Nov. 26, 1935. J. T. LEONARD 2,022,005

LUBRICATING APPARATUS

Filed Aug. 15, 1932 2 Sheets-Sheet 1

Fig. 1.

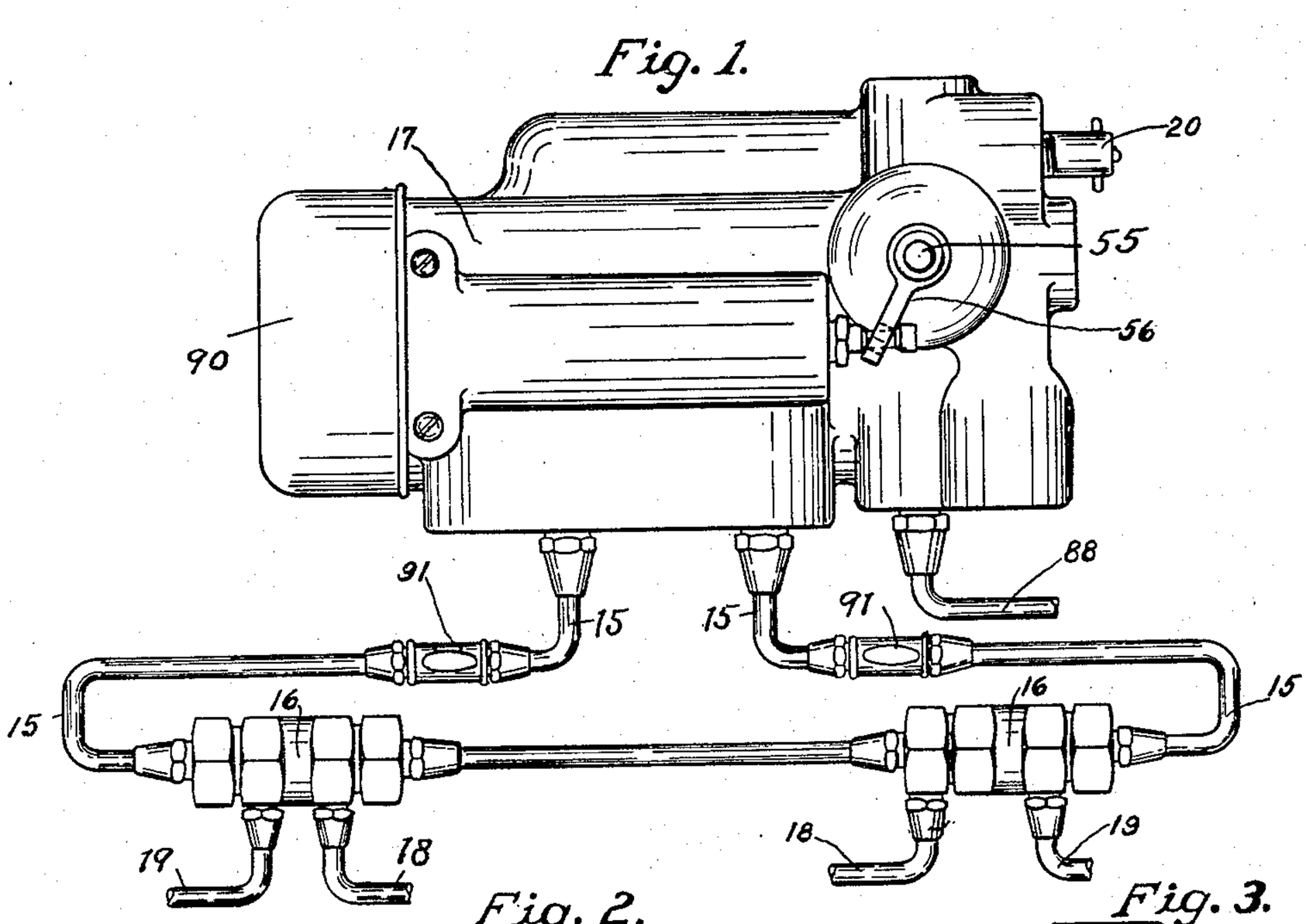


Fig. 2.

