

Jan. 27, 1953

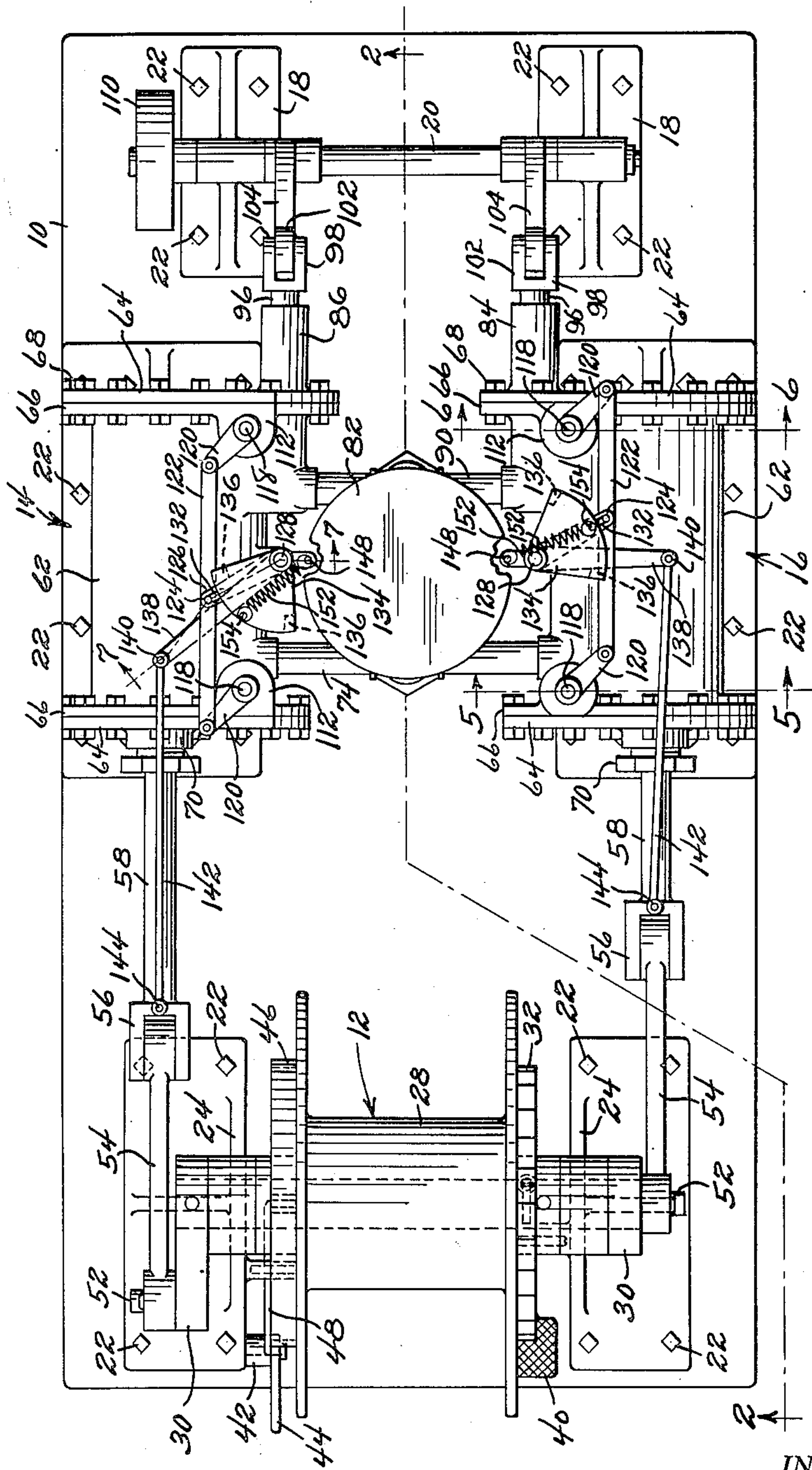
J. FRISONE
HYDRAULIC MECHANISM FOR IMPARTING
A ROTARY MOTION TO A MEMBER

2,626,504

Filed Jan. 10, 1947

4 Sheets-Sheet 1

Fig. 1.



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Fig. 7.

