Aug. 1, 1950 L. S. WOOD 2,517,153

TELESCOPIC POWER DOWN HOIST

Filed Aug. 16, 1946 4 Sheets-Sheet 1

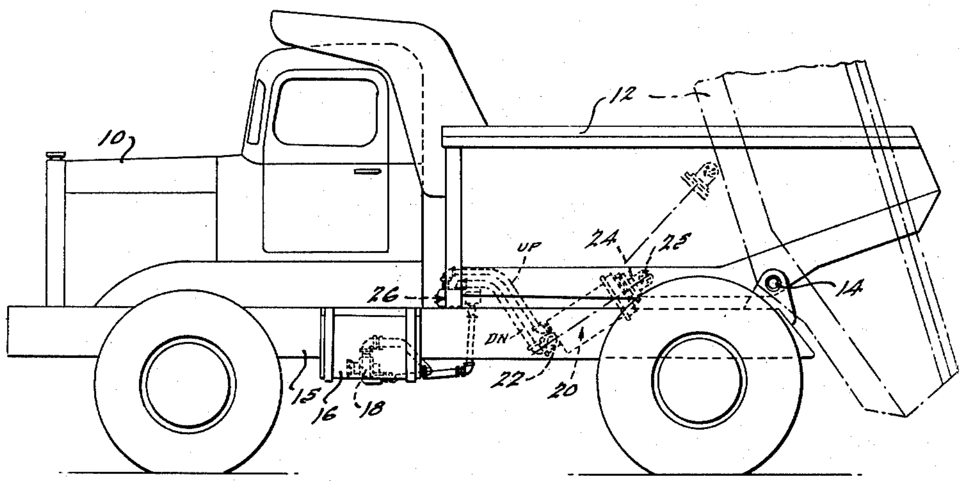

FIG. 1.

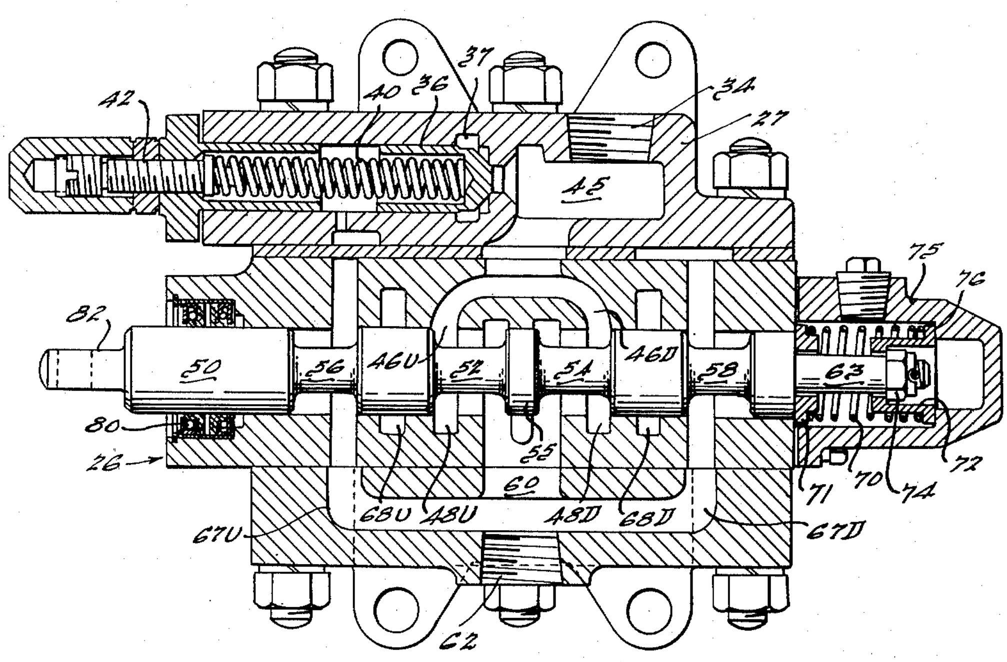

FIG. 6.

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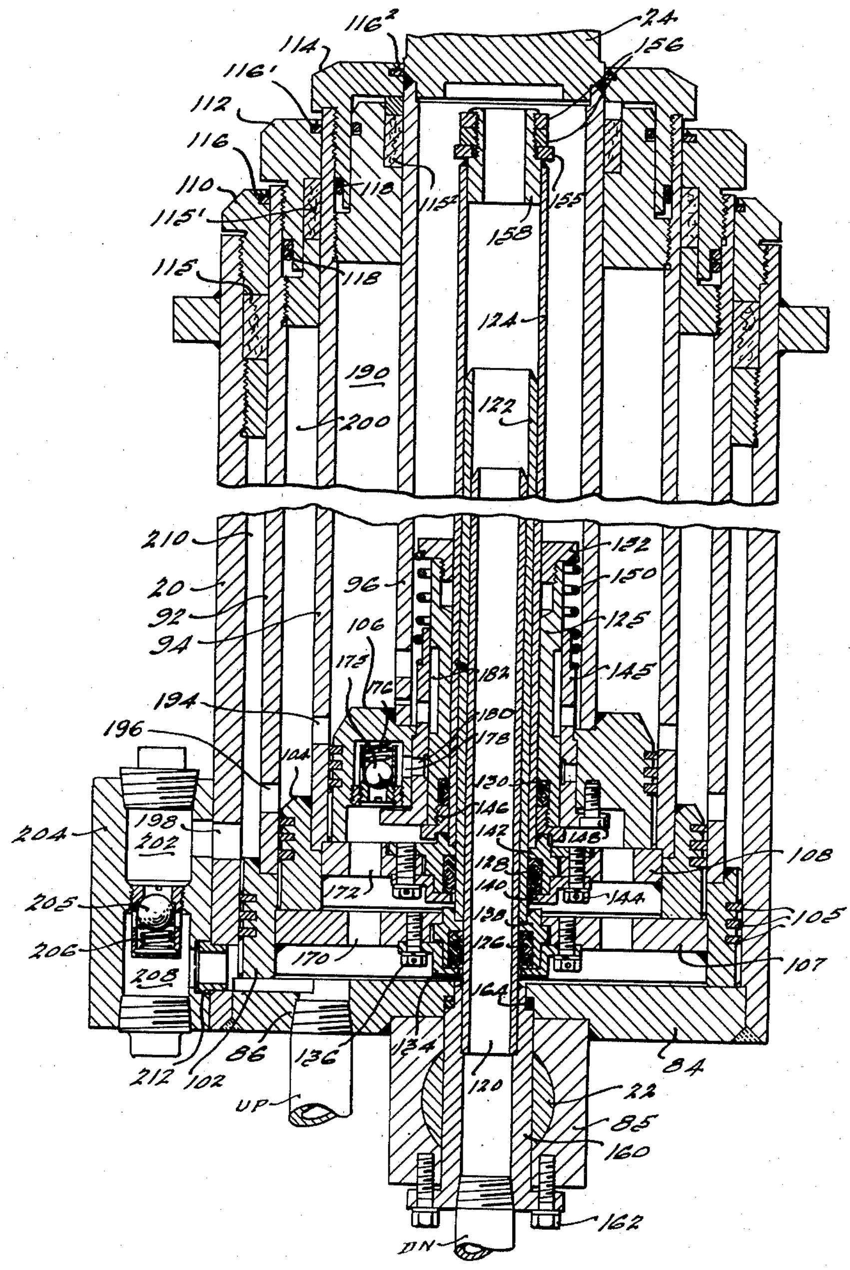

