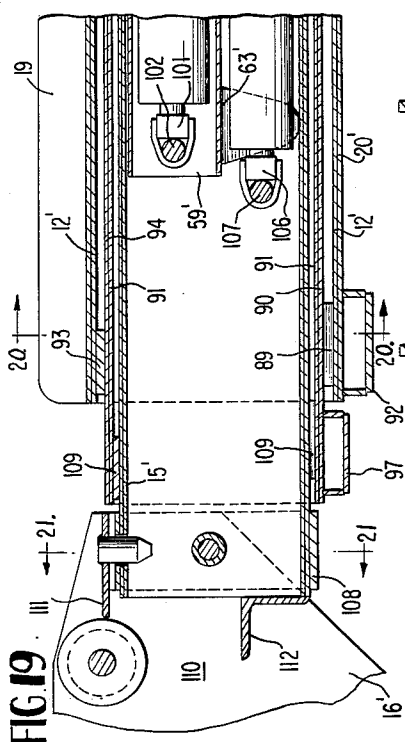


FIG. 20

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1

2

3,243,052

TELESCOPIC CRANE BOOM WITH LONGITUDINALLY EXTENDING CYLINDER CONNECTOR

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Filed Apr. 8, 1965, Ser. No. 446,602

14 Claims. (Cl. 212—55)

This invention relates broadly to cranes and more particularly to a multiple section, telescopic, hydraulically extensible boom structure.

The telescoping crane boom of the present invention is intended mainly for use on vehicles to provide a mobile hydraulic truck crane, but it is to be understood that the boom structure may also be used in other applications, mounted on stationary structures.

One of the problems encountered with heavy duty mobile hydraulic cranes is providing a telescoping boom with the required and desired strength in the different extended positions of the boom without having the boom sections unduly heavy, and without having the boom base section unduly large and heavy relative to the size and weight of the outermost boom section. Usually a boom of at least three extensible sections is required to obtain the reach normally required of mobile hydraulic cranes. In such booms, the base section is usually the largest and the strongest and the succeeding sections are successively smaller and weaker, telescopically disposed within each other. The problem is to design a crane boom in which the cross section modulus of succeeding telescopic sections is diminished only slightly from the succeeding section to maintain the outermost or fly section as strong as possible and to decrease the overall weight of the boom.

The problem becomes even more difficult in the design of a four-section hydraulically extendible self-storing boom structure, for heavy duty operations, because it is very difficult to provide a structure with hydraulic cylinders within the boom for hydraulically extending the various sections, while at the same time maintaining only a gradual change in the cross section of successive boom sections.

With present-day construction costs and techniques, the time involved in setting up a heavy duty crane at the job site is becoming increasingly more important. In the past large heavy duty mobile cranes have required a separate boom truck, to carry sections of the boom, and the set-up time at the job has required considerable time usually in the range of several hours. Thus, heretofore a mobile heavy duty crane has required approximately half a day for setup time and requires an expensive separate boom truck to stand by idly while it is in operation.

It is therefore the main object of the present invention to provide a novel construction for hydraulically extensible telescopic crane booms which overcomes all of the previously-mentioned problems.

Another object of the present invention is to provide a construction of a heavy duty, long-reach, self-contained four-section telescoping boom which can be quickly set up at a job site.

Another object of the invention is to provide a construction of heavy duty hydraulically extensible telescopic boom having a reach of approximately eighty feet which is extensible in a period of less than five minutes.

Another object of the invention is to provide a novel construction of a mid-section in a multi-section hydraulic boom which enables only a gradual reduction in the cross section modulus of successive boom sections in three and four section booms.

Another object of the invention is to provide a construction of heavy duty telescopic boom for a mobile hydraulic crane in which the boom is completely self-

contained and capable of carrying and storing the fullest amount of boom sections at all times so that they are immediately available at a job whether they are needed or not.

5 Still another object of the invention is to provide a construction of heavy duty telescopic crane boom which is lighter in weight than similar type booms of comparable reach and is capable of lifting heavier loads.

10 A further object of the invention is to provide a construction of heavy duty telescopic boom in which the fly section or outermost section is telescopically disposed within and also disposed around a portion of the succeeding section.