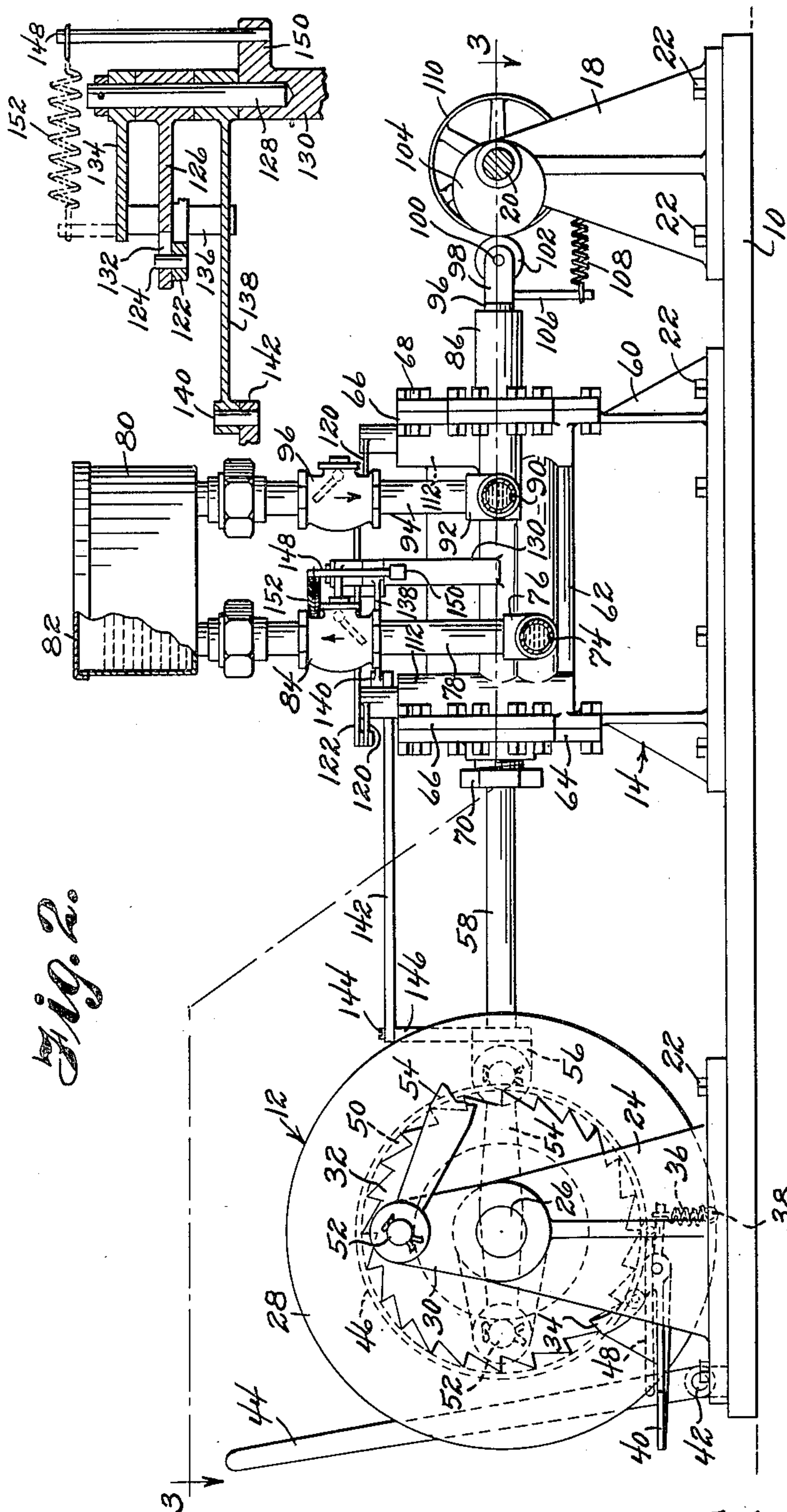


Fig. 2.

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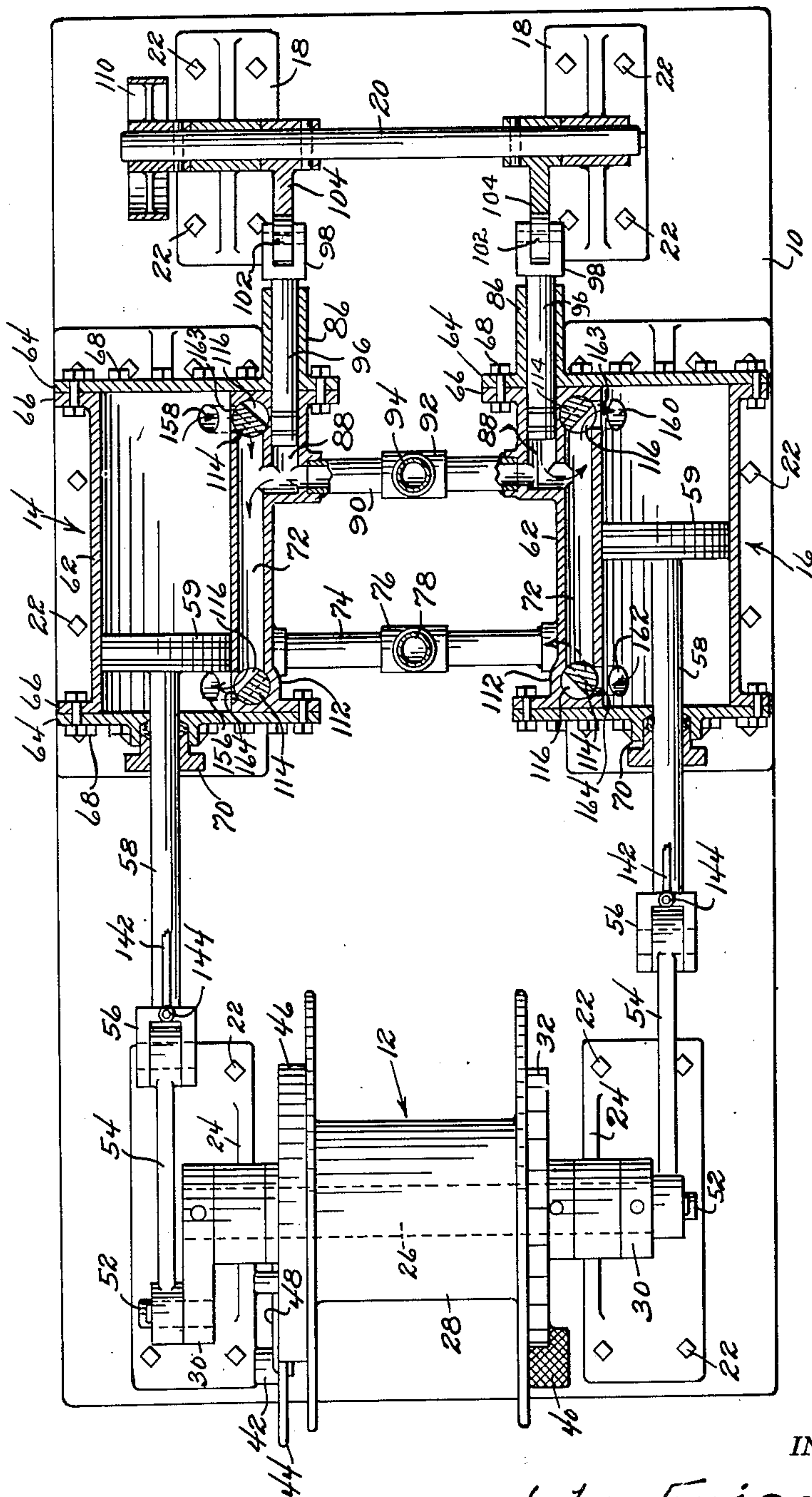
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Fig. 3.



