

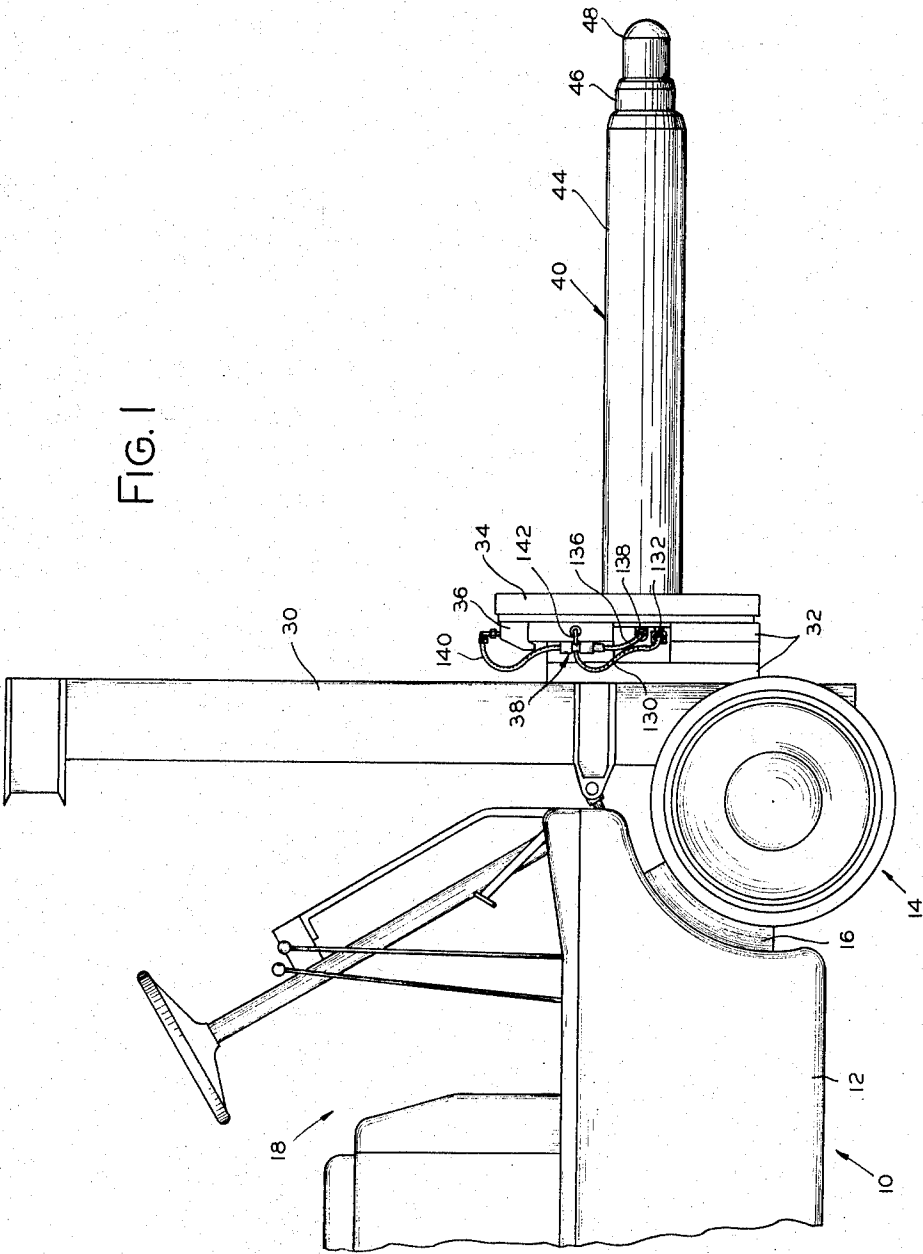
May 19, 1959

J. L. BRADY
TELESCOPIC CYLINDER ASSEMBLY

2,887,092

Filed Dec. 16, 1955

3 Sheets-Sheet 1