15 Other and further objects of the invention reside in the core construction for housing a hydraulic cylinder within a boom section, the structure of the four-section hydraulically extensible boom, the structure of the three-section hydraulically extensible boom, as well as other features which become apparent to one skilled in the art by reference to the specification hereinafter following and the drawings, in which:

FIG. 1 is a side elevational view showing a mobile hydraulic crane incorporating the crane boom of the invention, shown in its retracted stored position;

25 FIG. 2 is a perspective view of the mobile hydraulic crane of FIG. 1, showing the four-section boom in its extended position;

FIG. 3 is a side elevational view of the four-section boom of the invention;

30 FIG. 4 is an exploded view showing the outer three boom sections of the four-section boom of FIG. 3, and the manner in which the hydraulic extension cylinders are connected therebetween;

35 FIG. 5 is an enlarged longitudinal sectional view of a fragmentary portion of the outer end of the boom of FIG. 3, showing the manner in which the boom sections are connected within each other;

40 FIG. 6 is an enlarged longitudinal sectional view of a fragmentary portion of the opposite end of the boom of FIG. 3;

FIG. 7 is an enlarged fragmentary cross sectional view taken substantially along line 7—7 of FIG. 5 and particularly showing the roll connection between boom sections;

45 FIG. 8 is an enlarged cross sectional view taken substantially along line 8—8 of FIG. 5, and particularly showing the removable pin connection between the fly and outer mid-sections of the boom;

50 FIG. 9 is an enlarged cross sectional view taken substantially along line 9—9 of FIG. 6 and particularly showing the fly section telescopically disposed within the outer mid-section of the boom, and disposed about the inner core thereof;

55 FIG. 10 is an enlarged cross sectional view taken substantially along line 10—10 of FIG. 6, and particularly showing the manner in which the core or cylinder connection housing is connected within the outer mid-section of the boom;

60 FIG. 11 is a fragmentary end view of the outer mid-section of the boom showing the core or cylinder housing connecting flange;

FIG. 12 is an enlarged cross sectional view taken substantially along line 12—12 of FIG. 5;

65 FIG. 13 is a fragmentary top elevational view, partly in cross section, taken substantially along line 13—13 of FIG. 5;

FIG. 14 is an enlarged cross sectional view taken substantially along line 14—14 of FIG. 5;

70 FIG. 15 is an enlarged end elevational view of the back end of the boom of FIG. 3, with the winch removed, and particularly showing the pivotal winch mounting platform;

FIG. 16 is a side elevational view of a three-section boom according to the invention;

FIG. 17 is an exploded view partly in longitudinal section of the outer two sections of the boom of FIG. 16, showing the manner in which the telescopic cylinders are connected between adjacent sections;

FIG. 18 is a fragmentary top perspective view looking generally in the direction of arrow A in FIG. 17;

FIG. 19 is an enlarged, foreshortened, longitudinal sectional view of the three-section boom of FIG. 16;

FIG. 20 is a cross sectional view taken substantially along line 20—20 of FIG. 19; and

FIG. 21 is an enlarged cross sectional view taken substantially along line 21—21 of FIG. 19.

The four-sectional hydraulically extensible boom according to the invention is shown in FIGS. 1 and 2 mounted on a vehicle, indicated generally at 1, adapted for travel over roads or rough terrain, to form a mobile hydraulic crane. The vehicle is equipped with hydraulically extensible outriggers 2 for stabilizing the vehicle frame on the supporting surface and removing the load from the vehicle wheels when the crane is set up for operation. The boom assembly 3 is pivotally mounted at 4 to a pair of boom supports 5 on housing 6 which includes an operator's cab 7 and the hydraulic control system for the boom. A pair of hydraulic cylinders 9 are pivotally connected between the boom assembly and housing 6 at 10 and 11 respectively for raising and lowering the boom assembly. The housing and cab 6 and 7 are connected to the vehicle through turntable 8, operable from the operator's cab which enables the boom assembly 3 to be continuously rotated through 360°. Although the boom assembly has been shown mounted on a mobile vehicle, it is to be understood that it can also be mounted on a stationary platform.

Referring more particularly to FIGS. 3—15, the four-section, self-contained hydraulically expansible telescopic boom according to the invention includes a base section 12, an inner mid-section 13 telescopically disposed within base section 12, an outer mid-section 14 telescopically disposed within inner mid-section 13, and a fly section 15 telescopically disposed within outer mid-section 14 and having a boom nose assembly 16 connected to the outer end thereof for control of the hoist cable 17 and hook assembly 18.