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Fig. 4.

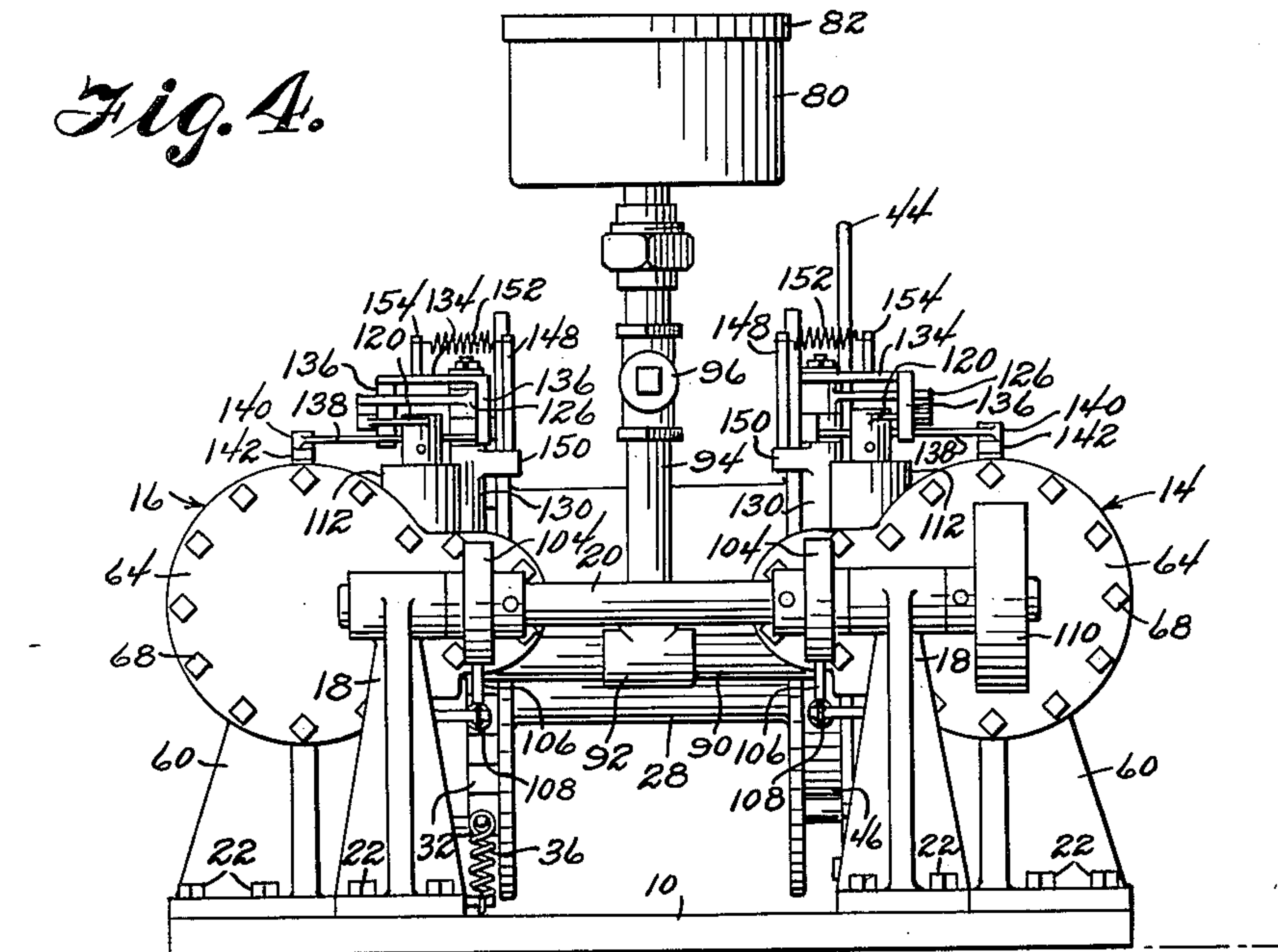


Fig. 5.