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FIG. 5

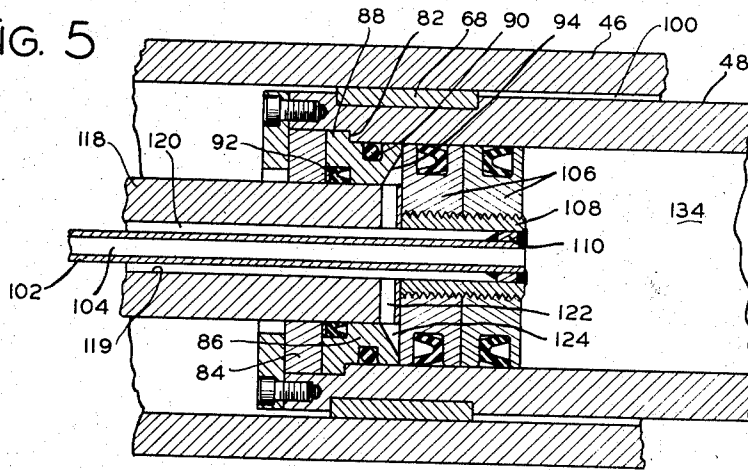
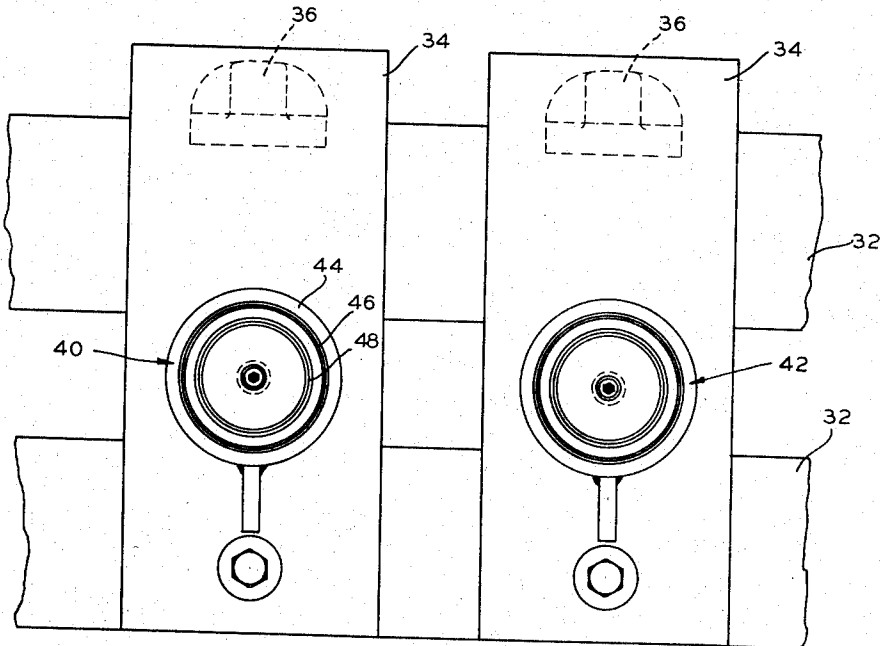