FIG. 2.

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TELESCOPIC POWER DOWN HOIST

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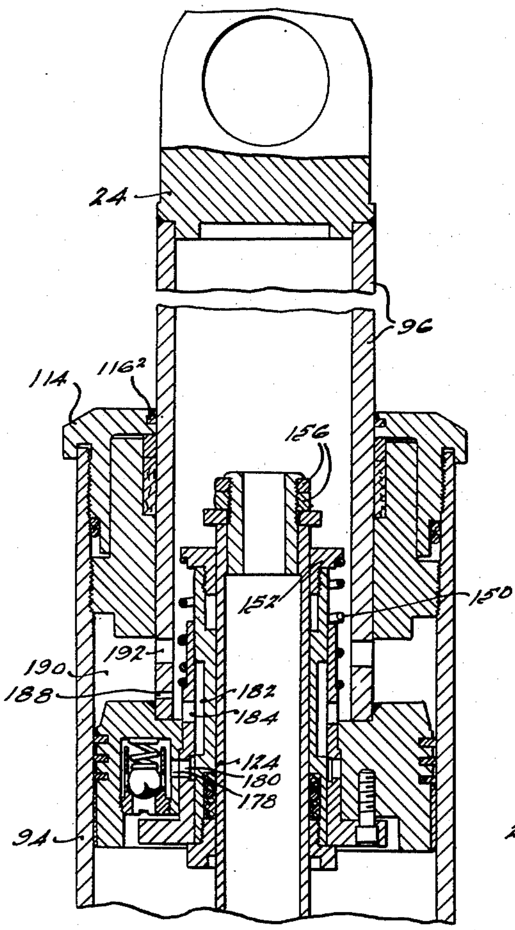

FIG. 4.

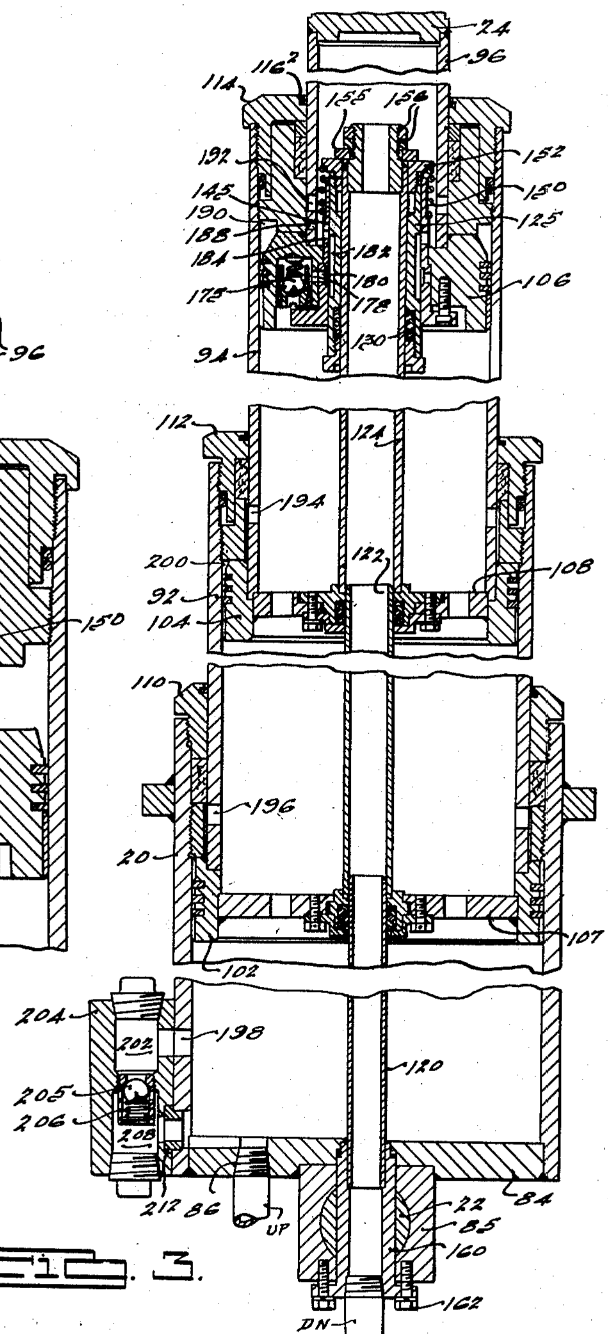

FIG. 3.

