

March 11, 1952

E. G. HUMPAL ET AL

2,588,928

JIB CRANE

Filed May 19, 1949

3 Sheets-Sheet 1

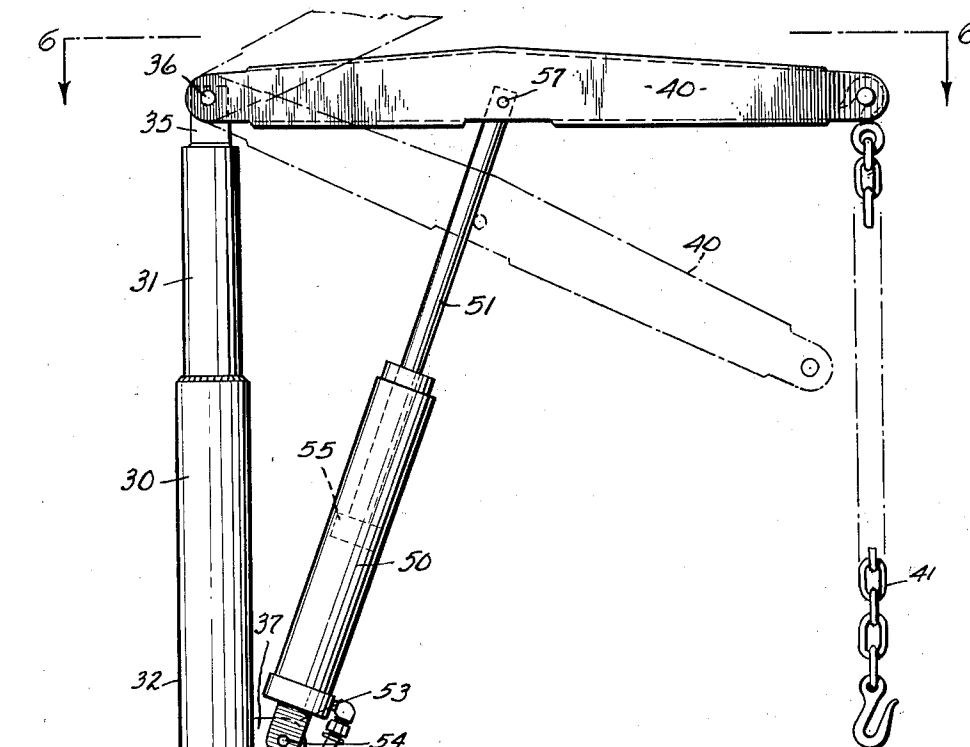


Fig. 1

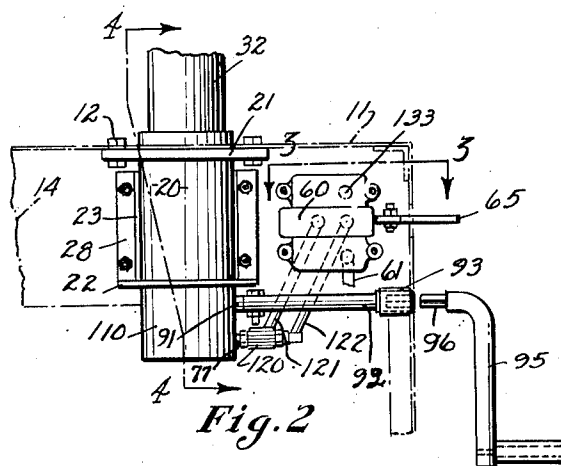


Fig. 2

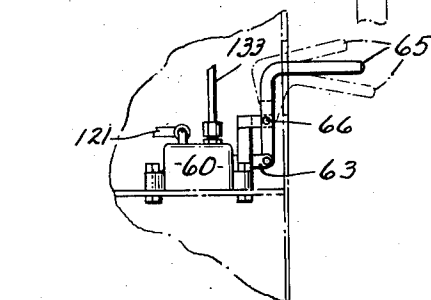


Fig. 3

INVENTORS.

