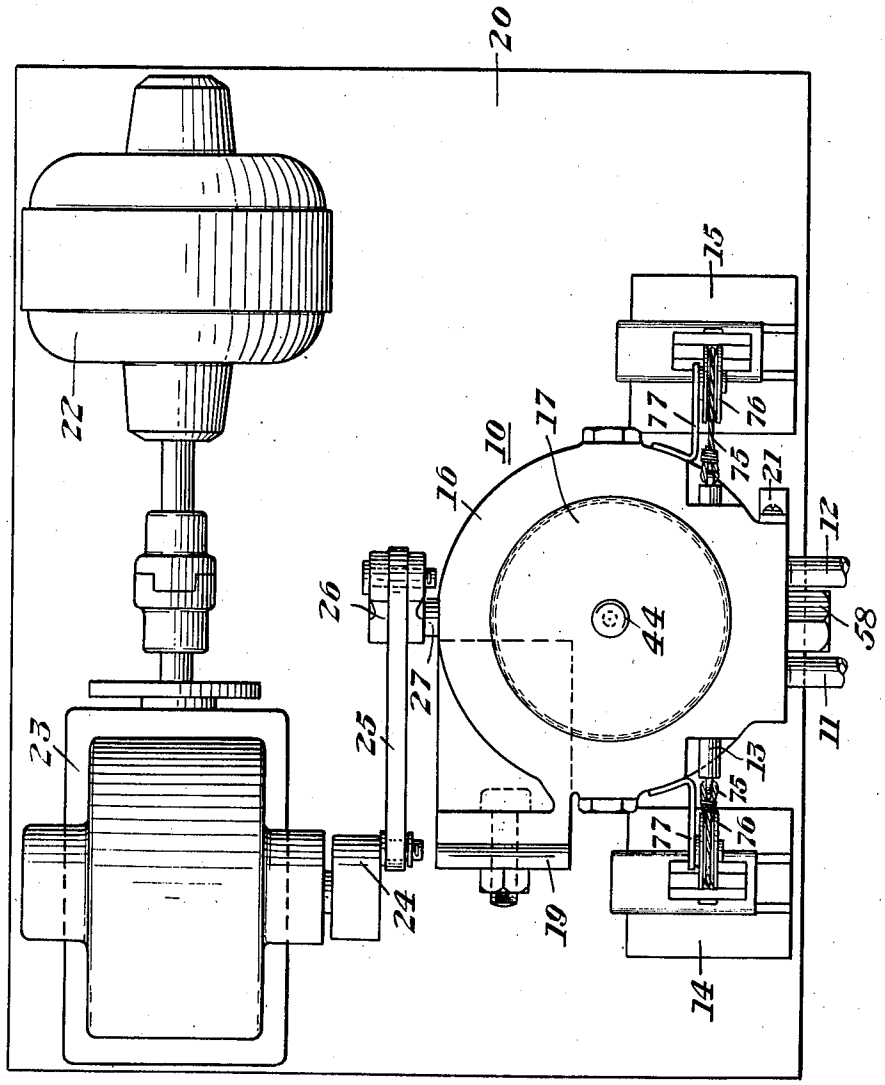
Oct. 12, 1943. E. P. DENIGAN 2,331,462

FLUID SUPPLY APPARATUS

Filed Jan. 20, 1942 4 Sheets-Sheet 1

Fig. 1.