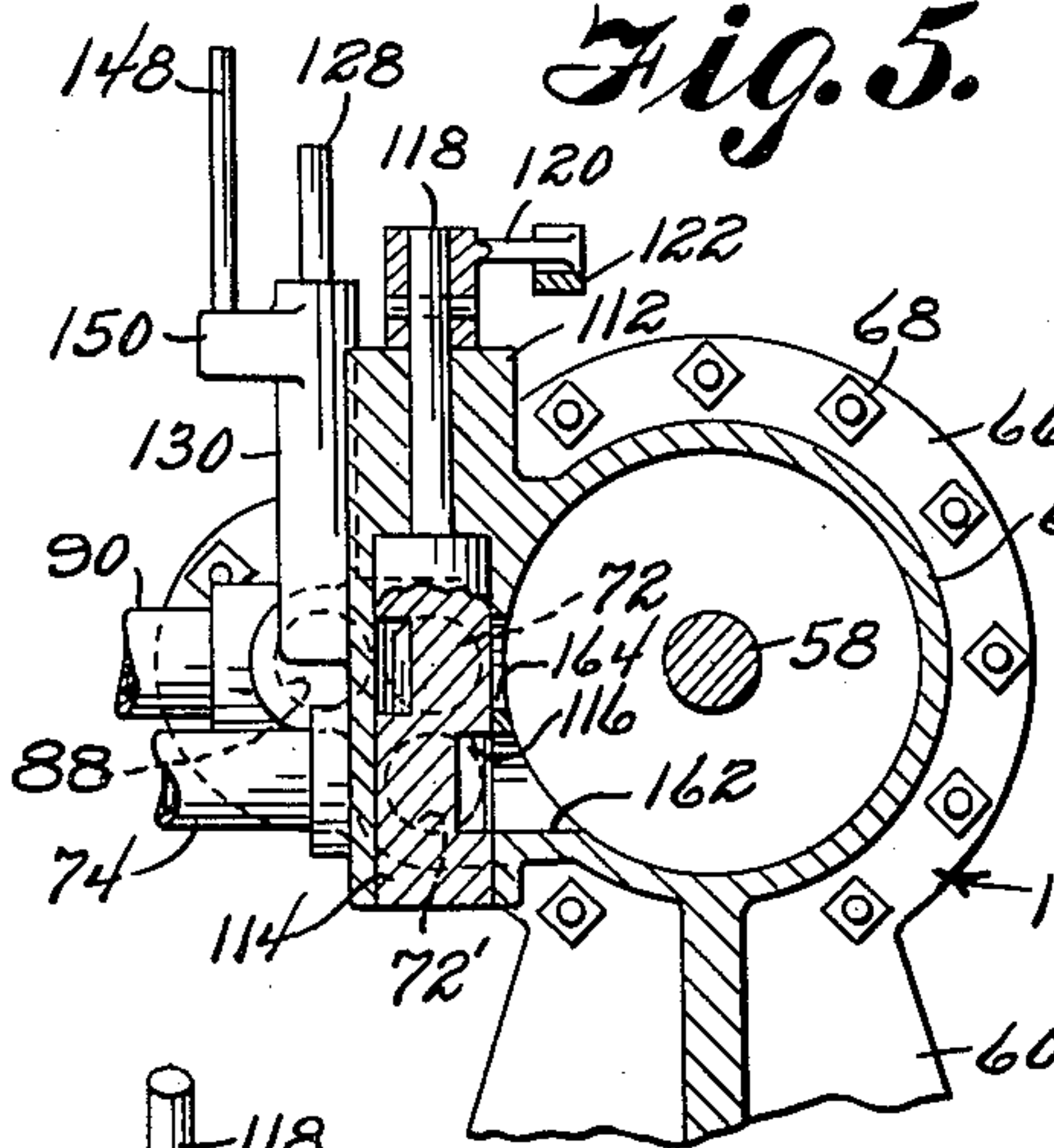


Fig. 6.