EUGENE G. HUMPAL &

ROY O. DALOGH

By Bates, Pearce & McLean
Attorneys

March 11, 1952

E. G. HUMPAL ET AL

2,588,928

JIB CRANE

Filed May 19, 1949

3 Sheets-Sheet 2

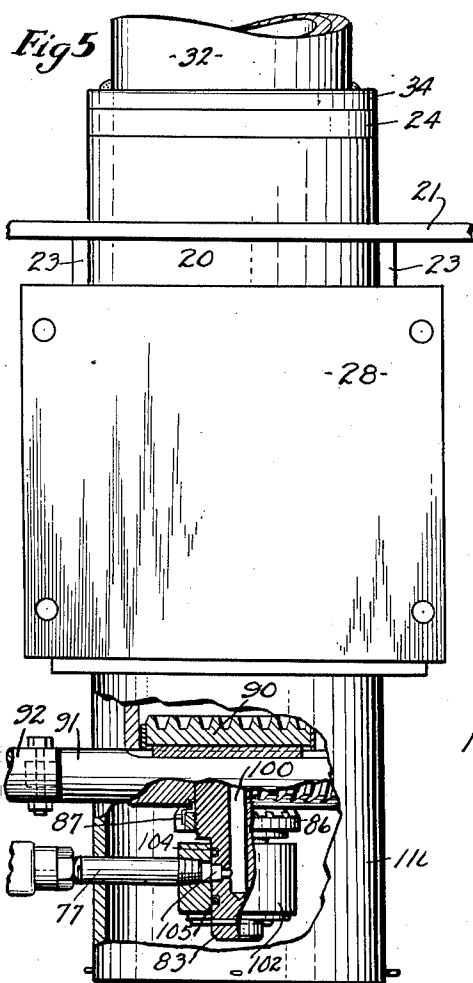
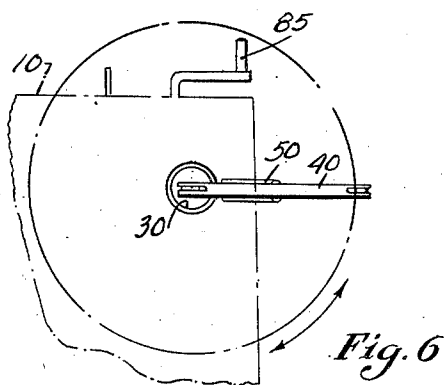
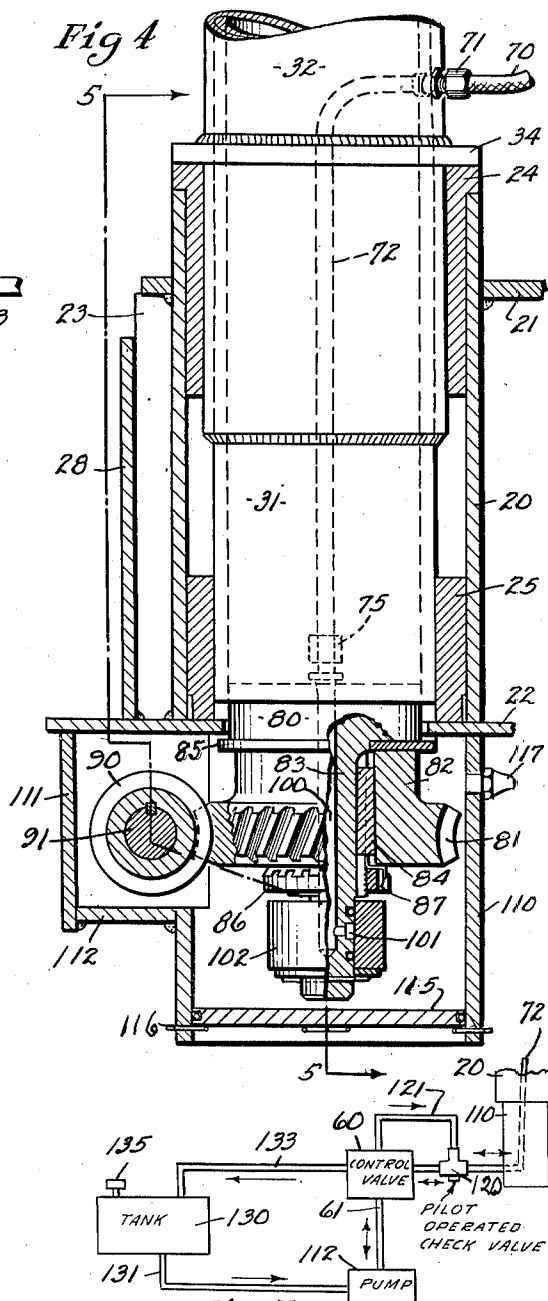


Fig. 7
INVENTORS,
EUGENE G. HUMPAL and
ROY O. DALOGH
By *Dales, Peare & McLean*
Attorneys