Base section 12 is of rectangular cross section as particularly shown in FIGS. 10 and 12, with an upwardly opening channel 19 connected on the upper surface thereof and coextensive therewith to provide a guide for the hoist cable 17 which lays within the channel. The sides of channel 19 converge somewhat inwardly toward each other from the back end to the forward end of the base section so as to provide a tapered channel.

The bottom of base section 12 is provided with a reinforcing base plate 20 which is coextensive with the length of the base section. The base end of the base section is provided with reinforcing side plates 21, securely connected thereto by welds and gusset plates 22, which extend to form a box section, indicated generally at 23, beneath the end of the base section in which transversely extending boom pivot bushing 24 and lift cylinder bushing 25 are rigidly mounted. Bushing 24 provides a connection for the pivot connection 4 between the boom assembly and the pair of boom supports 5 while bushing 25 provides a connection for the pivot connection 10 between the pair of hydraulic raising and lowering cylinders 9 and the boom assembly. The box section 23 provides a pair of rearwardly extending supports 26 adjacent the terminating end of the bottom surface of the base structure to which a platform 27 is pivotally connected at 28 as shown particularly in FIGS. 3 and 15. The sides of platform 27 are substantially L-shaped as indicated at 29 with the upper ends thereof bolted at 30 to the sides of base section 12. A hydraulically powered winch 31 is connected on the horizontal portion 32 of the platform at

the end of the base section such that the hoist cable 17 extending from and controlled by the winch is positioned within channel 19. The pivot connecting member 28 also provides a mount for rotatable hose wheel 33 over the hoses 34 from the movable hydraulic cylinder within the boom assembly extend and from which the hoses are guided onto spring-loaded hose reel 35, indicated in dotted lines in FIG. 1, for automatically taking up and extending the hydraulic hoses as the boom is retracted and extended, respectively. When access to the end of the boom assembly is desired for maintenance, or the like, the bolts 30 are removed from opposite sides of the platform 27 after cable 17 is slackened or retracted into the winch, and the winch platform is then pivoted downwardly about connection 28, as indicated in dotted lines in FIG. 3, moving the winch away from the end of the boom to expose the same and leave it clear of obstructions so that maintenance can be performed thereon. In FIG. 15 the winch is shown removed from the horizontal portion 32 of the platform for clearer illustration of the platform and its connection with the boom base section 12.

Inner mid-section 13 of the boom assembly is generally rectangular in cross section and is provided with reinforcing plates 36 and 37, respectively, on the top and bottom surfaces thereof and coextensive with the length thereof, with the lower reinforcing plate 37 providing a bearing surface for roller bearings 38 rotatably connected to the reinforcing collar 39 rigidly connected on the outer end of base section 12. The roller bearings 38 extend through apertures 40 adjacent the forward end of base section 12 and extend interior of the base section slightly above the lower surface thereof so that when inner mid-section 13 is telescopically disposed within the base section, reinforcing plate 37 is in bearing contact with the rollers.

An upper housing 41, comprising an inverted channel member, is securely connected by welding or the like to the top of inner mid-section 13, that is, the top of reinforcing plate 36 such that upper housing 41 is an integral part of mid-section 13 and telescopes within the base section since the overall height of the mid-section, including house 41, is slightly less than the interior height of base section 12. Upper housing 41 is substantially coextensive with inner mid-section 13, as shown in FIG. 4, but terminates adjacent the inner end of the mid-section to provide connection space for a pair of roller bearing assemblies 42, FIGS. 4 and 10, connected on the upper surface of the inner end of the inner mid-section. As shown in FIG. 10, when inner mid-section 13 is telescoped within base section 12 roller bearing assemblies 42 roll upon the inner top surface of base section 12.

A hydraulic cylinder 43 is disposed within upper housing 41 with the base end 44 of the cylinder casing connected by pivot pin and bushing assembly 45, FIGS. 3, 4, 6 and 10, to the top portion of the inner end of base section 12 while the end 46 of the piston rod, extending from cylinder 43, is pivotally connected through pivot pin and bushing connection 47, FIGS. 4, 5 and 12, to upper housing 41 of the inner mid-section 13, adjacent the outer end thereof. The pivot pin and bushing connections 45 and 47 by which cylinder 43 is connected between base section 12 and inner mid-section 13 extend transversely of the respective sections. The hydraulic lines 48 from opposite ends of the cylinder extend out of the rear of the boom assembly and to the hydraulic control system within housing 6 and cab 7.