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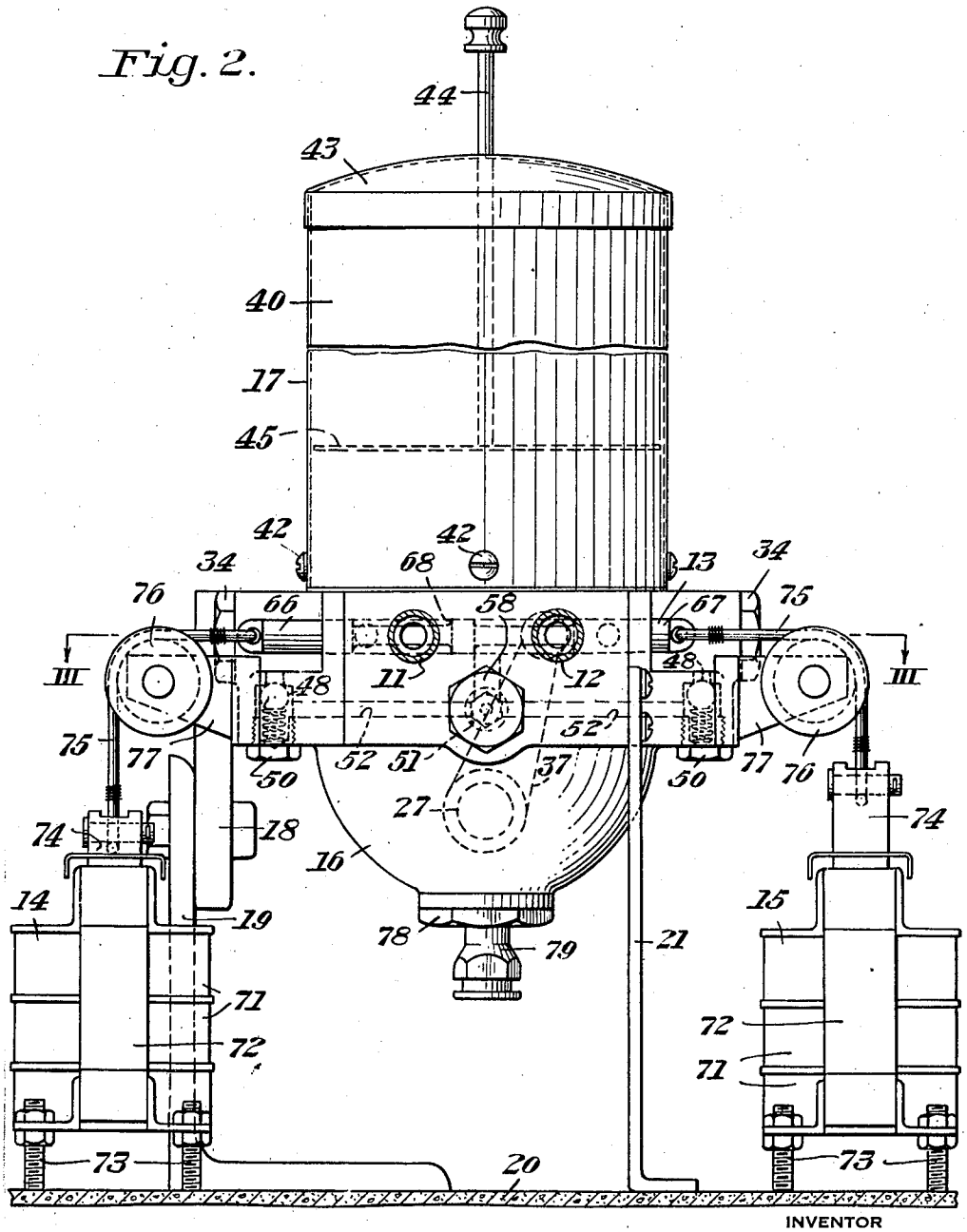
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FLUID SUPPLY APPARATUS

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Fig. 2.



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FLUID SUPPLY APPARATUS

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Fig. 3.