March 11, 1952

E. G. HUMPAL ET AL

2,588,928

JIB CRANE

Filed May 19, 1949

3 Sheets-Sheet 3

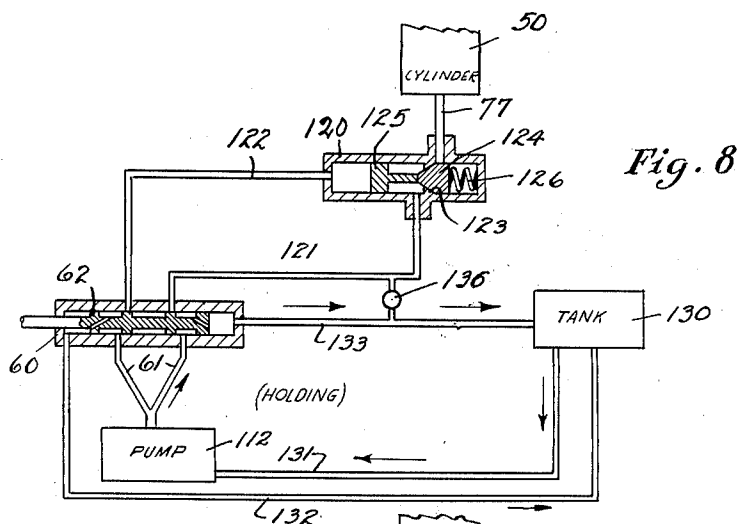
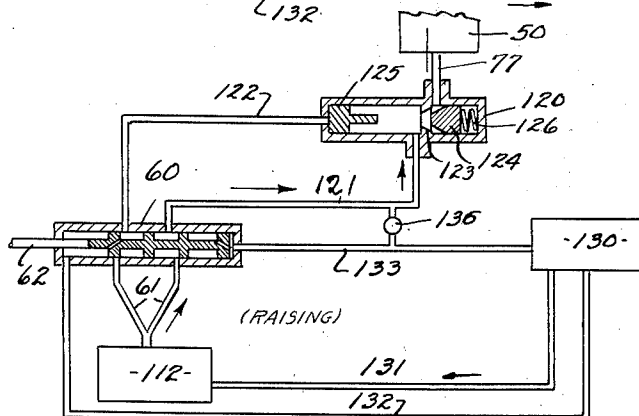


Fig. 8



UNITED STATES PATENT OFFICE

2,588,928

JIB CRANE

Eugene G. Humpal and Roy O. Balogh, Cleveland, Ohio, assignors, by mesne assignments, to McCabe-Powers Auto Body Co., St. Louis, Mo., a corporation of Missouri

Application May 19, 1949, Serial No. 94,144

2 Claims. (Cl. 212—35)

1

This invention relates to a hydraulically operated jib crane having a rotatable vertical supporting post, load-lifting mechanism carried by the post, and a piston and cylinder couple, one member of which is connected to the post near its lower end and the other member of which operates the load-lifting mechanism. One of the objects of the invention is to provide such a crane with a readily operable mechanism for turning the post on its axis to swing the lifting mechanism laterally throughout a large range of movement. Another object is to provide simple means for conveying pressure fluid between a stationary conduit and the cylinder irrespective of the position the cylinder may be given by the turning of the crane. Another object of the invention is to provide a simple and effective control for the pressure fluid to raise the lifting mechanism or lower it or hold it in any desired position.

A preferred form of the invention is illustrated in the drawings and is hereinafter more fully explained.

In the drawings, Fig. 1 is a side elevation of our crane, the same being shown as mounted on a suitable stationary support indicated in broken lines; Fig. 2 is a fragmentary elevation at right angles to Fig. 1, as indicated by the line 2—2 on Fig. 1, illustrating the manual turning mechanism and the controlling valve; Fig. 3 is a fragmentary plan, as indicated by the line 3—3 on Fig. 2, of the controlling valve; Fig. 4 is a vertical section through the portion of the crane concerned with mounting and turning the vertical post, the section being in offset planes, as indicated by the line 4—4 on Fig. 2; Fig. 5 is an elevation partly sectional of the parts shown in Fig. 4 in planes at right angles to Fig. 4, as indicated by the offset line 5—5 on Fig. 4; Fig. 6 is a diagram in the nature of a plan (indicated by the line 6—6 on Fig. 1) illustrating the wide sweep of the crane; Fig. 7 is a diagram illustrating the arrangement of tank, pump, valves and conduits, for hydraulically operating the boom arm of the crane; Figs. 8, 9 and 10 are diagrams showing the condition with the valves respectively in neutral position for holding the load, in position for raising it, and in position for lowering it.