A pair of roller bearings 49 are rotatably connected adjacent the outer edge of inner boom section 13 by side reinforcing members 50, such as to extend inwardly through apertures in the bottom surface of the boom section and terminate slightly above the inner bottom surface of the boom section as shown in FIG. 14. A cable guide drum 51 is rotatably connected on the outer end of upper housing 41 by means of upwardly extending drum mounting and cable guard straps 52 connected to housing 41.

5

A guard rod 53 is connected between guard straps 52 above and in spaced relation with drum 51 such that the hoist cable 17 disposed in channel 19 extends over guide drum 51 and beneath guard rod 53.

Outer mid-section 14 of the boom assembly is of hollow rectangular cross section having length and width dimensions slightly smaller than the inner dimensions of the lower portions of inner boom section 13, as illustrated in FIGS. 12 and 14. A reinforcing plate 54 is provided on the lower surface of the boom section and being longitudinally coextensive therewith forming a bearing surface for roller bearings 49 of inner mid-section 13 as outer mid-section 14 is extended and retracted relative thereto. A similar reinforcing plate 55 is coextensively disposed on the upper surface of the boom section, and the outer end of the boom is provided with a surrounding reinforcing collar 56 rigidly connected thereto. A guide loop 57 for guiding the hoist cable 17 is connected on the upper surface of collar 56 while transversely aligned apertures 58 are provided through the sides of the collar and outer mid-section as indicated in FIG. 8. The purpose of the aligned apertures is explained more fully hereinafter following.

A generally square cross-sectioned core of cylinder box housing 59, FIGS. 4, 5, 6, 9, 10, 12 and 13, is connected within outer mid-section 14 in spaced relation with the inner surfaces thereof by means of flange plate 60 rigidly connected to the inner end thereof and secured by bolts 61 to end flanges 62 rigidly connected to the inner end of outer mid-section 14, as shown more particularly in FIG. 10. Cylinder box housing or core 59 and outer mid-section 14 are thus rigidly connected together as a unit at their inner ends with the outer end of core 59 terminating somewhat inwardly of the outer end of outer mid-section 14, as shown in FIGS. 4 and 5. Since core 59 is of substantial length a pair of support skids 63, FIGS. 4, 5 and 13, are connected to the outer end of the core and are adapted to rest on the inner bottom surface of outer mid-section 14 when fly section 15 is not in place. When fly section 15 is telescoped within the outer mid-section, skids 63 will bear on the inner bottom surface thereof, as will be more fully understood later in the specification. Support skids 63 are curved upwardly and somewhat inwardly in converging relation on their outer ends to aid in sliding the fly section 15 in place if it is removed from the boom assembly.

Telescopic hydraulic cylinder 64 is disposed within core or cylinder box housing 59 with the end 65 of its piston rod pivotally connected to the outer end of core 59 by means of shaft and bushing connection 66, shown more particularly in FIG. 5. The shaft and bushing connection are preferably disposed vertically across the end of the core. The base end 67 of hydraulic cylinder 64 is pivotally connected to shaft 68 connected transversely between the sides of inner mid-section 13 on the inner end thereof as shown in FIGS. 4, 6 and 10. A pair of roller bearing assemblies 69 extending above the top surface of outer mid-section 14 are also connected to the inner end thereof to provide a rolling contact with the inner upper surface of inner boom section 13 as outer boom section 14 is extended and retracted therein.

The fly section 15 of the boom assembly is the outermost boom section and is of rectangular cross section with the cross-sectional dimensions being slightly smaller than the cross-sectional dimensions of outer mid-section 14, such that the fly section telescopes within the outer mid-section in close proximity to the inner walls thereof and is telescoped over core or cylinder box housing 59 such that the support skids 63 of the core slide on the inner bottom surface of the fly section. Reinforcing plates 70 and 71 are coextensively connected on the upper and lower surfaces of the fly section and a boom nose assembly 16 is securely connected to the outer end of the fly section. The boom nose assembly, as indicated in FIG. 3, carries a plurality of sheaves 72 about which the hoist

6

cable 17 is threaded to support the hook assembly 18 therebeneath, which is raised and lowered by the hoist cable under control of winch 31. The end of hoist cable 17 is anchored to lug 73 on the outer end of the fly section.