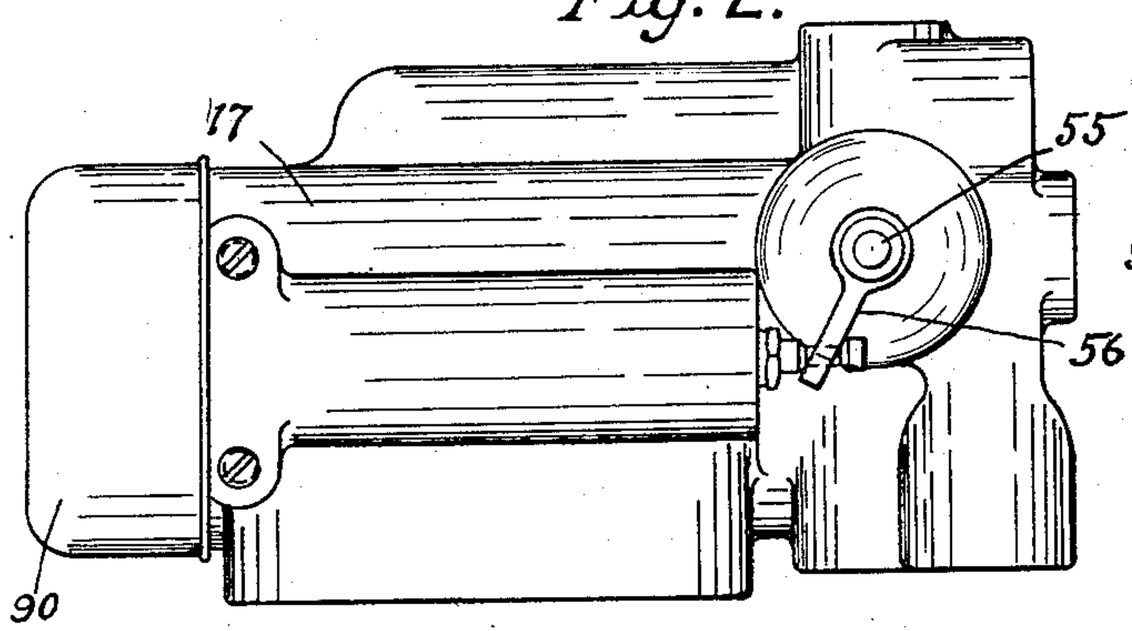


Fig. 3.

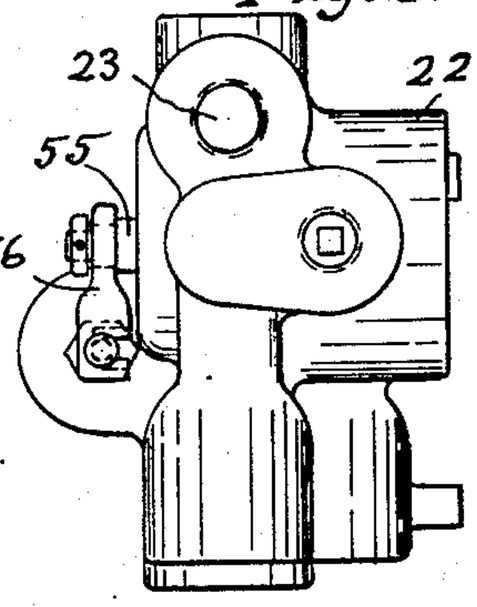


Fig. 4.