Briefly, our crane, as illustrated in Fig. 1, comprises a tubular base section 20 stationarily mounted on a supporting structure 10; an up-right post or column 30 extending within the stationary section 20 and swiveled thereto; a boom arm 40 pivoted to the top of the vertical column and having at its free end a lifting connection as a chain 41, and a piston and cylinder couple 50, 51

2

pivotaly connected at the lower end to the lower portion of the rotating column 30 and at the upper end to an intermediate portion of the boom 40. Suitable mechanism to be described turns the column 30 about its axis within the tubular support 20, while, irrespective of the position, a stationarily mounted controlling valve 60 and suitable conduits leading therefrom supply fluid under pressure to the cylinder 50 to operate the boom.

Referring first to the stationary tubular member 20, this member is rigidly supported in a vertical position by any suitable frame 10. The member 20 is a cylindrical tube. It is surrounded near its upper end by a plate 21 which is welded to it and which is shown as secured by bolts 12 to a top member 11 of the frame. At the lower end of the tube 20 is a transverse plate 22 welded to the tube. This plate is also welded to a pair of vertical plates 23 which are welded to opposite sides of the tube 20. The plates 23 are welded to a plate 28, providing means whereby they may be secured as by bolts 13 to a suitable vertical portion of the frame as, for instance, the channel-shaped bracket or beam 14, Fig. 1.

The stationary cylinder 20, as will be seen, is very rigidly held in vertical position in the frame and forms an effective support for the rotatable column mounted in the cylinder. To provide suitable bearings for the column, as well as to reinforce the tube 20, we mount in this tube two bushings 24 and 25. The bushing 24 is shown as having an outward flange at its upper end which rests on the top surface of the tube 20. The bushing 25 rests on the transverse plate 22.

The rotatable post or column 30, preferably comprises a cylindrical tube 31 extending throughout the length of the column and a reinforcing tube 32 snugly embracing an intermediate portion of the through tube and fixedly secured thereto, as by welding at the ends of the reinforcing tube. The reinforcing tube 32 has its bearing in the bushing 24 and carries a welded collar 34 resting on the upper end of the bushing. As the bushing rests on the top of the tube 20, the downward thrust on the collar is effectively taken by the tube. The column has a second bearing by reason of the through tube 31 being journaled in the lower internal bushing 25. Means to be later described may turn the column on its axis for a full 360° if desired.

At the upper end of the column 30 we provide a bracket 35 which may extend into the through tube 31 and project above it. This bracket forms a pivotal support for the boom 40. Either the

bracket or the boom is bifurcated and where they overlap a pin 36 provides the pivotal connection. Near its lower end the reinforcing portion 32 of the column carries a radially extending ear 37 which is embraced by a bifurcated ear 53 on the lower end of the cylinder 50, the two ears being pivotally connected by a transverse pin 54. A suitable piston 55 within the cylinder is secured on the lower end of the piston rod 51. The upper end of this rod is pivoted at 57 to an intermediate region of the boom.

The lower end of the cylinder 50 is connected by a flexible conduit 70 and a coupling 71 with a conduit 72 in the interior of the rotatable column. This latter conduit is swivelly connected, as later described, to a stationary conduit under the control of the control valve 60. This construction therefore enables pressure fluid to be supplied to the cylinder irrespective of the position it may occupy.

To turn the column about its axis to cause the boom to project in any direction desired we provide a head 80 rigidly carried by the rotatable column at its lower end and itself rigidly carrying a worm wheel 81. Meshing with this worm wheel is a worm 90 on a horizontal shaft 91 to which is coupled an extension shaft 92 suitably supported in the frame and carrying at its end a non-circular socket 93, Fig. 2. A removable crank 95 is provided which has a non-circular stud 96 adapted to non-rotatably enter the socket 93. Accordingly, this crank furnishes ready means for rotating the worm and thereby the worm wheel and thus turning the column with its boom and piston-and-cylinder couple about the axis of the column.

The worm wheel 81 with an extended hub 82 is shown in Fig. 4 as snugly surrounding a central tubular extension 83 of the head 80 and as locked to said extension by a key 84. The worm wheel is clamped axially in position against a washer 85 bearing against the head 80 by a nut 86 screwing onto the head extension 83. The nut is preferably notched and locked by a latch 87 in adjusted position. This construction enables the worm wheel to be readily mounted in place and effectively held in position.