FIG. 2



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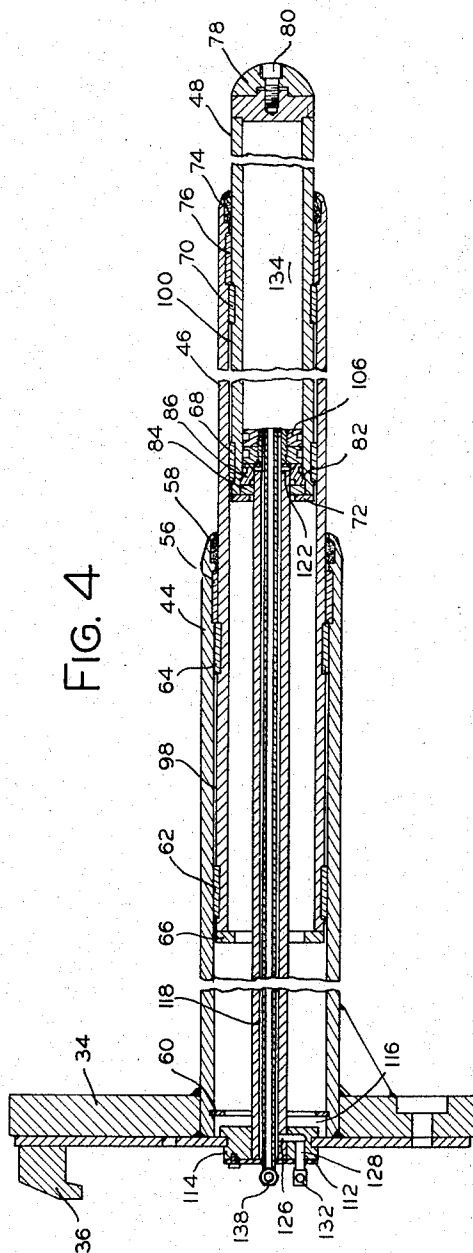
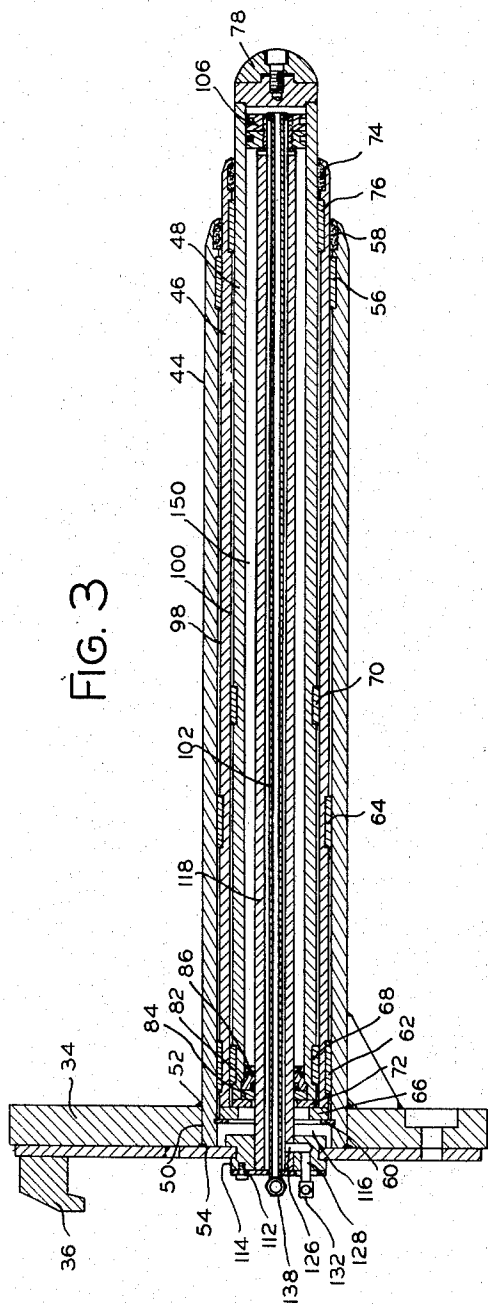
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3 Sheets-Sheet 3



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TELESCOPIC CYLINDER ASSEMBLY

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Application December 16, 1955, Serial No. 553,595

2 Claims. (Cl. 121-46)

This invention relates to telescopic cylinders and more particularly to a novel double-acting telescopic hydraulic cylinder of the type having a plurality of telescoping rams and which is particularly adapted for use as an attachment for industrial trucks, although many other uses will appear to those skilled in the art.