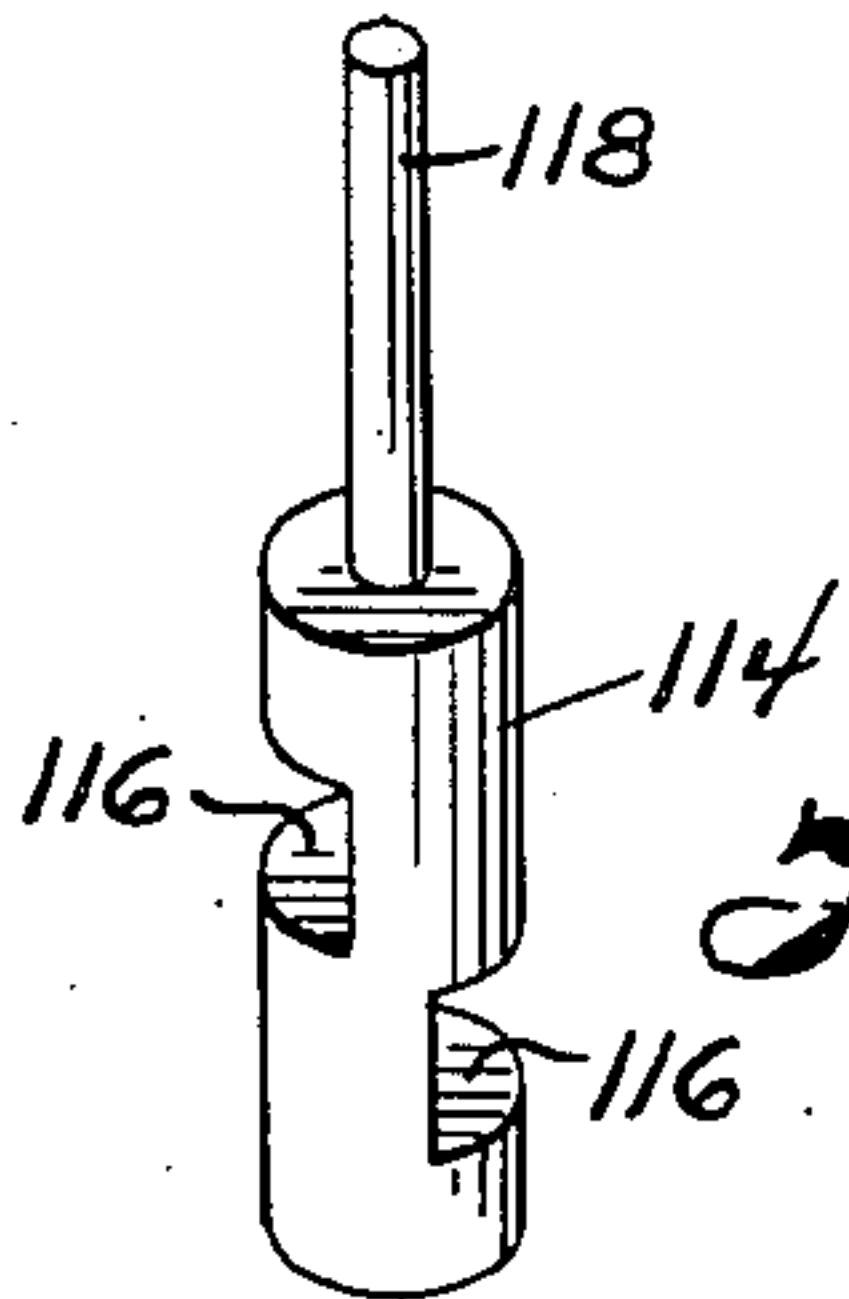
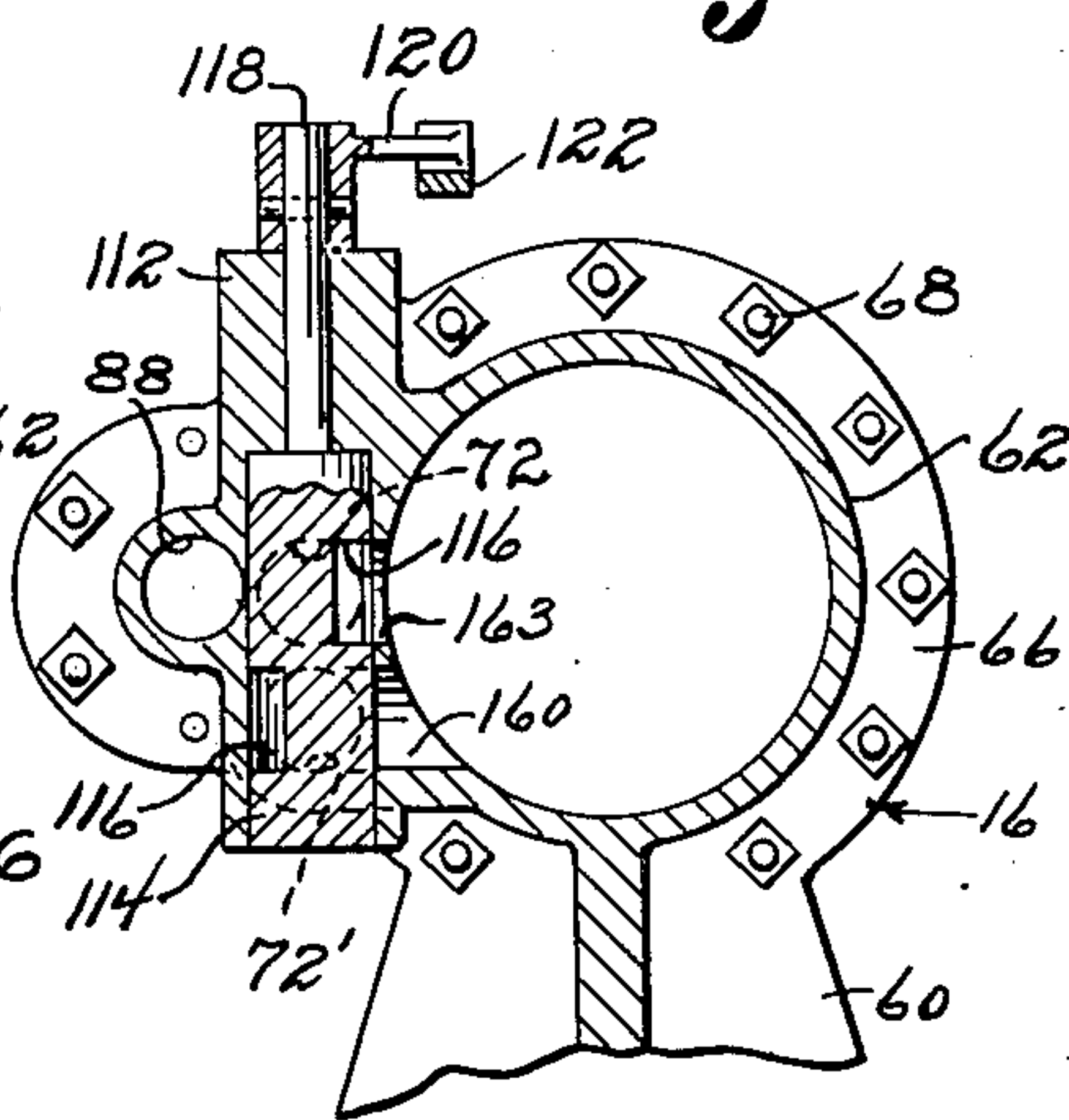


Fig. 7.