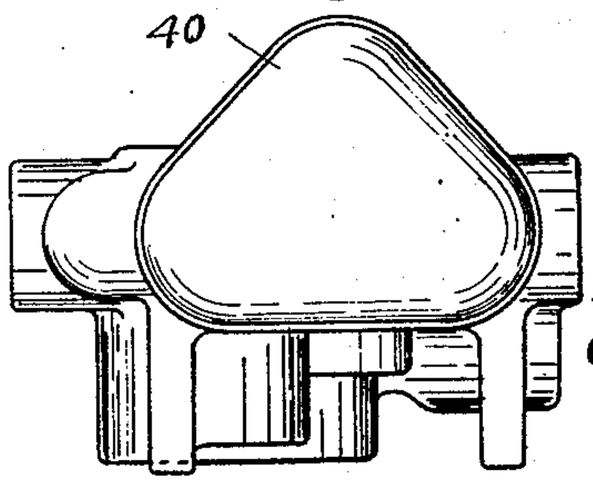
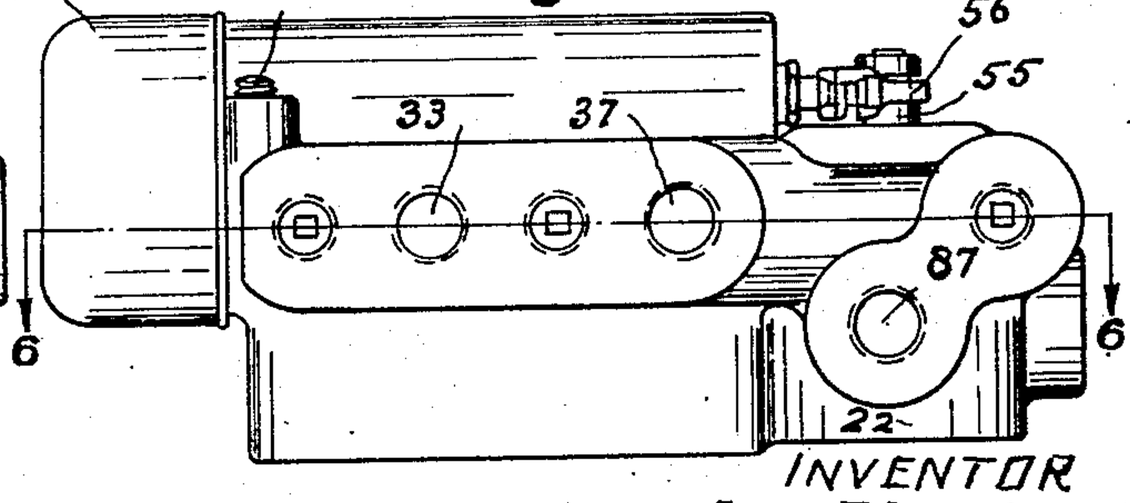


Fig. 5.



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Filed Aug. 15, 1932 2 Sheets-Sheet 2

Fig. 6.