The cylindrical central portion 83 of the column head 80 has a bore 100 extending almost to the bottom of the extension but closed at the bottom. The upper end of the bore is coupled at 75 to the conduit 72 within the column, which as heretofore explained leads to the cylinder 50. At the lower end of the passageway 100 is a lateral passageway terminating in annular groove 101. A stationary sleeve 102 surrounds the groove 101 and extends above and below it, where suitable packing as, for instance, a pair of O-rings 104, 105 prevent leakage of fluid. A stationary conduit 77 is coupled to the sleeve 102 and communicates through a radial passage therein with the groove 101. This conduit 77 communicates externally, in a manner to be later described, with the valve-controlled means for supplying fluid under pressure.

It results from the above construction that fluid under pressure supplied to the conduit 77 passes to the axial passageway 100 irrespective of the position of the column and thence passes to the cylinder 50. Accordingly, the fluid admitted may operate the cylinder in all positions of the column and whether the column is stationary or is in the act of being turned by the worm and worm wheel mechanism mentioned.

We provide a housing for the worm and worm

wheel mechanism and the swiveled connection from the supply conduit, which may contain proper lubricating material. This housing comprises a tubular section 110 which may align with the stationary tube 20 and at its upper end abut and be secured to the plate 22. This tubular portion 110 is open at the worm, which latter is boxed-in by plane portions 111, 112 welded to the sleeve-like portion 110. The sleeve 110 has an open bottom to allow access to the construction within the housing. Normally, however, such bottom is closed by a circular plate 115 within the housing supported by suitable radial pins 116. Withdrawal of the pins enables the removal of the plate to allow access to the interior. A suitable nipple 117 controlling a passageway through the sleeve 110 provides for the insertion of lubricant.

The controlling valve 60 as heretofore stated is carried by an angle beam portion 14 of the frame. The valve itself comprises a movable member within a suitable casing 60 secured to the frame member 14 and to the plate 28 by bolts 13. This casing 60 is hollow and its interior is connected by a conduit 61 with a supply of fluid under pressure from a suitable pump. Within the valve casing 60 is a specially formed multi-piston valve member 62 axially shiftable and having a shank extension 63 projecting beyond the casing and connected to an operating member. The operating member is shown in Fig. 3 as a bent lever 65 intermediately pivoted at 66 to a stationary bracket and having its other end pivoted to the valve shank 63. The full line position in Fig. 3 indicates the valve in its intermediate or holding position; a position of the lever for raising, and opposite extreme position for lowering, are indicated by broken lines in Fig. 3.

The multiple piston 62 within the casing controls passageways to the pump, to the supply tank and to a pilot-operated check valve 120 from which the conduit 77 leads through the swivel connection to the cylinder 50. The pilot-operated check valve 120 is shown in Fig. 2. It has two tubular connections 121 and 122 with the control valve. Internally it is of the form indicated in Figs. 8, 9 and 10, wherein there is a valve seat 123 on one side of which is a valve plug 124 and on the other side a piston 125. A spring 126 tends to keep the valve plug on its seat. The piston, however, is provided with a rod adapted to extend through the valve seat and abut the valve plug and when this piston is operated it may unseat the valve.

The conduit 121 from the control valve 60 leads to the space between the piston 125 and the valve plug 124 in the check valve, and the conduit 122 leads from the control valve to the space in the cylinder 120 behind the piston 125.

The coupling of the controlling valve with the pump; the tank; the pilot-operated check valve, and the crane cylinder is indicated in Figs. 7 to 10. There 130 indicates the tank; 131 a line leading therefrom to the pump; 61 a conduit leading from the pump to the control valve, and 132 and 133 lines from the control valve back to the tank. The tank 130 is provided with a suitable vent or breather 135 to prevent internal pressure.

The operation of the control valve piston and pilot-operated check valve will be best understood from a subsequent description of the connections for various conditions of operation in connection with the diagrams, Figs. 8, 9 and 10. It may be here noted, that it is possible by the

mere manipulation of the lever 65 to admit pressure fluid to the lower portion of the cylinder 50 to raise the boom and the load, or to hold such fluid as has been admitted in the cylinder and thereby hold the load stationary, or to release the fluid and allow gravity to bring down the boom or any load carried thereby.

A more detailed description of the manually operated control valve and pilot-operated check valve will now be given for their different positions in Figs. 8, 9, 10. Fig. 8 shows the valves in a neutral position, which is a holding position for the load. When the valve member 62 is in the position shown in Fig. 8, the pump conduits 61 are out of communication with either the conduit 121 or 122 leading from the control valve. However, the pump conduits are in communication with conduit 133 leading to the tank. This allows the pump to operate continuously though idly. As the check valve 124 is held seated by its spring 126, the fluid in the conduit 77 and in the lower portion of the cylinder holds the load in whatever position it may have.