For illustrative purposes I have shown my device connected to the vertically movable carriage of an industrial lift truck. This device generally comprises three hollow cylindrical telescoped members, the inner two of which are extensible outwardly to predetermined fully extended positions relative to each other and to an outer fixed member, inner fixed rod means extending coaxially within said ram members and having a first passage operatively connected to a first chamber in the inner movable ram member and a second passage operatively connected to a second chamber in the inner movable ram member, and hydraulic control means connected to said passages and chambers for selectively actuating the movable ram members to a variety of selected positions.

It is a primary object of this invention to provide an improved double-acting telescopic cylinder assembly.

Another important object of this invention is to provide a double-acting telescopic cylinder assembly which is of relatively simple structure, which is compact in arrangement, which is serviceable and rugged in form, and which is adapted for use with various types and configurations of fluid pressure operated rams in a variety of machines.

Other objects and advantages of this invention will be apparent to those skilled in the art from the following detailed description taken in conjunction with the accompanying drawings wherein:

Figure 1 is a side elevational view which schematically shows the front portion of an industrial lift truck having my telescopic cylinder assembly connected to the lift carriage thereof;

Figure 2 is a front elevation of a pair of telescopic cylinders mounted on the carriage means of Figure 1;

Figure 3 is a sectional view of the telescopic cylinder construction and carriage means therefor of Figure 1;

Figure 4 is a sectional view of the construction shown in Figure 3 when the inner and outer movable ram members are fully extended; and

Figure 5 is an enlarged view of a part of my construction which is shown in Figure 4.

Referring now to Figures 1 and 2, numeral 10 designates generally an industrial lift truck of well known construction, including a body portion 12, a chassis on which said body portion is mounted including a drive axle assembly 14 and a differential gear mechanism 16, and an operator control portion 18 in which is mounted a plurality of operator control means of well known construction, as shown, for controlling the truck 10 and lift and telescoping cylinder construction mounted thereon, as hereinafter described.

Mounted forwardly of the drive axle are load supporting uprights 30 within which is mounted for vertical

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movement in a well known manner a load support carriage 32 on which is mounted plate members 34 extending transversely of the truck and connected to carriage 32 by hanger members 36. A hydraulic pump, not shown, is mounted within body 12 for supplying hydraulic fluid under pressure to a control valve means, generally shown at 38, for a purpose to be described.

A pair of hydraulic cylinder constructions 40 and 42, which comprise the essence of this invention, are rigidly connected at the left ends thereof, as by welding, to the plates 34, each such cylinder construction generally comprising an outer fixed hollow cylindrical member 44, an outer movable hollow cylindrical member 46, and an inner movable hollow cylindrical member 48, said cylindrical members being coaxially mounted for telescoping movement relative to each other. The hydraulic control valve means 38 is operatively connected to cylinder construction 40 in a manner to be described, and is controlled by an operator in cab 18 by valve control means, not shown, of well known construction.

Since the cylinder constructions 40 and 42 are identical to each other and since they may be combined singly or in tandem with any given machine, the following detailed description of my cylinder construction and control means therefor will refer to unit 40 only.

Referring now to Figures 3, 4 and 5, outer fixed cylinder 44 passes through an opening 50 in carriage plate 34 and is welded thereto at annular welds 52 and 54. An annular stop and guide ring 56 and an annular sealing ring 58 are rigidly connected to the inner periphery of cylinder 44 near the open right end thereof, and an annular stop ring 60 is connected to the inner periphery of said cylinder near the left end thereof. The outer movable cylinder 46, shown in Figure 3 in a fully retracted position and in Figure 4 in a fully extended position, has connected to the outer periphery thereof an annular guide ring 62 and an annular stop and guide ring 64, said ring 64 limiting maximum extended position of cylinder 46 when in abutment with stop ring 56, as shown in Figure 4. Ring 66 is connected to the left end of cylinder 46 and fixes the fully retracted position thereof when in contact with ring 60, as shown in Figure 3.