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Aug. 1, 1950 L. S. WOOD **2,517,153**

TELESCOPIC POWER DOWN HOIST

Filed Aug. 16, 1946 4 Sheets-Sheet 4

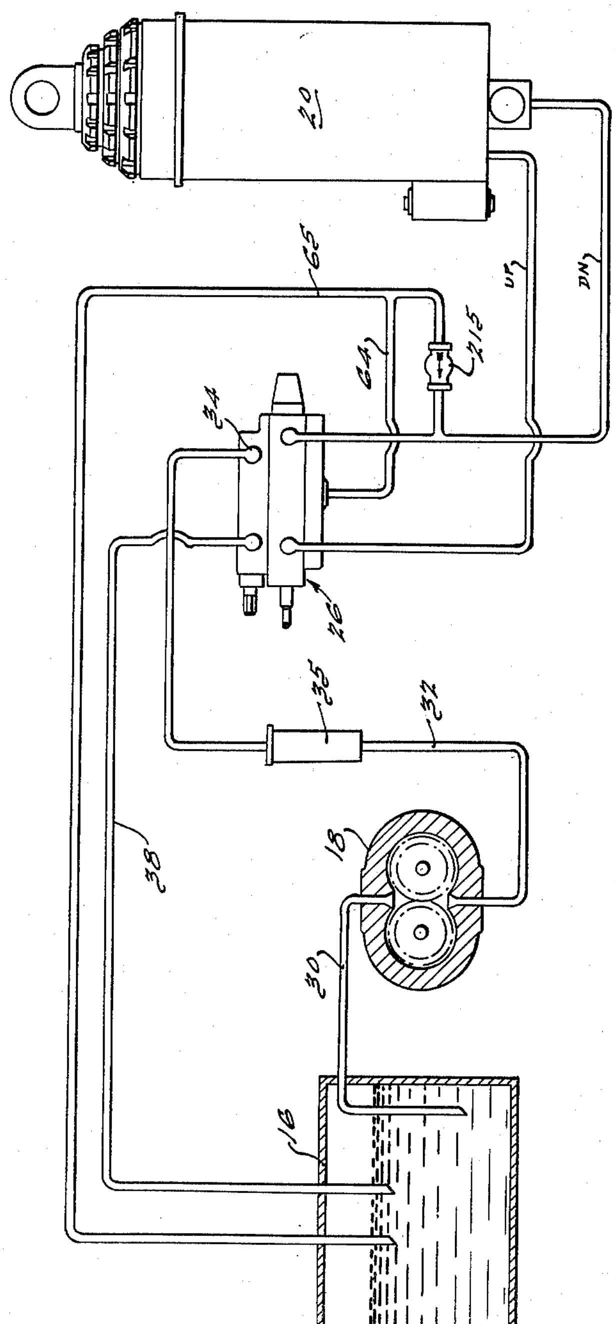

FIG. 9

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2,517,153

TELESCOPIC POWER DOWN HOIST

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Application August 16, 1946, Serial No. 691,108

10 Claims. (Cl. 121—46)

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The present invention relates to hydraulic hoists, particularly for dump-type cargo vehicle bodies.

In the design and construction of dump-type truck bodies for hauling dirt and other loose loads, it has become common practice to hinge the body near its back end, and to provide a tail gate adapted to be opened, dumping means being incorporated comprising hoist mechanism for swinging the portion of the body lying forward of the hinge axis upwardly, so that the load may slide or pour from the gate opening.

The hoist mechanism may conveniently take the form of a plurality of telescopically arranged cylindrical sections, the outer and inner ones of which are provided with suitable pivot-type coupling means whereby one may be connected to the frame or chassis of the truck or vehicle and the other connected to the pump body at a point spaced forwardly from the aforementioned hinge axis. Thus, fluid under pressure, as from a hydraulic system, may be applied to the telescopic cylinder assembly to extend the same and tilt and dump the body in the manner above-mentioned. Where the hoist mechanism incorporates no means for retracting the several sections into one another by positive application of actuating fluid, the dump angle to which the body is lifted must as a practical matter be limited to such value that the center of gravity of the empty body does not pass through a vertical line projected upwardly from the hinge axis, since if this were permitted, power would be required to lower the body. Provision has been made for such positive retraction by the application of hydraulic power to the telescopic hoist unit in such manner as to retract the sections into one another, in constructions heretofore proposed which have been designed to permit tilting the body over-center in the aforementioned manner, such positive retraction in certain prior art devices involving conducting the hydraulic fluid to an outer portion of the telescopic assembly through flexible hoses. While such constructions utilizing hose connections possess the advantage of permitting a greater dump angle and are therefor of assistance both in the dumping of sticky or coherent loads and with respect to rapidity of dumping, the provision of flexible hoses extending to the outer telescopic sections in the manner mentioned has several serious disadvantages. One of these disadvantages is of course the difficulty of arranging such hoses to avoid all danger of their being caught and injured by the movable parts of the body and hoist mechanism. It is also necessary when employing hoses in the indicated manner to incorporate positive keying means between each pair of telescopic sections, in order to prevent the outermost section to which the hose is attached from rotating and thereby injuring the hose. Such lengthy keying means are of course relatively fragile and if the entire mechanism is not to be seriously weakened by the incorporation thereof, it is necessary to make the structure more massive than would otherwise be necessary.

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An important object of the present invention is accordingly to provide an improved telescopic hoist of the indicated character incorporating positive fluid-operated retracting means requiring no external hoses or other fluid conducting means outside the hoist structure itself and arranged in such manner that rotation may be permitted between the several telescopic sections without injury to the parts.

Another object of the invention is to provide such a telescopic hoist of the positive retraction or "power-down" type arranged so that circulation of hydraulic fluid to and from the pump is permitted at both ends of its working stroke.

Still another object is to provide such a telescopic hoist of the power-down type which incorporates novel hydraulic cushioning means for controlling the rate of descent of the body.