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UNITED STATES PATENT OFFICE

2,626,504

HYDRAULIC MECHANISM FOR IMPARTING
A ROTARY MOTION TO A MEMBER

John Frisone, Lynn, Mass.

Application January 10, 1947, Serial No. 721,206

3 Claims. (Cl. 60—53)

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This invention relates to a hydraulic hoist, and the principal object of the invention is to provide a hoist that, operated by a step by step motion, will efficiently hoist an article in the same manner as a hoist using a rotary motion.

Another object of the invention is to provide a device composed of a small number of working parts that is durable in use, inexpensive to manufacture, and will accomplish the purpose for which it has been designed.

With the above and other objects in view, the invention consists of the novel details of construction, arrangement and combination of parts more fully hereinafter described, claimed and illustrated in the accompanying drawings in which:

Figure 1 is a top plan view of an embodiment of the invention;

Figure 2 is a sectional view on the line 2—2 of Figure 1;

Figure 3 is a sectional view on the line 3—3 of Figure 2;

Figure 4 is an end view of the device;

Figure 5 is a sectional view on the line 5—5 of Figure 1;

Figure 6 is a sectional view on the line 6—6 of Figure 1;

Figure 7 is a sectional view on the line 7—7 of Figure 1 and

Figure 8 is a perspective view of a control valve.

Referring more in detail to the drawing, the reference numeral 10 designates the horizontally-disposed base for mounting the component parts of the hoist which include the winch 12, hydraulically operated cylinders 14 and 16 respectively, and the bearing supports 18 for the drive shaft 20, all of which are secured to the base by bolts 22.

The winch 12 comprises the bearing supports 24 for mounting the axle 26 of the drum 28, and cranks 30 are secured to each end of the axle while a ratchet 32 is mounted on the drum for engagement with the pawl 34 pivotally mounted on one of the supports 24 and tensioned by a coil spring 36 secured at its free end at 38 to the base 10. The pawl is provided with a treadle 40 for the operation thereof.

Pivotally mounted at 42 on the base 10 is the brake lever 44 for operating the brake band 46 by means of the rod 48 and the band engages a brake drum 50 on the winch drum 28 for the braking thereof.

Connected to the cranks by pins 52 are the links 54 which are pivoted at their opposite ends in the forked coupling 56 on the ends of the piston rods 58 of the pistons 59.

Each of the cylinders 14 and 16 are similarly constructed, having the triangular shaped supports 60 for mounting the cylinder housings 62 of the cylinders 14 and 16. The housings have removable heads 64 at one end thereof, secured to the annular flanges 66 on the housings by bolts 68, and the heads 64 are provided with

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stuffing boxes 70 medially thereof for reception of the rods 58.

The housings 62 are provided with longitudinally extending spaced parallel tubular passageways 72, and 72' respectively, and said passageways are in communication with each other by means of a conduit 74 in which is provided at the center thereof, a T-coupling 76 which is connected by a conduit 78 to the reservoir 80, which is provided with a removable cover 82 for the filling thereof with liquid, a check valve 84 to control the upward flow of the fluid into the reservoir 80 being provided in the conduit 78.

The housings, at their opposite ends, are provided with piston or plunger housings or casings 86, and these housings communicate with the passageways 72, 72' by means of L-shaped passageways or conduits 88. The passageways are in communication with each other by means of the conduit 90 which is provided, at the center thereof, with a T-coupling 92 which is connected by a conduit 94 to the reservoir 80, and a check valve 96 for the downward flow of the fluid from the reservoir 80 is provided in the conduit 94.

Mounted for reciprocation in the housings 86 are the pistons or plungers 96 having a forked end 98 for mounting the axles 100 of the rollers 102, and these rollers engage the cams 104 on the drive shaft 20, inwardly of the bearing supports 18.

The forked end 98 of each plunger 96 is provided with the depending guide arm 106 having the coil springs 108 connected to the lower ends thereof, and the other end of the springs connected to the supports 18, to urge the rollers 102 into engagement with the cams 104.

The drive shaft 20 is provided with the pulley wheel 110 for a belt connection to a source of power not shown.

The passageways 72 and 72' at their ends, are provided with valve housings 112 in which are mounted the rotary control valves 114, and each valve is provided with diametrically opposed semi-circular ports 116 and a stem 118. Each stem is provided with a crank arm 120 which is interconnected by means of a link 122 which is provided at its center with a pin 124. A crank 126 is mounted loosely on the shaft 128 which is fixed in the boss 130 on each housing 62, and an elongated slot 132 is provided in the free end of the crank 126 to receive the pin 124 mounted on the shaft 128. Above the crank 126 is the sector or quadrant plate 134, which is provided with depending arms 136 at each outer end thereof, and the arms are of a length to engage the link 138, which is mounted on the shaft 128 below the crank 126. Each link 138 is pivoted at 140 to the rod 142, which is pivoted at 144 to the upstanding arm 146 which is provided on the upper side of each forked end 58 of each rod 58. A rod 148 mounted in the support 150 on each boss 130 carries one end of a coil spring 152 which is connected at the other end to the pin 154 formed at the center of the curve of the plate 134. As

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the links 54 are urged forward, the arms 146 carry the rods forward alternately due to the step by step action. As the rods move forward, the links 138 are likewise moved forward until they engage the arm 136. In its course of travel, arm 136 will move the quadrant 134 until the opposite arm 136 engages the crank 126 to move the crank forward until the action of the spring 150 will complete the movement of the crank in its full turn. The movement of the crank 126 will move the valve 114 associated therewith, thereby obtaining the following result.