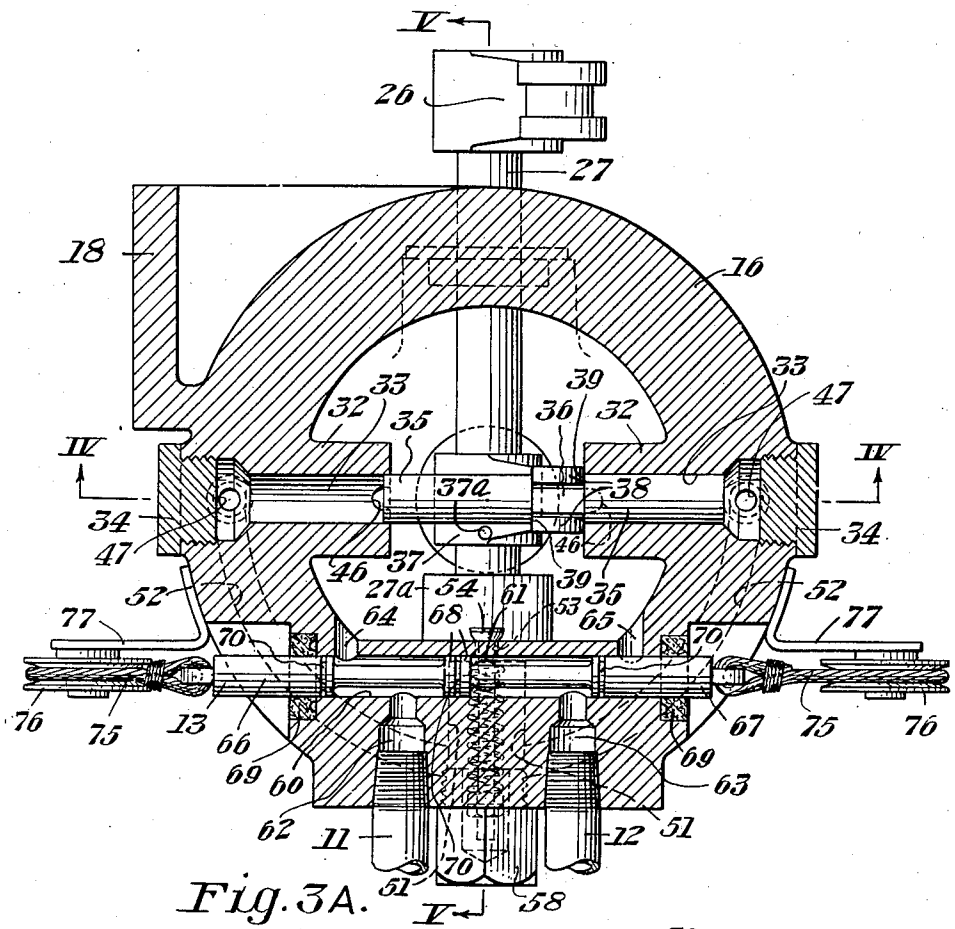
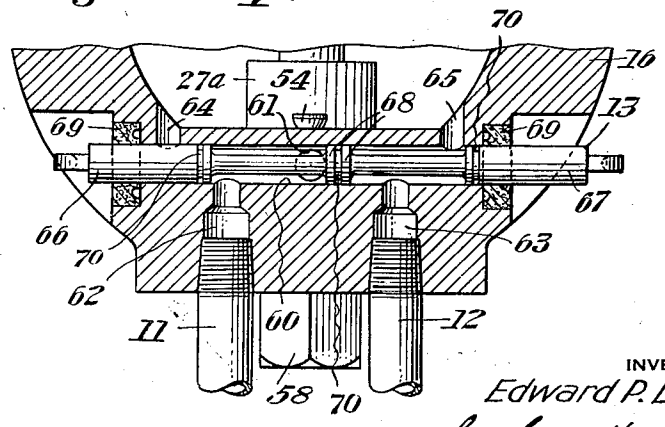


Fig. 3A.



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Fig. 4.