Other objects and advantages will be apparent upon consideration of the present disclosure in its entirety.

In the drawings:

Fig. 1 is a side elevational view of a motor truck provided with a dump body operable by hoist means constructed in accordance with the present invention.

Fig. 2 is a substantially diametric, longitudinal sectional view of the hoist, centrally broken away, showing the parts in their retracted positioning;

Fig. 3 is a view similar to Fig. 2 but on a smaller scale and showing the hoist extended;

Fig. 4 is a detail diametric sectional view on a larger scale showing the outer extremity of the hoist assembly with the parts in an intermediate position;

Fig. 5 is a schematic diagram, and

Fig. 6 is a sectional view of a control valve employed in the system.

Referring now to the drawings, reference character **10** designates generally a motor truck, shown equipped with a dump-type body **12** pivotally attached as by trunnion bearing means **14** to the frame **15** of the truck for swinging movement about a transverse horizontal axis. In Fig. 1 the body **12** is shown in full lines in its normal lowered running position, while the tilted or dumping position is fragmentarily illustrated in the same view in dot-dash lines. It is to be noted that in tilting the body to the fully raised position the center of gravity of the empty body passes through and beyond a vertical line projected upwardly from the hinge axis defined by the trunnion bearing means 14.

Power for hoisting the body and for returning it to the lowered, running position is derived from a hoist unit comprising a plurality of telescopically disposed cylindrical sections, the outermost of which, designated 20, is connected to the truck frame 15 for swinging movement about a transverse axis, as by means of the trunnion pivot pin 22, while the innermost section is provided with an end coupling portion 24 similarly pivotally connected as by the pivot pin 25 to the bottom of the dump body 12 at a point so spaced forwardly from the hinge axis 14 that the body is tilted to a desired angle when the hoist assembly is fully extended, as indicated in Fig. 1.

The hoist unit may be operated by means of a suitable hydraulic fluid (not shown) the bulk of which is normally stored in a reservoir tank 16 from which the fluid is forced under suitable pressure developed by a pump 18, through a control valve assembly, the body of which is generally designated 26, and through suitable flexible conduits as UP and DN to the hoist unit. The control means is so arranged that when hydraulic fluid is being delivered to the hoist unit through conduit UP, to extend the hoist, a return connection to the reservoir is provided by way of conduit DN, while conduit UP serves as a return line when fluid is being delivered to the unit through conduit DN to lower the body under power.

Fluid is conducted from the tank 16 to the pump 18 by way of a pipe or conduit 30 and forced through pump outlet conduit 32 to the control valve inlet 34. A suitable filter as 35 may be incorporated in the line from the pump to the valve, as indicated.

The upper section 27 of the valve casing 26 incorporates a piston-type pressure-limiting valve 36 which opens when the pump pressure exceeds a predetermined value to provide a direct return to the reservoir by way of conduit 38, which is connected to the escape port 37 of the valve. The pressure-limiting valve spring 40 is so calibrated as to maintain a desired maximum pump pressure, and the setting of the spring-controlled pressure is variable by a suitable adjusting screw 42 which permits changing the preloading of the helical compression-type spring, trapped behind the valve element 36 in the usual manner, as shown in Fig. 6.

The control valve 50 is of the balanced "spool" piston type, having a pair of central reduced areas 52, 54 separated by a central piston or "spool" section 55 and constituting means for selectively diverting the supply fluid to either of the pipes UP and DN through channels presently to be described. A second pair of symmetrically disposed outer reduced areas 56, 58 in the valve form annular channels through which the fluid may be returned to the reservoir during extension and retraction of the telescopic sections. With the valve in the centered position shown in Fig. 6 fluid from the pump enters at inlet 34, flows through the head chamber 45 of the pressure limiting valve to a pair of branching passages 46U, 46D, the former terminating in a port 48U which communicates with the outer end

of valve chamber 52 when the valve is in its centered position, while passage 46D similarly communicates with valve chamber 54. When the valve is in the centered position, both of its chambered portions 52, 54, open into a return passage 60 communicating with valve outlet 62, which is connected as by conduit means 64, 65 to the reservoir 16.

The valve 50 is yieldably maintained in the centered position shown in Fig. 6 by centering means including a spring 70 acting upon a reduced extension portion 63 projecting from one end of the valve and from its casing 26. Spring 70 is of the helical compression type and is trapped between a pair of slidable spring abutment pieces 71, 72, the former engageable by an abutment formed by the reduced right-hand extremity of the valve, as the same is viewed in Fig. 6, which reduced portion forms the plane of demarkation between the valve per se and the extension stem 63. The spring abutment 72 is also slidable upon the stem section 63 and engageable with a castellated nut 74 mounted upon the outer end of the stem portion. The outer end of the abutment 72 is also urged by the spring against a shoulder formed in the outer end of the cap 75 carried upon the end of the valve casing in axial alignment with the valve and enclosing the centering mechanism. When the valve is moved to the left, as viewed in Fig. 6, its relieved portion 52 provides communication between feed passage 46U and a port 68U connected to the main hoist cylinder 20 by the conduit UP. At the same time the port 68D, which is connected to the main hoist cylinder 20 by the conduit DN is brought into communication with the fluid return outlet coupling portion 62 of the valve by the valve section 58, which then provides communication between port 68D and a passage 67D formed in the valve body and communicating with the fluid return portions 60, 62. When the valve is reversed in position by moving it to the right of the centered position shown, communication is similarly provided between conduit UP and the return line portions 64, 65, and the reservoir by the reduced valve section 56, which then bridges and provides connection between port 68U and a passage 67U connected to return outlet 62 and corresponding to the passage 67D previously described.

Valve member 50 also projects from the other end of casing 26, through suitable packing means as 80, and is provided with a reduced and apertured extremity as 82 by which it may be actuated, either manually or through the agency of suitable actuating mechanism and/or connecting means (not shown).