To raise the load the control valve 62 is shifted by its lever 65 into the position shown in Fig. 9. In this position one of the pump conduits 61 is connected with the conduit 121 leading to the valve seat of the check valve. The pressure through the latter conduits unseats the valve, against the action of its spring 126, so that the fluid is admitted to the conduit 77 and passes to the cylinder, thus raising the load.

To lower the load the valve member 62 is shifted to the opposite end of its casing. In this position, shown in Fig. 10, the conduit 122 is connected with the pump. The result is that fluid under pressure is admitted to the conduit 122 to act against the piston 125 of the check valve to overcome the action of the spring 126 and unseat the valve. This connects the conduit 77 from the cylinder with the return conduit 121, so that the fluid may pass from the cylinder 120 back to the control valve 62 and thence via the line 133 to the tank 130. The weight of the load forces the fluid in the cylinder in this direction, as the load lowers by gravity. When the lowering has reached the proper amount, the operation of the valve lever to shift the member 62 back to neutral position stops the lowering operation and holds any load then suspended on the hook.

Figs. 8, 9 and 10 indicate at 136 a pressure relief valve of the usual type which is normally idle but may connect the conduit 121 with the conduit 133 back to the tank if the pressure is excessive. This prevents the crane being operated to pick up a heavier load than that for which it is intended.

It will be understood from the description given that we have provided a jib crane wherein the boom may be effectively operated and controlled by hydraulic pressure under the control of a convenient hand lever. The supporting post and hence the entire crane may be swung about the axis of the post to any extent desired by merely applying the hand crank to the worm wheel mechanism. The control valve with its manual lever, and the socket for receiving the hand crank, are preferably located in close proximity with each other as indicated in Fig. 2, so that one operator may readily effect all the controls and operations from a single position. Reference is made to our copending application,

Serial No. 169,586 filed June 22, 1950, which is directed to a related jib crane apparatus.

We claim:

1. In a jib crane, the combination of a stationary upright tubular support, a tubular post rotatably mounted in the support, a boom pivoted to the upper end of the post, a cylinder pivoted to a lower portion of the post, a piston in the cylinder having a rod pivoted to the boom, said post having a hollow cylinder extension provided across its bottom end with a transverse wall, a rod-like extension projecting co-axially downwardly from the transverse wall and being provided on its peripheral face adjacent its lower end with an annular groove, said rod-like extension further being provided internally with a closed-bottomed axial bore provided adjacent its lower end with a radial orifice communicating with the annular groove, a conduit connecting the cylinder with the axial bore of the rod-like extension, a ring surrounding the rod-like extension having a peripheral groove on its interior face, said groove matching with and opening into the annular groove, a supply conduit connected to the ring and communicating with the peripheral groove thereof, a worm wheel mounted on the downward extension of the post, and a worm meshing with the worm wheel for turning the post.

2. In a jib crane, the combination of a stationary upright tubular support, a tubular post rotatably mounted in the support, a boom pivoted to the upper end of the post, a cylinder pivoted to a lower portion of the post, a piston in the cylinder having a rod pivoted to the boom, said post having a hollow cylinder extension provided across its bottom end with a transverse wall, a rod-like extension projecting co-axially downwardly from the transverse wall and being provided on its peripheral face adjacent its lower end with an annular groove, said rod-like extension further being provided internally with a closed-bottomed axial bore provided adjacent its lower end with a radial orifice communicating with the annular groove, a conduit connecting the cylinder with the axial bore of the rod-like extension, a ring surrounding the rod-like extension having a peripheral groove on its interior face, said groove matching with and opening into the annular groove, a supply conduit connected to the ring and communicating with the peripheral groove thereof, a worm wheel mounted on the downward extension of the post, packing rings operatively disposed between the rod-like extension and the ring above and below said matching grooves, and a worm meshing with the worm wheel for turning the post.

EUGENE G. HUMPAL.
ROY O. BALOGH.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
290,074	Le Duke	Dec. 11, 1883
1,021,585	Ewert	Mar. 26, 1912
2,374,045	Soucia	Apr. 17, 1945
2,389,872	Ruger et al.	Nov. 27, 1945
2,437,466	Hail	Mar. 9, 1948
2,446,488	Pierce	Aug. 3, 1948