With the valves 114 positioned, as shown in Figure 3, fluid will flow from the passage 88 in the housing of cylinder 14, through passageway 72, through port 116 in the upper left hand valve 114, as viewed in Figure 3, and then through port 164 to move the piston 59 in cylinder 14 to the right, as viewed in Figure 3, port 156 to the lower tubular passageway 72' being closed by the said valve 114, and the fluid in the rear of the piston will flow out of port 158 into said lower passageway 72', since port 163 which connects with the upper passageway 72 is closed by the upper right hand valve 114, as viewed in Figure 3. This will continue until the previous operation of linkage described has operated, when the flow of fluid will be reversed by action of the rotation of the valves 114, so that fluid will enter through port 163 and flow outwardly through port 156.

In the housing of cylinder 16, fluid is entering the port 163 to the rear of the piston 59 in cylinder 16, and fluid is being driven out of the housing through port 162, port 116 in the lower left hand valve 114, as viewed in Figure 3, into the lower passageway 72', this flow being reversed as previously described at each stroke of the piston 59.

In use, excess or surplus oil from the housing alternately flows through ports 163 and 164 respectively in each housing to the passageways 72, 72' and then into the conduit 74, thence into the reservoir 80, to be returned through conduit 90 when further fluid is required for the operation previously described.

Thus while one piston is moving forward, the other is moving backward, so that at no time will a dead center be reached by the moving pistons 59. Thus a step by step motion is obtained, which is similar in all respects to a rotary motion for the rotation of the drum 28.

In operation of the hoist, the cylinders 14 and 16 are filled with sufficient fluid to position the pistons 59 in neutral position. In this position, the housings 62 are full. As the shaft 20 is rotated, the cams 104 will drive the plungers 96 forward, injecting into the cylinders the incompressible fluid, thereby forcing the pistons 59 forward to provide a step by step motion on the links 54 and subsequent rotation of the shaft 26 of the drum 58.

The pawl and ratchet arrangement described prevents rearward motion of the drum during the hoisting operation, and the brake controls the unwinding of the drum during the lowering motion of the hoist.

In use, power is applied to the pulley wheel 110 to thereby rotate the shaft 20 which has mounted thereon a pair of cams 104. These cams 104 impart a pumping action to the apparatus by means of the rollers 102 and the rods 96, so that fluid will be pumped into the cylinders from the reservoir 80 through the ports 116. The fluid in the exhaust sides of the cylinders 14 and 16 is forced through valve passages 158 and 162 back into the reservoir through pipe 74 and valve 84.

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The operation is reversed by the rotary valves which are turned to their opposite positions by means of the mechanism which includes the quadrant plate 134, rod 142, spring 152, arm 120 and link 122.

The actuating means for imparting rotary motion to the winch 12 includes the base 10 upon which is mounted the bearing supports 18, there being a drive shaft 20 rotatably supported by the bearings 18 which is adapted to be connected to a source of power. Cams 104 are connected to the shaft 20, and arranged above the base 10 and secured thereto are a pair of cylinders 14 and 16. A piston 59 is mounted for reciprocatory motion in each of the cylinders 14 and 16, and a piston rod 58 is secured to each of the cylinders.

A pair of superimposed tubular passageways 72 and 72' extend longitudinally along each of the cylinders and the ends of these passageways communicate with the interior of each of the cylinders. A valve means is provided for selectively causing opening and closing of the passageways, and plungers 96 are reciprocally mounted in casings 86, the casings communicating with the passageways. A roller 102 is mounted on each of the plungers 96 for coacting with the cams 104.

Arranged above the cylinders and supported on the base 10 is a reservoir 80 which is adapted to hold a quantity of hydraulic fluid therein and conduits 78 and 94 serve to connect the reservoir 80 to the passageways. In use, fluid passes from the tank 80 down through the conduit 94, then through the conduit into the casings 86, during left to right movement of the plungers 96, Figure 3. When the plungers 96 move in the opposite direction, that is from right to left in Figure 3, then the hydraulic fluid is forced into the uppermost passageway 72 of the previously mentioned tubular passageways. During this movement of the plunger 96 from right to left in Figure 3, the rotary valves are set or positioned so that the rotary valve 114 adjacent the gland end of the cylinder is open to permit flow of hydraulic fluid from the uppermost passageway 72 through the upper cut-out 116 in the valve, then through the port 164 into the cylinder 14 to thereby cause the piston 59 to be moved away from the gland end of the cylinder 14. At the same time, hydraulic fluid is being discharged from the opposite end of the cylinder 14 through port 158, through the lowermost cut-out 116 in the rotary valve 114 and into the lower of the pair of passageways 72. This discharging hydraulic fluid then passes to the conduit 74 and through the conduit 78 back to the reservoir 80. As the pistons 59 continue to reciprocate, a linkage mechanism causes the valves 114 to rotate so that when the piston 59 is moving toward the gland end of the cylinder, hydraulic fluid enters the cylinder through port 163 and is discharged through port 156. It is to be understood that the other cylinder 16 operates in the same manner as the cylinder 14, and the piston 59 in the cylinder 14 operates 90 degrees out of phase with respect to the piston 59 in the other cylinder 16.