The hoist assembly comprises four cylindrical sections slidable within one another, the outer cylinder 20 having a lower head or end plate 84 welded or otherwise rigidly secured in place and rigidly supporting in a central position the downwardly projecting trunnion bearing support 85 into which the trunnion bearing pin 22 is tightly fitted to rockably support the hoist assembly with respect to the vehicle frame in the manner described above and best indicated in Fig. 1. The bottom plate 84 is also provided with a coupling portion 86 to which the conduit UP is coupled and through which fluid for extending the hoist is introduced. Three telescopically arranged inner cylindrical hoist sections are provided, successively designated 92, 94 and 96, the last-mentioned, innermost cylinder projecting from the rest and carrying the coupling element

24 which closes its outer end and is adapted to be connected by the pivot pin 25 to the bottom of the dump body as previously indicated. Coupling element 24 is welded to the inner cylinder 96, as shown in Fig. 2. Cylinders 92, 94, 96 are actuated by piston portions 102, 104, 106, respectively rigidly attached to their lower extremities and somewhat exceeding the diameter of and serving as spacers for the respective cylindrical sections, to which they are attached as by welding. Each piston is provided with packing means such as the piston rings 105 slidably engaging the interior of the next outermost cylindrical section into which the piston portion is in each instance fitted. The bottom closure or head for the piston 102 attached to cylindrical section 92 is formed by a plate 107 welded to the piston. A similar head plate 108 provides a closure for the piston 104, while piston portion 106 forms a closure for the bottom of the cylindrical section 96 as well as filling the space between the cylinders 94, 96. Each of the cylindrical sections or sleeve 20, 92, 94, carries a packing nut at 110, 112, 114, screwed in place or otherwise suitably attached at its outer end and co-operating with packing means as 115, 115^1, 115^2, providing a sliding seal between the sleeve by which the nut and packing are carried and the sleeve mounted next therewithin. Supplemental packing means such as felt rings 116, 116^1, 116^2, and resilient O-rings 118 may also be provided, the felt rings being arranged to supplement the compressible packings 115, 115^1, 115^2, and being located at the other extremities of the packing nuts, and serving as wipers adapted to remove foreign matter from the outer surfaces of the slidable cylinders, while the O-rings 118 seal the threads of packing nuts 112, 114, since the compressible packing material 115^1, 115^2, associated with these nuts is not so arranged as to seal the nut threads as will be apparent.

A by-pass or feed tube 120 extends through and is rigidly secured in axial position with respect to main cylinder head plate 84, and projects into the interior of the assembly far enough to maintain slidable connection with a similar tube 122, extending through and rigidly carried by plate 107 and slidably fitted upon the tube 120, the tubes being of such length that their connection is maintained even when the hoist is fully extended. A similar tube 124 slidably surrounding the tube 122 is supported in corresponding position by the plate 108, tube 124 being slidably surrounded by a sleeve 125 attached to and movable with piston 106 and its attached piston sleeve 96.

Piston portion 107 is slidably sealed with respect to tube 120 as by means of the chevron packing assembly generally designated 126. A similar seal between piston 108 and the tube 122 is provided by corresponding chevron packing 128. Additional chevron packing means as 130 may be provided to furnish a running seal between the sleeve 125 and its connected piston 106 and the tube 124 connected to the head plate 108. A cupped follower and retaining member as 134, 140 may be provided for each of the packing assemblies 126, 128, attached to the supporting head plate as by means of screws 136. A retaining collar 138 is provided, forming a hub for the plate 107 and a support for the attached tube 122, which may be welded thereto. Similar retaining means consisting of a cupped follower 140 and hub 142 may be provided for the packing 128, the parts being secured together and the packing compressed by means of screws 144. Packing 130 may be compressed by a conventional packing screw 146, threaded into the lower end of the sleeve 125.

The assembly comprising sleeve 125, packing 130, and other elements supported by the sleeve, is slidable in a surrounding sleeve 145 flanged at its lower end to underlie the piston 106, to which it is secured as by screws 148, sleeve 125 being yieldably positioned with respect to sleeve 145 and the connected piston 106 and tube 96 by means of a coil-compression spring 150 trapped between a shouldered portion (undesignated) of sleeve 145 and the head of an abutment screw 152 secured in the outer end of sleeve 125. Spring-induced outward movement of the sleeve 125 is limited by the head of packing screw 146, which head overlies the lower end of the sleeve 145. The sleeves 125, 145, are provided with oil passages and ports the purpose and arrangement of which will presently be described. Outward movement of the abutment screw 152 and so of sleeve 125, sleeve 145, piston 106 and attached piston sleeve 96, is limited by an abutment washer 155 retained upon the end of tube 124 by lock nuts 156 threaded upon a nipple 158 welded in the end of tube 124. As indicated in Fig. 3, abutment screw 152 brings up against the washer 155 when the hoist is fully extended, the spring 150 being compressed as the piston and sleeve assembly 106, 96, continues its outward movement, the limit being reached when the outer end of sleeve 145 brings up against the underside of the nut 152.

Coupling member 24 forms a fluid-tight closure for the outer end of cylinder 96 and it will be seen that the slidable tubes 120, 122, 124, provide fluid conductive communication between the supply conduit DN and the interior of cylinder 96. Conduit DN is connected to a coupling nipple 160 secured to the trunnion-supporting block 25 as by means of the screws 162 and projecting through and tightly fitted in said block 85 to provide communication between the conduit DN and tube 120. The inner end of the nipple 160 may be welded to tube 120 and also sealed with respect to head 84 as by means of packing washers 164. Nipple 160 also extends through an appropriately dimensioned and positioned aperture in trunnion shaft 22 and may serve to retain such shaft in the block 85.