The inner movable cylinder 48, shown in fully retracted position in Figure 3 and fully extended in Figure 4, has connected in predetermined positions to the outer periphery thereof an annular guide ring 68 and an annular stop and guide ring 70, and to the left end thereof a ring 72 which abuts ring 66 when cylinder 48 is in its fully retracted position. An annular sealing ring 74 and an annular guide and stop ring 76 are connected to the inner periphery of cylinder 46 near the right end thereof, said ring 76 being adapted to abut ring 70 of cylinder 48 for limiting the maximum extended position of said latter cylinder. A hemispherical cap member 78 is connected to the closed right end of cylinder 48 by a bolt 80. Held in fixed axial position along the inner periphery of cylinder 48 between end ring 72 and a diametrically stepped down portion 82 is a spacing ring 84 and a cup-shaped annular member 86 which is held in position by a flange 88 located between ring 84 and the stepped down portion 82, said member 86 having an outer annular sealing groove 90 therein, an inner annular sealing groove 92, and a partial cone-shaped milled-out section 94 formed in the outer face thereof (see Figure 5).

The rings 56 and 58 which are connected to cylinder 44 and the rings 62 and 64 which are connected to cylinder 46 cooperate to maintain a predetermined annular clearance 98 between cylinders 44 and 46 along the entire length of cylinder 46 within cylinder 44 irrespective of the degree of extension of cylinder 46 and

the rings 74 and 76 which are connected to cylinder 46 and the rings 68 and 70 which are connected to cylinder 48 cooperate similarly to at all times maintain a clearance 100 between cylinders 46 and 48, thereby minimizing friction and wear problems of the parts of the cylinder construction 40.

An inner fixed tube member 102 having an axially extending passage 104 therethrough extends well into cylinder construction 40 in coaxial relation with each of the cylinders and is held in such relation by tapped sealing and guiding means 106, which is threadedly connected to a sleeve member 108 of inner tube 102 at the right end thereof, and by a plate 112 having a central opening therein supporting the left end of tube 102 and bolted to a spacing ring-shaped member 114 which is held in position between carriage 34 and stop ring 60 by a spacing member or shim 116. The sleeve member 108 is held in spaced relation to tube 102 by a ring 110 welded in position between the tube 102 and the sleeve.

An outer tube member 118 having an axially extending opening 119 therethrough which is of greater diameter than tube 102, forms an annular passage 120 with tube member 102, and is coaxially related to tube 102 and the cylinder construction 40, extending at the right end thereof through supporting members 84 and 86 and at the left end thereof through supporting members 114 and 116. Radially outwardly extending passages 122 are located in the right end of the tube 118 and register with an annular chamber 124, which is formed between the milled-out section 94 of member 86 and members 106, when inner movable cylinder 48 is in a fully extended position. Radially outwardly extending passage 126 is located near the left end of tube 118 and connects annular passage 120 with valve means 38 by way of a passage 128 and a conduit 130, said conduit being connected to the passage 128 by a member 132 having a port therein.

A chamber 134 of cylinder 48 is operatively connected to valve means 38 by means of passage 104, a conduit 136, and a ported member 138. A conduit 140 connects valve means 38 with the discharge side of pump means, not shown, and a conduit 142 connects said valve means with the inlet side of such pump means, said valve means being controlled by means, not shown, to selectively connect either of passages 104 or 120 with hydraulic fluid under high or low pressure through conduits 140 or 142, respectively, for extending or retracting cylinder means 40 in a manner to be described.

In operation, valve means 38 may be controlled to connect either of passages 104 or 120 with high pressure fluid in conduit 142, and to simultaneously connect the other of said passages with low pressure fluid in conduit 140.