There has thus been provided, a hoist which by a step by step motion, will hoist a load, and it is believed that from the foregoing description, the operation and construction of the invention will be apparent to those skilled in the art.

It is also to be understood that changes in the minor details of construction may be resorted to, provided they fall within the spirit of the invention and the scope of the appended claims.

Having thus described the invention, what is

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claimed as new and desired to be secured by Letters Patent is:

1. In an actuating means for imparting rotary motion to an axle, a horizontally-disposed base, a plurality of bearing supports supported on said base, a rotatable drive shaft carried by said bearing supports for connection to a source of power, cam means carried by said drive shaft, a pair of spaced cylindrical housings arranged in spaced relation above said base and supported on the latter, a piston mounted for reciprocary movement in each of said housings, a piston rod having one end secured to each of said pistons and its other end operatively connected to said axle for rotating the latter upon reciprocation of said pistons, there being a pair of superimposed tubular passageways extending longitudinally in each of said housings, the ends of each of said passageways communicating with the interior of each of said housings, valve means coacting with the ends of said passageways and operatively connected to said piston rods for selectively causing opening and closing of said passageways with respect to the interior of each of said housings, a plunger casing carried by each of said cylindrical housings, a conduit connecting certain of each of said passageways to the complemental plunger casing, a plunger mounted for reciprocary movement in each of said casings, means carried by each of said plungers and coacting with said cam means for causing reciprocary movement of said plunger in response to rotary movement of said drive shaft, a reservoir spaced above said housings and supported on said base for containing a hydraulic fluid, conduit means operatively connecting said reservoir to said passageways and casing for conveying said hydraulic fluid to the latter, and a check valve interposed in said conduit means for controlling the flow of fluid therethrough, whereby rotary movement of said drive shaft causes reciprocation of said plungers to selectively force hydraulic fluid into said housings to thereby reciprocate said pistons and rotate said axle.

2. In an actuating means for imparting rotary motion to an axle, a horizontally-disposed base, a plurality of bearing supports supported on said base, a rotatable drive shaft carried by said bearing supports for connection to a source of power, cam means carried by said drive shaft, a pair of spaced cylindrical housings arranged in spaced relation above said base and supported on the latter, a piston mounted for reciprocary movement in each of said housings, a piston rod having one end secured to each of said pistons and its other end operatively connected to said axle for rotating the latter upon reciprocation of said pistons, there being a pair of superimposed tubular passageways extending longitudinally in each of said housings, the ends of each of said passageways communicating with the interior of each of said housings, valve means coacting with the ends of said passageways and operatively connected to said piston rods for selectively causing opening and closing of said passageways with respect to the interior of each of said housings, a plunger casing carried by each of said cylindrical housings, a conduit connecting certain of each of said passageways to the complemental plunger casing, a plunger mounted for reciprocary movement in each of said casings, a roller mounted on each end of said plunger and coacting with said cam means for causing reciprocary movement of said plungers in response to

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rotary movement of said drive shaft, resilient means operatively connected to said bearing support and to each of said plungers for biasing the latter into engagement with said cam means, a reservoir spaced above said housings and supported on said base for containing a hydraulic fluid, and conduit means operatively connecting said reservoir to said passageways and casing for conveying said hydraulic fluid to the latter, whereby rotary movement of said drive shaft causes reciprocation of said plungers to selectively force hydraulic fluid into said housings to thereby reciprocate said pistons and rotate said axle.

3. In an actuating means for imparting rotary motion to an axle, a horizontally-disposed base, a plurality of bearing supports supported on said base, a rotatable drive shaft carried by said bearing supports for connection to a source of power, cam means carried by said drive shaft, a pair of spaced cylindrical housings arranged in spaced relation above said base and supported on the latter, a piston mounted for reciprocating movement in each of said housings, a piston rod having one end secured to each of said pistons and its other end operatively connected to said axle for rotating the latter upon reciprocation of said pistons, there being a pair of superimposed tubular passageways extending longitudinally in each of said housings, the ends of each of said passageways communicating with the interior of each of said housings, valve means coacting with the ends of said passageways and operatively connected to said piston rods for selectively causing opening and closing of said passageways with respect to the interior of each of said housings, a plunger casing carried by each of said cylindrical housings, a conduit connecting certain of each of said passageways to the complemental plunger casing, a plunger mounted for reciprocary movement in each of said casings, a roller mounted on each end of said plungers and coacting with said cam means for causing reciprocary movement of said plungers in response to rotary movement of said drive shaft, resilient means embodying a coil spring operatively connected to said bearing support and to each of said plunger for biasing the latter into engagement with said cam means, a reservoir spaced above said housings and supported on said base for containing a hydraulic fluid, conduit means operatively connecting said reservoir to said passageways and casing for conveying said hydraulic fluid to the latter and a check valve interposed in said conduit means for controlling the flow of fluid therethrough whereby rotary movement of said drive shaft causes reciprocation of said plungers to selectively force hydraulic fluid into said housings to thereby reciprocate said pistons and rotate said axle.

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