A bushing 75, shown particularly in FIGS. 4 and 8, is connected interior of the fly section adjacent the outer end thereof and transversely between the sides to form a transverse passage through the fly section. As shown in FIGS. 4 and 6, a pair of bushings 76 are disposed through opposite side walls of the fly section in registration with each other, spaced somewhat inwardly of the inner end thereof. When the fly section is telescoped within the outer mid-section skid plates 77, connected on the upper surface of the fly section, slide along the inner top surface of outer mid-section 14, as shown in FIGS. 6 and 9, and the lower reinforcing plate 71 thereof is disposed in sliding relation with skid plate 78 connected interior of outer mid-section 14 on the outer edge thereof, as shown in FIGS. 5 and 8. Side shims 79, which serve as bearing members to remove side slack from the telescoping sections, are appropriately connected between the sides of the various sections as shown in FIGS. 4, 8, 9, 10 and 14.

The fly section 15 is normally manually movable within outer mid-section 14 since there is no hydraulic cylinder connected thereto for hydraulic extension of the same, and the core 59 within the outer mid-section enables the difference in the cross section modulus between the fly and the outer mid-sections to be a minimum. During transportation and when the fly section is not in use it is locked in its retracted position within outer mid-section 14 by manually removable pin 80 passing through apertures 58 in reinforcing collar 56 and the outer end of outer mid-section 14 and hollow transverse bushing 75 in the outer end of fly section 15, which bushing is disposed in registration with apertures 58. The outer ends of the fly and outer mid-sections are thus normally locked to each other by pin 80. To extend the fly section, pin 80 is removed, the fly sections are pulled out of outer mid-section 14 until the bushings 76 adjacent the inner end of the fly section move into registration with apertures 58 in the outer end of outer mid-section 14, and then pin 80 is inserted through the apertures 58 and bushings 76 to lock the inner end of the fly section to the outer end of the outer mid-section.

The hydraulic hoses 34 from the front and rear ends of hydraulic cylinder 64 extend out through the inner end of the boom assembly over hose wheel 33 and onto the automatically retractable and extensible spring-load hose reel 35 so that the hydraulic hoses for the cylinder are automatically played out and retracted as inner mid-section 13, to which the cylinder is connected, is moved relative to base section 12.

To retract the fly section pin 80 is removed to unlock the inner end of fly section 15 from the outer end of outer mid-section 14. Hydraulic winch 31 is actuated to draw hook assembly 18 tight against nose assembly 16 and by slowly winding hoist cable 17 onto the winch the cable pulls on the nose assembly 16 and slides fly section 15 inwardly to retract the same within outer mid-section 14. Pin 80 is then inserted to lock the front or outer end of fly section 15 to the outer end of outer mid-section 14. The remaining boom sections are then retracted with the hydraulic cylinders 43 and 64 in the usual manner.

By way of example, a four-section boom, having a base section 24 feet long, provides an overall boom assembly including the winch and nose assembly having a retracted length just short of 30 feet and an effective extended length of slightly over 80 feet.

THREE-SECTION TELESCOPIC BOOM

In FIGS. 16-21 the inventive feature of the use of a core or cylinder housing 59' within a boom section to provide a three-section hydraulically extensible hydraulic boom is illustrated. Use of the core 59' provides a three-

section boom structure having a very gradual difference in the cross section modulus of succeeding boom sections enabling reductions in weight and increased strength in the boom assembly as a whole. Components corresponding to those described in connection with the four-section telescopic boom are designated by similar reference numerals and a description and explanation of the same is not repeated with respect to the present boom structure.

Base section 12' is generally rectangular in cross section, in the same manner as the base section for the four-section boom, having a greater height than width. The section is provided with a reinforcing plate 20' coextensive with its lower surface and the lower surface of the base section, adjacent its outer end, is provided with a pair of cutouts 88 therein in which a pair of bearing pads 89 are slidably inserted. The bearing pads are constructed of brass or other relatively soft bearing material and extend somewhat above the lower inner surface of the base section for sliding contact with lower reinforcing plate 90 on mid-section 91. The outer lower end of base section 12' is provided with a reinforcing collar 92 connected thereto, and bearing shim pads 93 constructed of brass or the like are connected to the top and side inner surfaces at appropriate places to eliminate slack movement between the base section and mid-section during their telescopic travel.