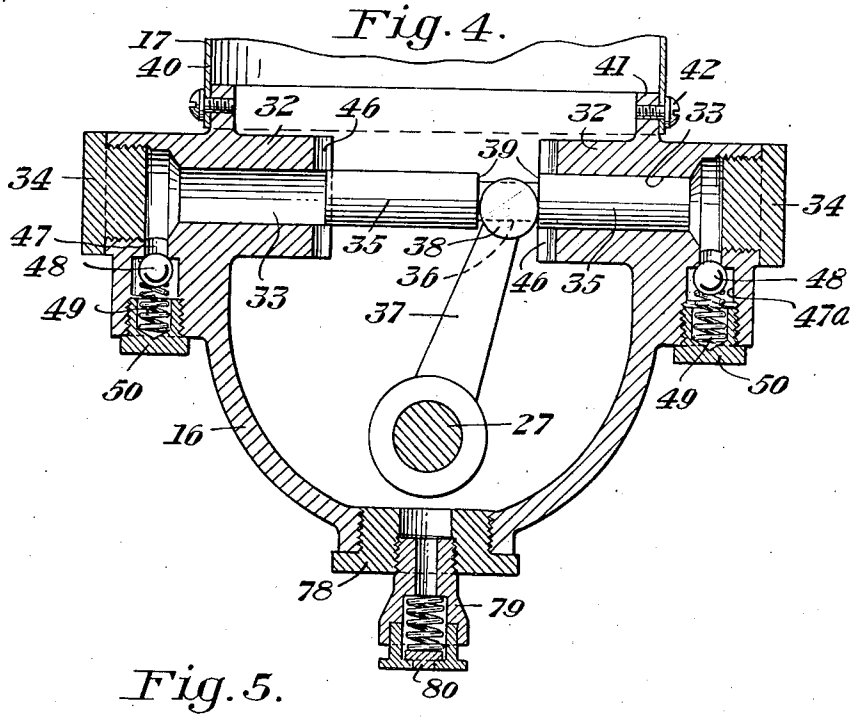
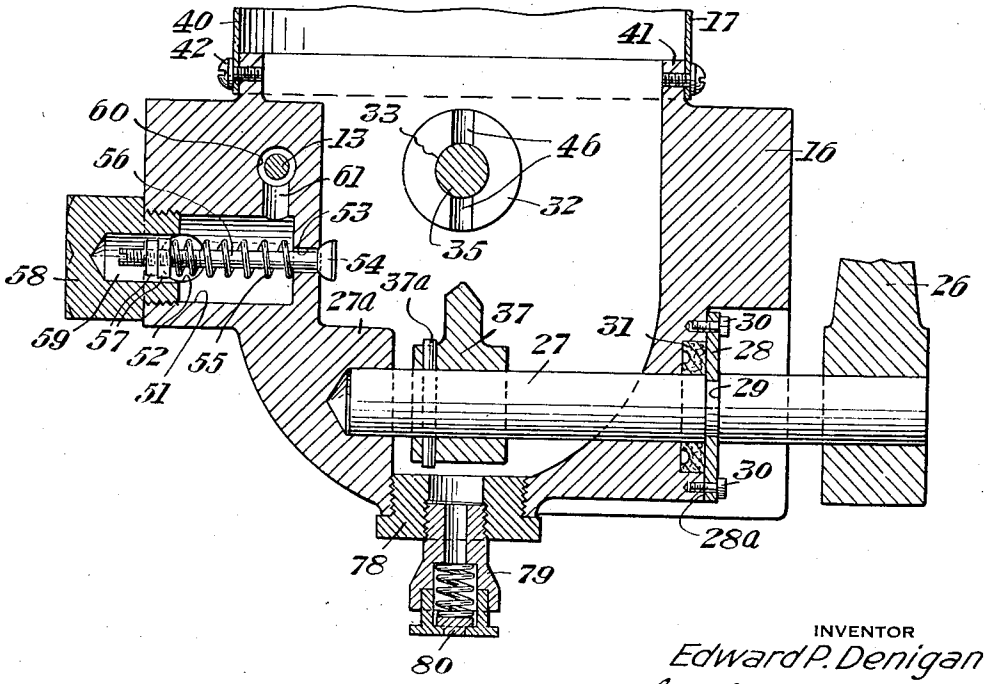


Fig. 5.



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UNITED STATES PATENT OFFICE

2,331,462

FLUID SUPPLY APPARATUS

Edward P. Denigan, Pittsburgh, Pa., assignor to Blaw-Knox Company, Pittsburgh, Pa., a corporation of New Jersey

Application January 20, 1942, Serial No. 427,433

11 Claims. (Cl. 103—171)

This invention relates to apparatus for supplying fluid under pressure to a system of distribution pipes. The invention is of particular utility in a two-pipe, lubricant-distribution system but its application is in no wise limited thereto.