It is believed that the remaining components of the hoist mechanism and connected hydraulic system may best be considered in connection with a description of their operation. When the hoist is to be extended, valve 50 is moved to the left, as viewed in Fig. 6, thereby establishing communication between the fluid-supply conduit 32 from the pump and the flexible conduit UP coupled to the lower cylinder head 84, the fluid being routed through valve chambers and passages 45, 46U, 52 and 68U, the latter constituting the outlet port and being permanently connected to the conduit UP. The fluid flows through ports 170 in plate 107 and through similar ports 172 in plate 108, so that fluid pressure is applied to the underside of piston 106 and the fluid fills all of the space between the plates 84, 107, 108, and piston 106. There is at this time no avenue of escape for the fluid fed into the space beneath the piston 106, since the ball check valve 175 incorporated in piston 106 has no effective outlet under the conditions being considered. Fluid pressure accordingly projects the several telescopic sections. Although the fluid pressure tends at this time to lift the ball check 175 from its seat, against the effort of its closing spring 176, it will be noted that the check valve outlet port 178 opens into an annular channel 180 in sleeve 145, which channel is sealed off by the outer surface of sleeve 125 so long as the latter sleeve is held in the projected position by the spring 150. As the sections approach the fully projected positioning, sleeve 145 is moved outwardly over sleeve 125, as the latter is restrained by abutment washer 155, until channel 180 is brought into registry with an external annular channel 182 in the surface of sleeve 125, as best shown in Fig. 3. The fluid may then flow from the check valve through port 178, channel 180, chamber 182 and through a port 184 in sleeve 145 to the interior of cylinder 96. From cylinder 96 the fluid returns to conduit DN through the several telescopic by-pass tube sections 124, 122, 120, previously described. Thus, if the valve 50 is held in the left-hand position while the hoist is extended, the fluid is returned through valve port 68D, valve chamber 58, and valve passages 67D, 62, to the return conduits 64, 65, through which it flows back to the reservoir 16. The hydraulic fluid may thus circulate continuously while the hoist is in its extended positioning, thereby eliminating any danger of overloading the pump or hydraulic system, or any necessity for reliance upon overload pressure relief valves. It will be understood by those skilled in the art that this arrangement also reduces the tendency to overheat the oil which would be present if overload relief valves were relied upon.

To initiate power retraction of the hoist assembly, the valve 50 is moved to the right, as viewed in Fig. 6, to establish communication between ports 48D, 68D, through the agency of which fluid delivered to the valve body from the pump by way of conduit 32 is conducted to the conduit DN, whence it is delivered to the telescopic bypass tube assembly 120, 122, 124, by conducting and connecting means previously described, the fluid pressure being thereby introduced into the interior of the cylinder 96, whence it may flow into the interior of the surrounding cylinders, but only in the spaces above the piston sections of each, in a controlled manner. With the assembly initially extended, the interior of cylinder 96 communicates through a port 188 of restricted cross section with a chamber 190 defined by the area between cylinders 94 and 96 above piston 106. It will be understood that if desired, in order to prevent undue straining of the hoist mechanism, the upward tilting movement of the dump body as 12 may be limited so that the hoist sections are never extended as fully as they are shown in Fig. 3, which indicates the extreme limit of possible movement. Although the lower port 188 in the wall of cylinder 96 is shown in Fig. 3 as moved upwardly slightly above the abutting faces of the piston portion 106 and the head of cylinder 94, it will be appreciated that at the start of power down operation, the fluid will force its way between such piston and head portions to drive the piston 106 downwardly. The fluid cannot move upwardly because of the packing 152, and the fit of the slidable metal parts will not, as a practical matter, prevent the fluid from entering the space 190 in this manner, even if the cylinder 96 is moved outwardly to the extreme limit as shown in Fig. 3. The cross-sectional area of the head portion of piston 106 exposed to the interior of chamber 190 exceeds in area the cross section of the active inner face of coupling-closure member 24, so that the fluid-supply pressure urges the piston 106 inwardly with greater effort than it exerts in an outward direction against the inner head of cylinder 96 represented by the under surface of member 24. Cylinder 96 is accordingly forced inwardly by the fluid pressure, a port 192 of greater cross-sectional area than port 188 being uncovered as cylinder 96 commences its inward movement, permitting the fluid to flow rapidly into the chamber 190 and slide the sleeve 96 inwardly. As the cylinder 96 completes its inward movement, piston 106 uncovers a port 194 formed in the wall of cylinder 94 near the inner end of the latter, and the fluid then flows through port 194 into the space 200 between the cylinders 92, 94, forcing the piston section 104 downwardly to slide its connected cylinder 94 into the cylinder 92. As the piston 104 and connected cylinder 94 complete their inward movement, the piston 104 uncovers a port 196 positioned in the wall of cylinder 92 near the inner end of the latter, and the fluid then flows under pressure into the chamber 210 between the cylinders 20, 92, and above the piston 102, forcing the cylinder 92 inwardly with respect to the main cylinder 20 and bringing the parts to the fully telescoped positioning shown in Fig. 2.

As the piston 102 completes its inward travel, it uncovers a port 198 in the lower portion of the wall of cylinder 20. Port 198 communicates with the upper chamber portion 202 of a check valve body 204 containing a ball check valve 205 arranged to be unseated by the fluid under pressure thus introduced. As the ball 205 is moved away from its seat, against the resistance of its closing spring 206, fluid enters the lower check valve chamber 208 which communicates through a connecting nipple 212 with the space within the cylinder 20 beneath the piston 102, which area is in direct communication with the conduit UP. After the telescopic sections are fully retracted, therefore, and while the valve 50 remains in the right-hand or down position fluid may return to the reservoir by way of check valve body 204, conduit UP, and valve ports and passages 68U, 56, 67U, and 62, whence it returns to the reservoir by way of connecting conduits 64 and 65. It will thus be apparent that the oil may circulate freely with the hoist in the down position in a manner analogous to the above-mentioned free-circulating action which is provided when the hoist is extended.