Mid-section 91 of generally rectangular cross section is disposed within base section 12' and is also provided with an upper reinforcing plate 94 coextensive with the section, and as indicated in FIG. 18 is provided with a pair of bearing pads 95 inserted in recesses 96 adjacent the inner end of upper reinforcing plate 94. The pads extend somewhat above the level of plate 94 and are disposed in sliding engagement with the inner top surface of base section 12'. The outer end of the mid-section is provided with a reinforcing collar 97 similar to the reinforcing collar of the base section.

Core or hydraulic cylinder housing 59' of hollow rectangular cross section is disposed longitudinally within the upper portion of mid-section 91 with the outer end of the core terminating somewhat inwardly of the outer end of the mid-section. The core is spaced from the inner walls of the base section and is rigidly connected through flange 60' to the top portion of the inner end of the mid-section. The forward or outer end of core 59' is supported by skids 63' which bear on the lower inner surface of fly section 15' when the fly section is telescoped within mid-section 91 and telescoped over core 59'.

Telescopic hydraulic cylinder 98 is pivotally connected at its base 99 to a shaft assembly 100 connected transversely across the inner end of base section 12'. The extensible end 101 of the piston rod of cylinder 98 is connected through transverse shaft assembly 102 to the outer end of core 59'. In a similar manner, telescopic hydraulic cylinder 103 is pivotally connected at its base 104 through transverse shaft assembly 105 to the lower portion of the inner end of mid-section 91 beneath core 59' and the end 106 of the extensible piston rod thereof is pivotally connected through transverse shaft assembly 107 to fly section 15', at a point somewhat inwardly of the outer end thereof, as shown in FIGS. 17 and 19. The cylinders 98 and 103 are thus disposed one above the other with cylinder 98 disposed within core 59'. The fly section is disposed in surrounding relation to both cylinders and the core.

Fly section 15' is provided with a reinforcing collar 108 about its outer end and bearing shim plates 109 similar to pads 93 are appropriately connected between the sides, tops and bottoms of the various sections to provide a smooth telescoping action therebetween.

To extend the boom assembly, cylinder 103 is first actuated to extend fly section 15' relative to mid-section 91, and then cylinder 98 is actuated to extend mid-section 91, carrying the fly section, relative to base section 12'.

The nose assembly 16', carrying the sheaves over which hoist cable 17 is threaded to support hook assembly 18, includes side plates 110 connected by top plate 111 and transverse support 112 spaced inwardly of the end of the nose assembly. The end of the nose assembly at its connection with the fly section is an inverted U-shape with top plate 111 carrying a downwardly protruding pin connector 113 for insertion through aperture 114 in the top of collar 108 and fly section 15'. When the nose assembly is in position transverse support 112 lays across the terminating end of the fly section, FIGS. 19 and 21, and operates to transfer the majority of the load from the nose assembly pin connectors 113 and 80' to the axis of the boom. Most lifting is done when the boom is in an elevated position with the normal maximum elevation angle being 75°. When the boom is thus elevated the direction of the load on the cable supporting the hook is such that most of the load is transferred through support 112 to the boom assembly.

The side plates 110 are apertured and disposed in registration with a hollow bushing 75' disposed transversely through the outer end of the fly section and collar 108, and are disposed to receive removable pin connector 80' passing therebetween to lock the nose assembly on the end of the fly section. The nose can be quickly removed by removing the hoist cable therefrom, removing pin 80' and lifting off the nose assembly.

While the winch 31 has been shown mounted on the end of the boom assembly it is understood that it can also be mounted on a stationary part of the boom supports 5 or the like. While the invention has been described in certain preferred embodiments it is realized that modifications can be made without departing from the essence of the invention, and it is to be understood that no limitations on the invention are intended other than those 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. A boom section for a plural section hydraulically extensible telescopic boom structure, including means connected to one end of said boom section and extending longitudinally and interior thereof and having an end terminating adjacent the opposite end thereof, said means disposed in spaced relation to the interior of said boom section substantially throughout its length, and a connection on the terminating end of said means adapted to receive one end of a hydraulic cylinder connected at its opposite end to another boom section adapted to telescopically receive said boom section therein, whereby said boom section is adapted to telescopically receive throughout its length a further boom section therein in surrounding relation to said means.