Assuming now that the cylinders comprising the cylinder construction 40 are in a fully retracted position as shown in Figure 3 wherein end stop rings 60, 66 and 72 of cylinders 44, 46 and 48, respectively, are in abutment, movement of valve means 38 to connect ported member 138 with high pressure conduit 142 results in the following sequence of operations: (a) High pressure fluid flows through passage 104 of tube 102 into chamber 134 of cylinder 48 to actuate said cylinder extensibly outwardly without affecting the retracted position of cylinder 46 until such time as stop ring 70 of cylinder 48 is actuated into abutment with stop ring 76 of cylinder 46; and (b) continued application of pressure fluid in chamber 134 causes extending movement of cylinder 46 until full extension thereof results with stop ring 64 of cylinder 46 in abutment with stop ring 56 of fixed cylinder 44. It is apparent that the degree of extension of cylinder construction 40 can be adjusted as desired between full retraction and full extension thereof by selectively neutralizing the position of valve means 38,

wherein the flow of fluid into chamber 134 ceases and no venting of said fluid out of said chamber occurs.

In order to retract cylinders 46 and 48 from a fully extended position, as shown in Figure 4, the position of valve means 38 is reversed so that pressurized fluid flows into chamber 124 by way of conduit 130, ported member 132, passages 128, 126 and 120, and radial passages 122, the pressure fluid in chamber 134 being bled off through passage 104, ported block 138, and conduits 136 and 140 to the low pressure area at the pump inlet, whereupon the high pressure fluid acting on the outer face of member 86 in chamber 124 first actuates leftwardly cylinder 48 only until stop ring 72 contacts stop ring 66 of cylinder 46, following which simultaneous retraction of cylinders 46 and 48 occurs until stop ring 66 abuts ring 60 of cylinder 44 in the full retracted position shown in Figure 3. At any position between fully retracted and fully extended positions it is apparent that chamber 124 is out of registry with radial passages 122 and that the annular chamber 150 formed between tube 118 and cylinder 48 conducts pressurized fluid to the outer face of member 86 to return cylinders 46 and 48 to a full or intermediate retracted position from any given extended position.

From the above it will be apparent that I have provided a relatively simple, compact, and efficient telescoping cylinder construction manufacturable at relatively low cost and providing for a minimum amount of sliding movement between the parts thereof, with full control of the degree of relative extension or retraction of said parts, by providing for alternate successive and simultaneous actuation of the telescoping members of the hydraulic construction during extending or retracting movement thereof.

Although I have described but one embodiment of my invention it will be apparent to those skilled in the art that certain modifications in the structure and arrangements of parts may be made without departing from the scope of the invention.

I claim:

1. A hydraulic cylinder ram assembly for use as an attachment with lift trucks having a carriage located at one end thereof, comprising a hollow cylinder secured to the carriage support means, a first movable hollow cylinder coaxial with and slidable within said fixed cylinder between predetermined maximum retracted and extended positions, a second movable hollow cylinder slidable within said first movable cylinder between predetermined maximum retracted and extended positions, first and second variable volume chambers formed wholly within and between the ends of said second movable cylinder, a first conduit coaxial with said second movable cylinder and adapted to connect said first chamber with a source of pressure fluid, a second conduit coaxial with said second movable cylinder and said first conduit and adapted to connect said second chamber with a source of pressure fluid and means connected to the one ends of said first and second conduits for blocking communication between said first and second chambers and between said first and second conduits, communication between said first chamber and said source of fluid pressure through said first conduit effecting successive extensible sliding movement first between said second and first movable cylinders and then between said first movable and said fixed cylinders, and communication between said second chamber and said fluid pressure source through said second conduit effecting successive retractable sliding movement between said second and first movable cylinders, and then between said movable and said fixed cylinders.

2. A cylinder assembly as claimed in claim 1 plus co-operable stop means located adjacent an open end of each of said first and second movable cylinders, and wherein communication between said second chamber and pressure fluid through said second conduit effects

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retraction of said first cylinder relative to said second cylinder until said stop means are in abutting relation, and stop means adjacent one open end of the fixed cylinder adapted for abutment with the stop means on the one open end of the second cylinder upon full retraction thereof.

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