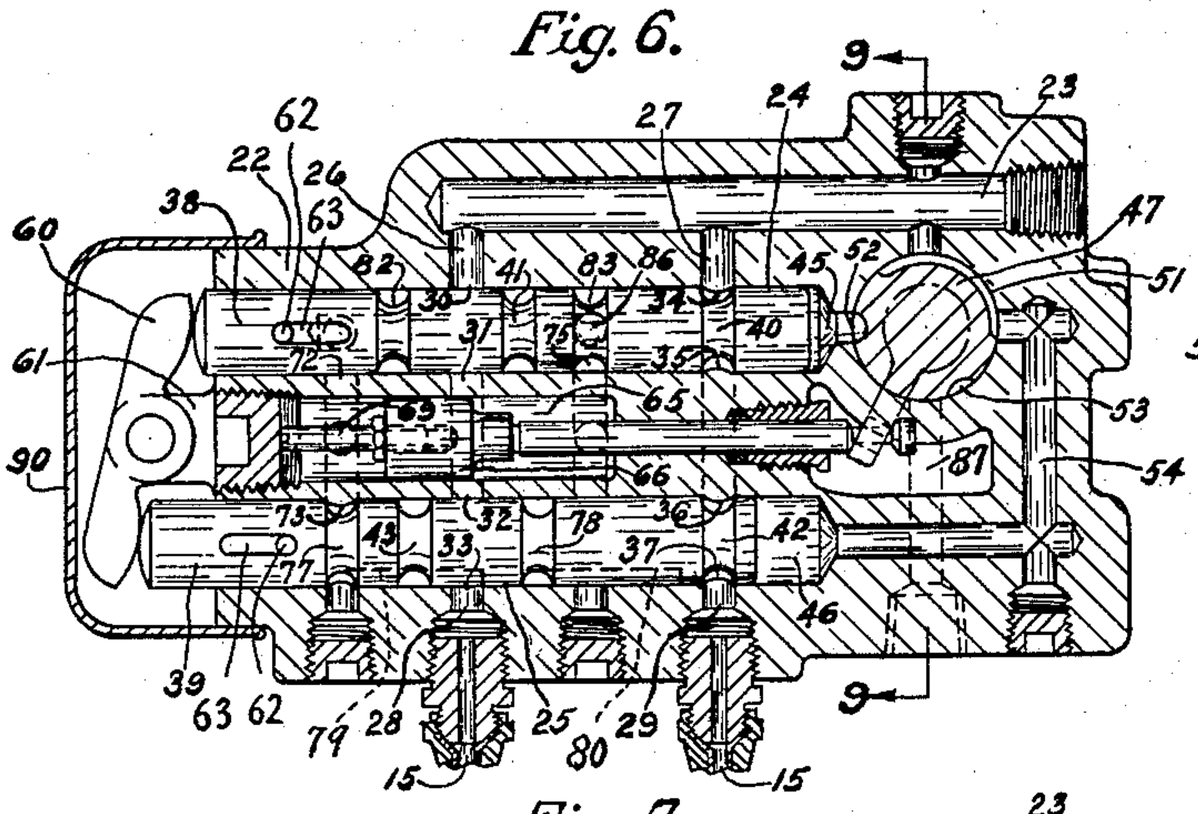


Fig. 9.

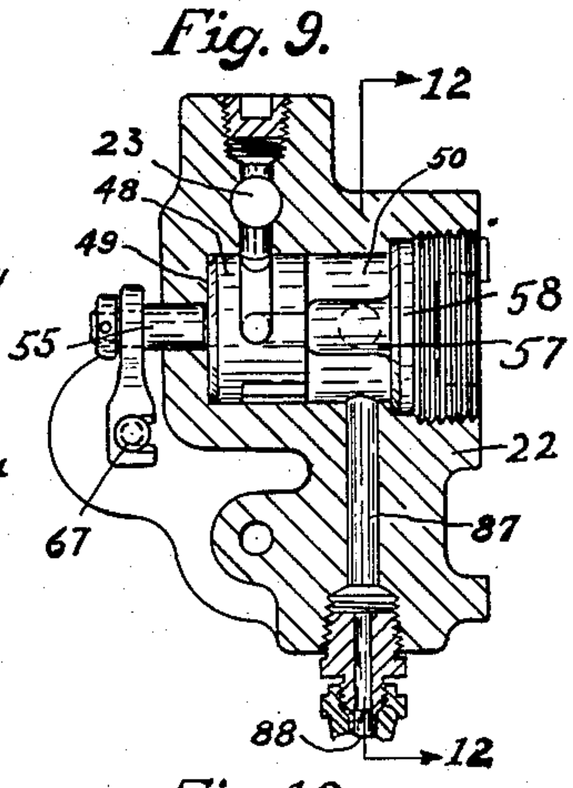


Fig. 7.