It will be apparent that while the hoist is being extended, fluid is returned to the reservoir by counterflow through the telescopic by-pass tubes 120, 122, 124 and conduit DN as the fluid is forced out of the areas 190, 200, 210 as such areas diminish in size with projection of the telescopic sections. Correspondingly, during power-induced retraction of the hoist section the fluid is forced out of the areas between the plates 84, 107, 108, and piston 106, through the several passages 170, 172, previously mentioned and returned by way of conduit UP to port 68U, whence it is delivered to the return lines 64, 65, in the manner previously mentioned.

When in the downward movement of the telescopic sections the body passes over center, so that its weight tends to augment the inward closing effort exerted upon the hoist sections, the pressure developed as a result of the weight of the body and the compressive force it exerts upon the telescopic hoist sections may exceed the pump pressure delivered to conduit DN from the pump in the manner previously described. In that event a check valve 215 is opened to permit the fluid thereby returned under the augmented pressure to recirculate to the line DN and back through the hoist unit, so that the pump 18 then need only supply such excess fluid as is required to fill the increasing areas 190, 200, 210, as the hoist sections collapse.

While it will be apparent that the preferred embodiment of my invention herein disclosed is well calculated to fulfill the objects and attain the advantages set forth in the introductory portion of this specification, it will be appreciated that the invention is susceptible to modification and change without departure from the spirit and scope of the following claims.

What is claimed is:

1. In a fluid-operable motor unit of the type including a cylinder, a piston slidable therein, and means for selectively directing fluid into the cylinder upon either side of the piston whereby the piston may be driven in either direction, a tubular member attached to and movable with the piston and slidably projectable from one end of the cylinder, said member being closed at its outer end, said means for directing fluid into the cylinder upon one side of the piston comprising a feed tube of lesser diameter than said first mentioned tubular member extending into the opposite end of said cylinder and projecting slidably through the piston and into the first mentioned tubular member and substantially sealed with respect to said member and piston, the effective cross sectional area of the piston outside the tubular member exceeding the effective cross sectional area of said tubular member, and passage-defining means connecting the interior of the tubular member with the space within the cylinder upon the same side of the piston as that from which the tubular member projects, whereby fluid introduced into the tubular member through said tube may act upon the piston to move the same in a direction to retract said tubular member with respect to the cylinder, means for introducing fluid directly into the cylinder upon said opposite side of the piston to project the tubular member with respect to the cylinder, passage-defining means providing direct communication between the portions of said cylinder upon opposite sides of the piston, means including a check valve and normally closed port-defining means incorporated in the aforementioned passage-defining means, the port-defining means being adapted to be opened by movement of the piston to one extreme of its travel.

2. In a fluid-operable motor unit of the type including a cylinder, a piston slidable therein, and means for selectively directing fluid into the cylinder upon either side of the piston whereby the piston may be driven in either direction, a tubular member attached to and movable with the piston and slidably projectable from one end of the cylinder, said member being closed at its outer end, said means for directing fluid into the cylinder upon one side of the piston comprising a feed tube of lesser diameter than said first mentioned tubular member extending into the opposite end of said cylinder and projecting slidably through the piston and into the first mentioned tubular member and substantially sealed with respect to said member and piston, the effective cross sectional area of the piston outside the tubular member exceeding the effective cross sectional area of said tubular member, and passage-defining means connecting the interior of the tubular member with the space within the cylinder upon the same side of the piston as that from which the tubular member projects, whereby fluid introduced into the tubular member through said tube may act upon the piston to move the same in a direction to retract said tubular member with respect to the cylinder, means for introducing fluid directly into the cylinder upon said opposite side of the piston to project the tubular member with respect to the cylinder, passage-defining means providing direct communication between the portions of said cylinder upon opposite sides of the piston, means including a check valve and normally closed port-defining means incorporated in the aforementioned passage-defining means, the port-defining means being adapted to be opened by movement of the piston to either extreme of its travel.

3. In a fluid-operable motor unit of the type including a cylinder, a piston slidable therein, and means for selectively directing fluid into the cylinder upon either side of the piston whereby the piston may be driven in either direction, a tubular member attached to and movable with the piston and slidably projectable from one end of the cylinder, said member being closed at its outer end, said means for directing fluid into the cylinder upon one side of the piston comprising a feed tube of lesser diameter than said first mentioned tubular member extending into the opposite end of said cylinder and projecting slidably through the piston and into the first mentioned tubular member and substantially sealed with respect to said member and piston, a second cylinder within which the first-mentioned cylinder is slidable but from which it projects at one end, said cylinders being of substantially different diameters and being in substantially sealed sliding relation at the inner end of the first mentioned cylinder and at the outer end of the second cylinder, to provide a chamber therebetween, and means providing communication between the outer end of said first mentioned cylinder and said chamber when the tubular member is fully retracted into the first mentioned cylinder, the sealing means at the inner end of the first mentioned cylinder being then adapted to serve as a piston to actuate the first mentioned cylinder inwardly with respect to the second cylinder.

4. In a fluid-operable motor unit of the type including a cylinder, a piston slidable therein, and means for selectively directing fluid into the cylinder upon either side of the piston whereby the piston may be driven in either direction, a tubular member attached to and movable with the piston and slidably projectable from one end of the cylinder, said member being closed at its outer end, said means for directing fluid into the cylinder upon one side of the piston comprising a feed tube of lesser diameter than said first mentioned tubular member extending into the opposite end of said cylinder and projecting slidably through the piston and into the first mentioned tubular member and substantially sealed with respect to said member and piston, a second cylinder within which the first-mentioned cylinder is slidable but from which it projects at one end, said cylinders being of substantially different diameters and being in substantially sealed sliding relation at the inner end of the first mentioned cylinder and at the outer end of the second cylinder, to provide a chamber therebetween, and means providing communication between the outer end of said first mentioned cylinder and said chamber when the tubular member is fully retracted into the first mentioned cylinder, the sealing means at the inner end of the first men-

tioned cylinder being then adapted to serve as a piston to actuate the first mentioned cylinder inwardly with respect to the second cylinder, and a second feed tube slidably interfitted with respect to the first mentioned feed tube and projecting into the opposite end of the second cylinder to that from which the first mentioned cylinder projects.