Fluid distribution systems such as the aforementioned two-pipe lubricating system have come into extensive use. Conventional means have customarily been employed for delivering fluid under pressure and for connecting the pipes alternately to the pressure source. A reciprocating pump and a transfer or two-way valve are sufficient for the purpose but present several objections from the standpoint of practical operating conditions. Usually the pump is motor driven and is controlled by an automatic timer and a change-over switch for operating the transfer valve magnetically. It is the object of my invention, therefore, to provide an improved apparatus for delivering fluid under pressure alternately to one of two distribution pipes, which is simple and relatively inexpensive in construction, is entirely self-contained, unitary and compact, and operates to develop the desired pressure efficiently, without requiring excessive maintenance nor, indeed, any attention at all if automatic control is provided therefor.

In a preferred embodiment of the invention, I provide a pump-and-valve mechanism including a body portion surmounted by a storage container or reservoir for the fluid to be delivered. The body of the apparatus is preferably open at the top and the reservoir open at the bottom, thus insuring free communication therebetween. The body is bored to provide pump cylinders. A control valve is also incorporated in the body and connecting passages between the pump cylinders and the valve are cored or otherwise formed in the wall of the body. The valve is preferably of the sliding-piston type and I provide electro-magnetic operating means therefor particularly suited for automatic control. Pistons reciprocating in the pump cylinders may be operated manually or may be power driven. The transfer valve, furthermore, may be operated manually as well as automatically.

Further details, novel features and advantages of the invention will become apparent from the following detailed description and explanation which refer to the accompanying drawings illustrating the preferred embodiment briefly outlined above. In the drawings,

Figure 1 is a plan view showing the pump-and-valve mechanism in cooperative relation with a power drive therefor;

Figure 2 is a side elevation of the mechanism such as would be seen by looking from the right in Figure 1, parts being shown in section and the drive being omitted;

Figure 3 is a horizontal sectional view taken on the plane of line III—III of Figure 2;

Figure 3A is a partial section similar to Figure 3 showing certain parts in alternate positions;

Figure 4 is a vertical section taken on the plane of line IV—IV of Figure 3; and

Figure 5 is a vertical section taken on the plane of line V—V of Figure 3.

Referring now in detail to the drawings, the pump-and-valve mechanism of my invention is indicated generally at 10 and is adapted to deliver fluid, e. g., a lubricant such as grease, to one of two distribution pipes 11 and 12. The mechanism 10 includes a piston-type transfer valve having a piston 13 reciprocable in a suitable bore, which serves in a manner to be explained more fully hereinafter, to connect the outlet of the pump proper to one or the other of the pipes 11 and 12. The valve 13 is reciprocated from one extreme position to the other by solenoids 14 and 15.

The mechanism 10 includes a body 16 surmounted by a reservoir 17. The body 16 has a bracket 18 depending therefrom secured to a standard 19 mounted on a base 20. An auxiliary supporting leg 21 is secured to the body 16 and to the base. A motor 22 mounted on the base 20 drives a gear reducer 23 also disposed on the base. The low-speed shaft of the reducer has a crank 24 thereon. A link 25 is pivoted to the crank 24 and to a rocker arm 26 on a shaft 27 journaled in the body 16. When the motor 22 is running, therefore, the shaft 27 oscillates back and forth.

The body 16 is somewhat bowl-shaped and has a relatively thick rim. The shaft 27 is inserted in a transverse bore through the body near the bottom thereof until its inner end enters a socket bored in a boss 27a. It is secured by a keeper ring 28, the inner edge of which enters a groove 29 turned in the surface of the shaft. The exterior of the bowl has a flat surface 28a adapted to receive the ring 28 which is held in place by screws 30. A packing ring 31 is disposed in a counter-bore within the surface 28a.

Cylindrical bosses 32 project inwardly from the wall of the body 16 from diametrically opposed locations and are bored axially to provide pump cylinders 33. The ends of the bore through

the bosses 32 are counter-bored and tapped to receive closing plugs 34. A piston 35 has its ends slidably received in the cylinders 33. The piston has a reduced central portion 36. An arm 37 secured to shaft 27 by a pin 37a is rounded and bifurcated at its upper end, providing spaced bearing portions 38, one on each side of the reduced portion 36 of the piston, adapted to engage the spaced shoulders 39 formed by the latter. By this construction, oscillation of the shaft 27 causes reciprocation of the piston 35.