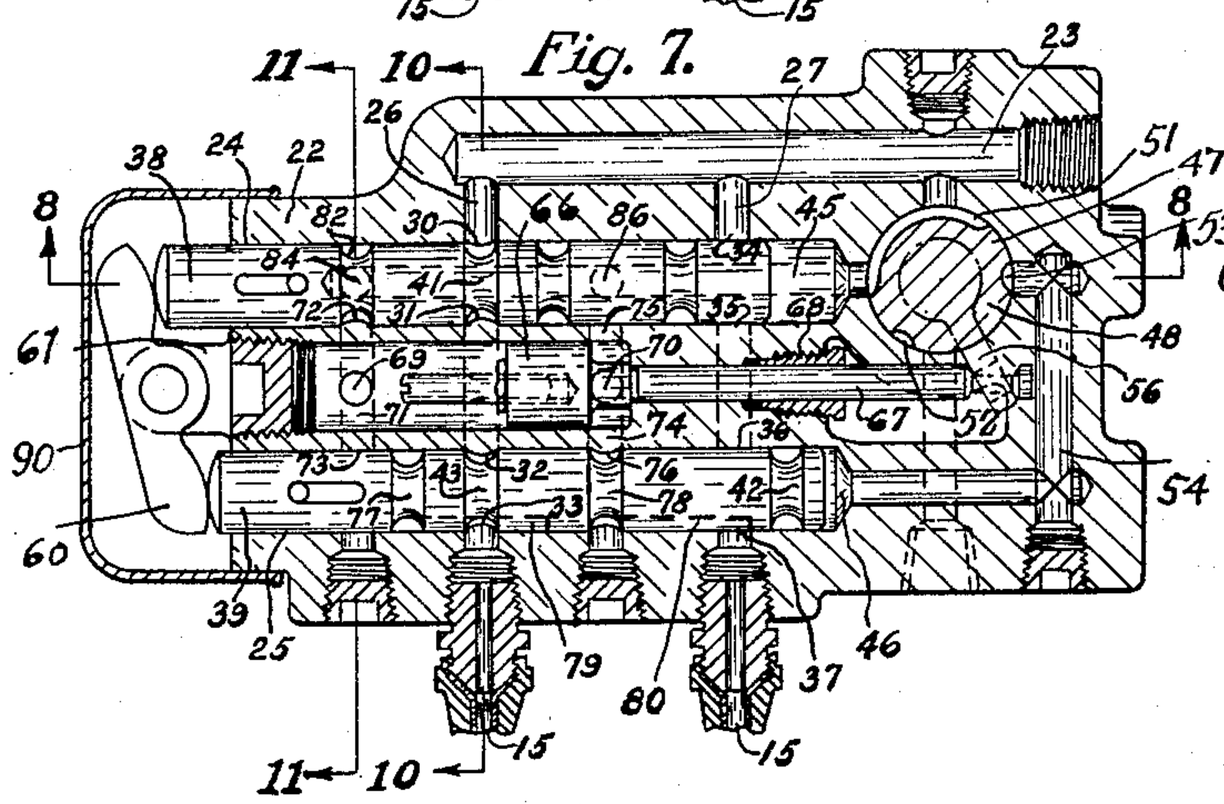


Fig. 10.

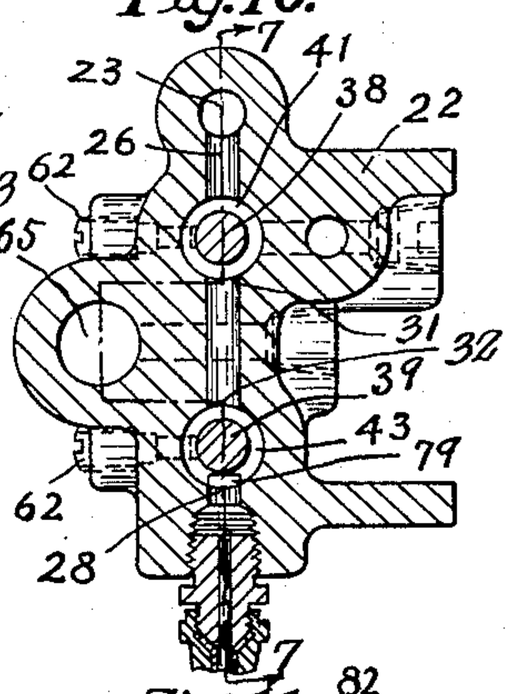


Fig. 8.