2. A boom section as set forth in claim 1 in which said means comprises a hollow core member adapted to house a hydraulic cylinder.

3. A mid-section for a telescopic hydraulic boom of the type having at least an inner section, a mid-section telescopically disposed in the inner section and an outer section telescopically disposed in the mid-section, the improvement comprising; means extending longitudinally of the interior of said mid-section in spaced relation thereto and rigidly connected at one end to the inner end of said mid-section, and a connector on the other end of said means adapted for connecting a hydraulically extensible cylinder on the inner section to said mid-section, whereby said mid-section is adapted to telescopically receive an outer section interior thereof in surrounding relation to said means and said connector.

4. A telescopic hydraulically extensible boom for a crane or the like having at least three sections comprising an inner section, a mid-section telescopically disposed in the inner section, means extending longitudinally of the interior of said mid-section in spaced relation thereto and rigidly connected at one end to the inner end of said mid-section, an outer section telescopically disposed in

said mid-section in surrounding relation to said means for longitudinal movement relative to said mid-section and means, and a lineally extending power means connected at one end to said inner section and at the other end to said means for moving said mid-section longitudinally relative to said inner section.

5. A telescopic boom as set forth in claim 4 in which said lineally extending power means is connected at one end adjacent the inner end of said inner section and at the other end adjacent the outer end of said means.

6. A telescopic boom as set forth in claim 4 including a second lineally extending power means connected at one end to said mid-section and at the other end to said outer section for moving said outer section longitudinally relative to said mid-section and said means.

7. A telescopic boom as set forth in claim 6 in which said lineally extending power means and said second lineally extending power means are disposed one above the other in said mid-section.

8. A telescopic fluid motor extensible boom for a crane or the like comprising an inner section, a mid-section telescopically disposed in said inner section for relative longitudinal movement, a hollow housing extending longitudinally of the interior of said mid-section and rigidly connected at the inner end to the inner end of said mid-section, an outer section telescopically disposed in said mid-section in surrounding relation to said hollow housing for longitudinal movement relative to said mid-section and hollow housing, and fluid motor means disposed in said hollow housing and connected at one end to said inner section and at the other end to said hollow housing for moving said mid-section longitudinal relative to said inner section.

9. A telescopic boom as set forth in claim 8 including downwardly extending skids connected to the outer end of said hollow housing and extending into sliding contact with said outer section to support said hollow housing within said mid-section.

10. A telescopic boom as set forth in claim 9 including second fluid motor means disposed beneath said hollow housing with one end connected to said mid-section and the other end extending between said skids and connected to said outer section for moving the outer section longitudinally relative to said mid-section and hollow housing.

11. A telescopic boom as set forth in claim 8 including second fluid motor means connected at one end to said

mid-section and at the other end to said outer section for moving the outer section relative to said mid-section, said second fluid motor means disposed interiorly of said outer section adjacent said hollow housing.

12. A telescopic hydraulically extensible four-section boom, comprising a base section, an inner section, connecting means on the upper surface of said inner section, said inner section and said connecting means telescopically disposed as a unit in said base section, first fluid motor means connected at one end to said base section and at the other end to said connecting means for moving said inner section lineally relative to said base section, an outer section telescopically disposed in the inner section, means extending longitudinally of the interior of said outer section and connected at the inner end to the inner end of said outer section, second fluid motor means connected at one end to said inner section and at the other end to said means for moving said outer section and said means lineally relative to said inner section, and a fly section telescopically disposed substantially throughout its length in said outer section in surrounding relation to said means and said second fluid motor for movement lineally relative to said outer section and said means.

13. A telescopic boom as set forth in claim 12 in which said connecting means comprises a hollow housing substantially coextensive with said inner section, and said first fluid motor means longitudinally disposed in said hollow housing.

14. A telescopic boom as set forth in claim 13 in which said hollow housing is disposed above said means in the retracted position of the boom, with said hollow housing being above said outer section, and said means spaced longitudinally of said hollow housing in the extended position of the boom.

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