As shown in Figures 4 and 5, the body 16 is open at the top and the reservoir 17 is open at the bottom. The reservoir comprises a cylindrical shell 40 secured to a flange 41 upstanding from the body 16, by screws 42. As shown in Figure 2, the shell 40 has a cover 43. An indicator stem 44 is reciprocable through the cover 43 and is supported by a disc 45, the lower end of which bears on the surface of the fluid within the reservoir, thus indicating the volume of fluid contained therein at any time.

By virtue of the construction of the body 16 and reservoir 17 described above, the interior of the body is maintained full of fluid at all times since it is in direct communication with the reservoir. The ends of the bosses 32 are slotted as at 46 to provide inlets through which fluid may flow into the cylinders 33. As the piston is withdrawn from either cylinder, a vacuum will be created therein because of means to be described later. When the end of the piston clears the slot 46, fluid will immediately fill the cylinder.

Outlet ports 47 are drilled into the periphery of the body 16 from below and communicate with the counter-bores at the outer ends of the cylinder bore. The outlet ports are counter-bored as at 47a to form seats for ball check valves 48. These valves are held against their seats, subject to displacement by fluid discharged through the outlet ports, by springs 49 carried in plugs 50 threaded into the counter-bores 47a.

The wall of the body 16 has a radial bore or cored recess 51 providing a common outlet or relief valve chamber. Cored passages or ducts 52 in the wall of the body communicate with each other through the chamber 51 at one end and with the counter-bores 47a respectively at their other ends. A relief port 53 communicates with the chamber 51 and the interior of the body 16. A relief valve 54 is normally maintained seated against the outer end of the port 53 by a compression spring 55 on the stem of the valve indicated at 56. The spring bears on the inner end of the chamber 51 and on adjusting nuts 57 threaded onto the outer end of the valve stem. A plug 58 closes the outer end of the chamber 51 and is recessed at 59 to receive the end of the valve stem. It will be apparent that the valve 54 opens when the pressure in the chamber 51 becomes excessive, to permit lubricant in the chamber to flow to the interior of the body 16 in which the pressure on the fluid is only that caused by the head of the fluid above the valve port 53.

It will be apparent from the foregoing description that on reciprocation of the piston 35, fluid is delivered under pressure alternately through the outlets 47, past the check valves 48 and through the passages 52 to the chamber 51. The check valves, of course, prevent reverse flow of fluid on withdrawal of the piston from either cylinder. When the check valve is closed, withdrawal of the piston from the cylinder creates a vacuum in the cylinder, causing it to fill with grease when the inlet 46 is uncovered, as shown in the left hand portion of Figure 4.

The piston 13 is slidably disposed in a cylinder 60 bored transversely through the wall of the body 16, preferably parallel to the cylinders 33. A vertical passage 61 connects the cylinder 60 to the chamber 51. Outlet or delivery ports 62 and 63 are drilled through the wall of the body 16 and communicate with the cylinder 60 at points spaced along the length thereof. By-passing or return ports 64 and 65 also communicate with the cylinder 60 at points spaced outwardly of the ports 62 and 63 and with the interior of the body 16.

The piston 13 has a snug sliding fit with the cylinder 60 at its two end portions 66 and 67 and a middle portion 68, but is of reduced diameter therebetween. The end portions 66 and 67 are sufficiently long to provide for packing rings 69 to prevent entrance of dirt. They are inserted from without and are self retaining. Small grooves 70 are turned in the close fitting portions 66, 67 and 68 of the piston 13. These fill with grease and are effective in keeping the piston in alignment and lubricating it within the cylinder 60.

It will be apparent that when the valve 13 is in the position in which it is shown in Figure 3, the fluid delivered by the piston 35 will flow from the chamber 51 through the passage 53, thence through the portion of the cylinder 60 between portions 67 and 68 and thence through the outlet port 63 to pipe 12. At the same time, the pipe 11 and outlet port 62 are in communication with the by-passing port 64 through the portion of the cylinder 60 between portions 66 and 68. This feature is of particular importance in two-pipe, pressure lubrication systems since it is desirable, in such systems, to relieve the pressure on one pipe when supplying fluid to the other pipe.