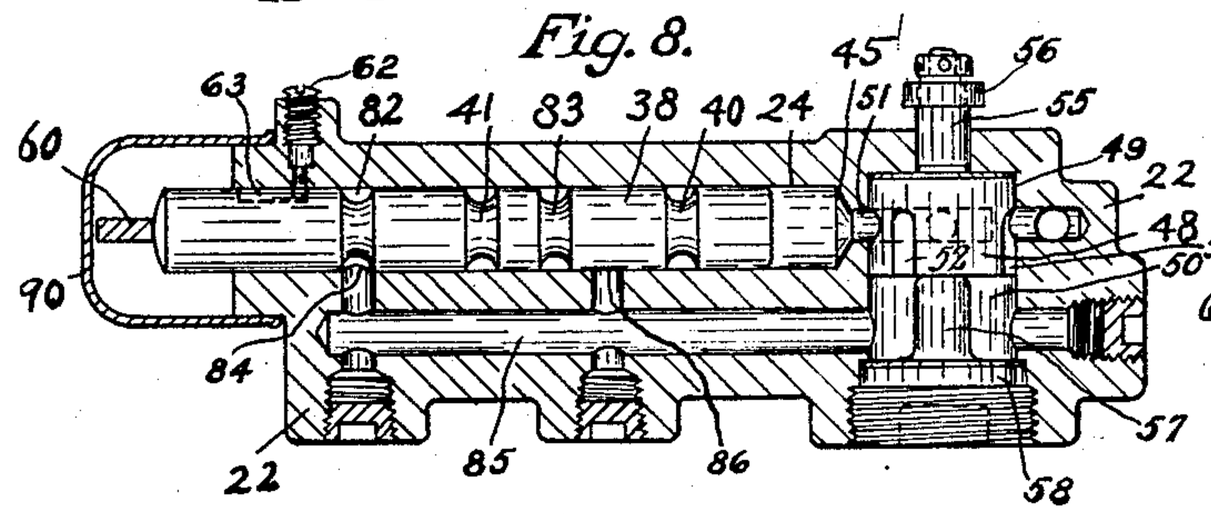


Fig. 11.

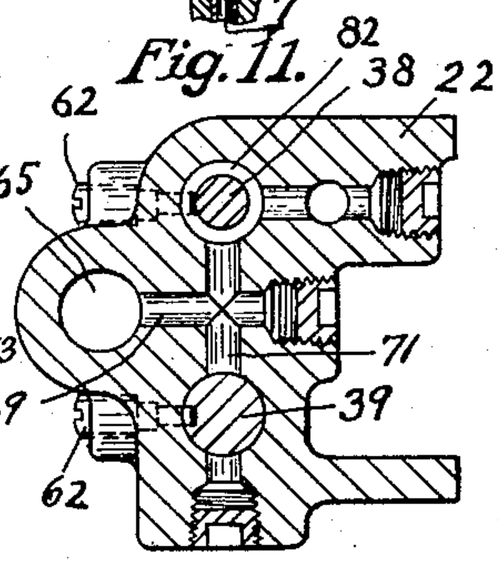
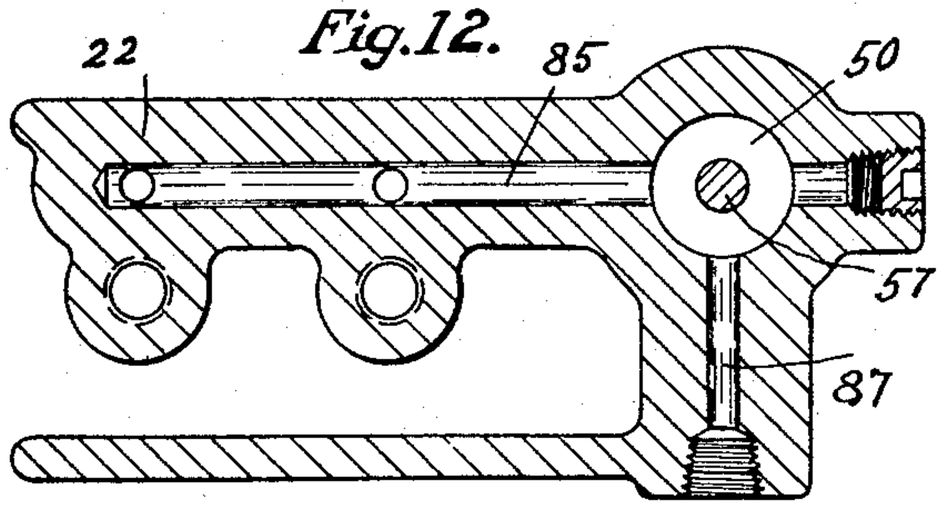