5. In a fluid operable motor unit of the type including a cylinder, a piston slidable therein, and means for selectively directing fluid into the cylinder upon either side of the piston whereby the piston may be driven in either direction, a tubular member attached to and movable with the piston and slidably projectable from one end of the cylinder, said member being closed at its outer end, said means for directing fluid into the cylinder upon one side of the piston comprising a feed tube of lesser diameter than said first mentioned tubular member extending into the opposite end of said cylinder and projecting slidably through the piston and into the first mentioned tubular member and substantially sealed with respect to said member and piston, the effective cross sectional area of the piston outside the tubular member exceeding the effective cross sectional area of said tubular member, passage-defining means connecting the interior of the tubular member with the space within the cylinder upon the same side of the piston as that from which the tubular member projects, whereby fluid introduced into the tubular member through said tube may act upon the piston to move the same in a direction to retract said tubular member with respect to the cylinder, means for introducing fluid directly into the cylinder upon said opposite side of the piston to project the tubular member with respect to the cylinder, passage-defining means providing direct communication between the portions of said cylinder upon opposite sides of the piston, a check valve carried by said piston and adapted to provide one directional fluid communication therethrough from the inner to the outer side of the piston, and valve means also carried by the piston and positively preventing fluid flow through said check valve in either direction except when the piston approaches one extreme of its movement.

6. In a fluid-operable motor unit of the type including a cylinder, a piston slidable therein, and means for selectively directing fluid into the cylinder upon either side of the piston whereby the piston may be driven in either direction, a tubular member attached to and movable with the piston and slidably projectable from one end of the cylinder, said member being closed at its outer end, said means for directing fluid into the cylinder upon one side of the piston comprising a feed tube of lesser diameter than said first mentioned tubular member extending into the opposite end of said cylinder and projecting slidably through the piston and into the first mentioned tubular member and substantially sealed with respect to said member and piston, the effective cross sectional area of the piston outside the tubular member exceeding the effective cross sectional area of said tubular member, passage-defining means connecting the interior of the tubular member with the space within the cylinder upon the same side of the piston as that from which the tubular member projects, whereby fluid introduced into the tubular member through said tube may act upon the piston to move the same in a direction to retract said tubular member with respect to the cylinder, means for introducing fluid directly into the cylinder upon said opposite side of the piston to project the tubular member with respect to the cylinder, passage-defining means providing direct communication between the portions of said cylinder upon opposite sides of the piston, and valve means normally closing off such communication comprising a sleeve valve slidable with said piston and tubular member and slidably encircling said feed tube, said valve being actuatable to a position to establish such communication as the piston approaches one extreme of its movement.

7. A telescopic fluid motor unit comprising a plurality of telescopically interfitted cylinders having walls radially spaced from one another sufficiently to define annular chambers therebetween, each cylinder except the innermost having an inwardly overhanging head portion slidably engaging the cylinder next therewithin, and each cylinder except the outermost having an outwardly extending piston portion slidably engaging the next outermost cylinder, whereby chambers are provided between the cylinders, means for applying fluid to the interiors of at least some of the cylinders to project them with respect to one another, and means for applying fluid to the chambers between the cylinders to retract them, including a plurality of telescopic feed tubes carried by and extending through the interiors of at least some of said cylinders.

8. A telescopic fluid motor unit comprising a plurality of telescopically interfitted cylinders having walls radially spaced from one another sufficiently to define annular chambers therebetween, each cylinder except the innermost having an inwardly overhanging head portion slidably engaging the cylinder next therewithin, and each cylinder except the outermost having an outwardly extending piston portion slidably engaging the cylinder next radially outermost whereby chambers are provided between the cylinders, means for applying fluid to the interiors of at least some of the cylinders to project them with respect to one another, means for applying fluid to the chambers between the cylinders to retract them, means providing communication between the interiors of all of said cylinders except the outermost thereof, means providing communication between the interior of the outermost cylinder and said chambers, and means for selectively delivering fluid either to the interior of said outermost cylinder or to the interiors of the other cylinders, said last-named means comprising a plurality of telescopic feed tubes, one such feed tube being carried by and extending through the interior of each of said other cylinders and opening into said outermost cylinder.

9. A telescopic fluid motor unit comprising a plurality of telescopically interfitted cylinders having walls radially spaced from one another sufficiently to define annular chambers therebetween, each cylinder except the innermost having an inwardly overhanging head portion slidably engaging the cylinder next therewithin, and each cylinder except the outermost having an outwardly extending piston portion slidably engaging the next outermost cylinder whereby chambers are provided between the cylinders, means for applying fluid to the interiors of at least some of the cylinders to project them with respect to one another, means for applying fluid to the chambers between the cylinders to retract them, means providing communication between the interiors of all of said cylinders except the outermost thereof, means providing communica-

tion between the interior of the outermost cylinder and said chambers, means for selectively delivering fluid either to the interior of said outermost cylinder or to the interiors of the other cylinders, said last-named means comprising a plurality of telescopic feed tubes extending through the interiors of said other cylinders and opening into said outermost cylinder, and means providing communication between said chambers comprising port-defining portions successively providing communication therebetween as the several cylinders approach the inner extremities of their individual travel.

10. A telescopic fluid motor unit comprising a plurality of interfitted cylinders of materially variant diameters to provide substantial spacing therebetween, each cylinder except the innermost having an inwardly overhanging head portion slidably engaging the cylinder next therewithin, and each cylinder except the outermost having an outwardly extending piston portion slidably engaging the next outermost cylinder, whereby chambers are provided between the cylinders, means for applying fluid to the interiors of at least some of said cylinders to project them with respect to one another, and means for applying fluid to the chambers between the cylinders to

retract them, said last-named means including a plurality of axially arranged telescopically interfitted feed tubes, said feed tubes being in substantially sealed slidable relation to one another and extending through the interiors of at least some the cylinders.

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