When the piston 13 is in its other extreme position, as shown in Figure 3A, the pipe 11 and outlet port 62 are in communication with the passage 61 through which fluid is delivered from the chamber 51 by reciprocation of the piston 35, and pipe 12 and outlet 63 are in communication through by-passing port 65 with the interior of the body 16.

The solenoids 14 and 15 for reciprocating the piston 13 include coils 71 assembled in a frame 72 carried on studs 73 extending upwardly from the base 20. Cores 74 reciprocable through the coils are connected to opposite ends of the piston by cables 75 trained over sheaves 76. The sheaves are journaled on brackets 77 secured to the body 16. By this construction, it will be evident that energization of the coils of the two solenoids alternately will cause the piston 13 to move back and forth between its extreme positions. The vertical positions of the solenoid coils may be changed by adjusting the nuts on the studs 73 so that the piston will be in the proper position at the end of its stroke in both directions.

The solenoids will usually be energized alternately by a suitable change-over switch operating at the end of each pumping operation. The pump is usually controlled by an automatic timer to operate for a predetermined period at definite intervals, say a few minutes out of each hour. A typical control system is disclosed in application Ser. No. 427,434 of William H. Venable, filed January 20, 1942.

The reservoir 17 may be filled by removing the cover 43 with the stem 44 and its disc 45. I make

alternate provision for filling the reservoir in the form of a bushing **78** threaded into a tapped hole in the bottom of the body **16**. A fitting **79** is threaded into the bushing **78** and has a check-valve closure **80** in its outer end which is adapted to cooperate with a grease gun and coupler of any suitable design. When the reservoir **17** is filled through the fitting **79**, the disc **45** and stem **44** will be raised as the filling progresses.

It will be apparent from the foregoing description that the invention provides a fluid-supply apparatus having numerous advantages over previous arrangements for delivering fluid under pressure to a distribution system. The device of my invention is simple, compact, unitary and entirely self-contained. The construction is such that the device may be manufactured at relatively low cost by simple machining operations and conventional foundry practice. The pump and valve cylinders as well as their inter-connecting passages are easily formed by drilling straight through the body or by cores in the casting thereof. The pump piston is insertable through either end of its bore and the crank for actuating it may be fitted after insertion into the body from either the top or through the hole in the bottom for the bushing **78**.

The device is well suited to manual operation as well as to a power drive. The piston **13**, for example, may easily be actuated by a manually exerted pull on the cables **75** or a handle or knob may be secured to one end of **13** instead of the cables and solenoids at both ends; and the shaft **27** may be oscillated by manual effort applied to the crank **26** if the link **25** is omitted.

A continuous supply of fluid is maintained at the inlets **46** of the cylinders **33** because of the construction and relation of the body **16** and reservoir **17**. By incorporating the transfer or reversing valve and the relief valve in the body of the device, I eliminate numerous joints which would be necessary if these parts were separate, which is advantageous because every joint in a high-pressure system is a potential leak. As already stated, the transfer valve operates to relieve the pressure in the pipe other than the one to which fluid under presure is being supplied. The bottom-filling connection is desirable in that it avoids the possibility of the introduction of dirt into the reservoir which might result from filling the latter from above.

The valve-actuating solenoids hang vertically and thus balance each other and move with little friction. The relief valve prevents the development of excessive pressures which might occur in a lubrication system after operation of all the dosers connected thereto.

I claim:

1. A fluid-supply apparatus comprising a pump-and-valve body open at the top and surmounted by a reservoir, opposed coaxial cylinders open at their inner ends to the interior of said body, a piston having its ends slidably disposed in said cylinders, respectively, discharge ducts leading from said cylinders, respectively, to an outlet chamber, a transverse valve bore through the body in communication with said chamber, outlet ports intersecting said bore at points spaced therealong, and a valve piston reciprocable in said bore adapted, in alternate positions, to connect said ports selectively to said outlet chamber.

2. A fluid-supply apparatus comprising a bowl-shaped body open at the top and surmounted by a reservoir, coaxial cylinders bored radially in the body wall, a piston having its ends slidably disposed in said cylinders, respectively, discharge passages extending from the outer end of said cylinders, respectively, to an outlet chamber, a transverse valve bore through one side of said body, a connecting passage from said chamber to said bore, outlet ports extending through the body wall and intersecting said valve bore at points spaced therealong, and a valve piston reciprocable in said bore and adapted to place said connecting passage in communication with said ports successively when moved from one alternate position to another.

3. A fluid-supply apparatus comprising a bowl-shaped hollow pump-and-valve body having a thickened circumferential rim, opposed, coaxial cylinders extending from said rim interiorly of said body, a piston having its ends slidably disposed in said cylinders, respectively, inlet ports adjacent the inner ends of said cylinders, outlet ducts in said circumferential rim leading from the outer ends of the cylinders, respectively, to an outlet chamber, a pair of outlet ports extending into said body, and a valve in said body movable from one extreme position to another and effective in each extreme position to connect one of said outlet ports to said chamber.

4. A fluid-supply apparatus comprising a hollow pump-and-valve body, opposed, coaxial cylinders extending interiorly of said body, a piston having its ends slidably disposed in said cylinders, respectively, inlet ports adjacent the inner ends of said cylinders, outlet ducts leading from the outer ends of the cylinders, respectively, to an outlet chamber, a relief valve disposed in said chamber and opening into said body, a pair of outlet ports extending into said body, and a valve in said body movable from one extreme position to another and effective in each extreme position to connect one of said outlet ports to said chamber.

5. A fluid-supply apparatus as defined by claim 3 characterized by return ports opening into said body, said valve being effective to connect to one of said return ports the outlet port other than the one connected to said chamber.

6. A fluid-supply apparatus comprising a bowl-shaped body open at the top and surmounted by an open-bottomed reservoir, diametrically opposite bosses projecting inwardly of said body, said bosses having a bore therethrough providing opposed co-axial cylinders, a piston having its ends slidably disposed in said cylinders, inlet ports adjacent the inner ends of said cylinders opening into the interior of said body, discharge passages extending through the wall of said body from the outer ends of said cylinders, respectively, to a relief-valve chamber, a spring-closed valve in said chamber opening into the interior of said body, a valve bore through the wall of said body adjacent one side thereof communicating with said chamber, outlet ports extending into the wall of the body and intersecting the valve bore at points spaced therealong, return ports intersecting said valve bore at points spaced therealong and opening into the interior of said body, and a valve slidable in said valve bore between alternate extreme positions, said valve being effective in each position to connect one of said outlet ports to said chamber, and the other outlet port to one of said return ports.

7. A fluid-supply apparatus comprising a pump-and-valve body open at the top and surmounted by an open-bottomed reservoir, a cyl-

inder extending inwardly of the wall of said body, a piston reciprocable in said cylinder, a relief valve chamber in the wall of said body and spaced from said cylinder, a passage through the wall of said body from the outer end of said cylinder to said chamber, outlet ports extending into the wall of said body, and a valve in said wall effective to place said outlets selectively in communication with said chamber.

8. A fluid-supply apparatus comprising a pump-and-valve body open at the top and surmounted by a reservoir, opposed coaxial cylinders open at their inner ends to the interior of said body, a piston having its ends slidably disposed in said cylinders, respectively, discharge ducts communicating at one end with said cylinders, respectively, and in communication with each other at their other ends, outlet ports extending into said body, and a valve in said body movable from one extreme position to another and effective in each extreme position to connect one of said outlet ports to the intercommunicating ends of said ducts.

9. A fluid-supply apparatus as defined by claim 8 characterized by each of said cylinders having an inlet port open tothe interior of the body and reservoir and so positioned adjacent the inner end of the cylinder that the inlet port of a given cylinder is uncovered when said piston moves to its extreme retracted position relative to a said cylinder.

10. A fluid-supply apparatus as defined by claim 8 characterized by a relief valve subject to the pressure in the intercommunicating ends of said ducts, said valve opening into the interior of said body.

11. A fluid-supply apparatus as defined by claim 8 characterized by return ports intersecting said valve bore and opening into said body, said valve piston being further adapted to connect to one of said return ports, the outlet port other than the one connected to the intercommunicating ends of said ducts.

EDWARD P. DENIGAN.