Fig. 12.



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Patented Nov. 26, 1935 2,022,005

UNITED STATES PATENT OFFICE

2,022,005

LUBRICATING APPARATUS

John T. Leonard, Evansville, Ind.

Application August 15, 1932, Serial No. 628,841

12 Claims. (Cl. 184—7)

This invention relates to fluid control means, and more particularly to an improved form of lubricant distributing apparatus.

An object of this invention is to provide an improved form of fluid distributing apparatus, involving the use of a delivery conduit through which the fluid is forced and means responsive to fluid pressure, transmitted through the conduit, for reversing the direction of fluid travel.

Another object of this invention is to provide fluid distributing apparatus of improved form having a plurality of delivery passages, and a pressure fluid actuated valve for selectively connecting said delivery passages with a pressure fluid inlet passage, and wherein the pressure fluid actuation of said valve is controlled by fluid pressure transmitted through one of said delivery passages.

A further object of this invention is to provide a lubricant flow reversing device having passages communicating with the ends of a distributing conduit, and a lubricant pressure actuated main valve for selectively connecting said passages with a lubricant pressure inlet passage, to thereby control the direction of flow through said conduit, and also having a pilot valve for controlling the pressure fluid actuation of the main valve, and means responsive to fluid pressure transmitted through the conduit for actuating the pilot valve.

Other objects and advantages of the invention will be apparent from the following description, when taken in conjunction with the accompanying sheets of drawings, wherein

Fig. 1 is a plan view of fluid distributing apparatus embodying my invention.

Fig. 2 is a plan view of the flow reversing means.

Fig. 3 is an end view thereof.

Fig. 4 is another end view thereof.

Fig. 5 is a side elevation of the flow reversing means.

Fig. 6 is a sectional plan view taken substantially as indicated by line 6—6 of Fig. 5.

Fig. 7 is a similar sectional plan view but with the moving parts in a different position.

Fig. 8 is a longitudinal sectional elevation taken on line 8—8 of Fig. 7.

Fig. 9 is a transverse sectional view taken on line 9—9 of Fig. 6.

Fig. 10 is a transverse sectional view taken on line 10—10 of Fig. 7.

Fig. 11 is a transverse sectional view taken on line 11—11 of Fig. 7, and

Fig. 12 is a sectional plan view taken on line 12—12 of Fig. 9.

For a more detailed description of my invention, reference will now be made to the accompanying drawings, wherein I have illustrated a preferred form of my fluid distributing apparatus which may be used in obtaining a desired distribution of fluids of various kinds, but which is especially suitable for distributing lubricant. It should be understood, however, that my invention is not to be regarded as limited to the particular construction herein illustrated, but may be embodied in various other arrangements and devices.

Before proceeding with the detailed description, it is pointed out that, in general, my invention involves the use of a lubricant distributing conduit having a series of lubricant feeders therein, and an automatic reversing device which is actuated by the lubricant pressure for reversing the direction of flow of lubricant through the conduit. As will be explained more in detail hereinafter, the lubricant forced into one end of the conduit actuates the feeders in succession, each feeder acting to discharge a predetermined quantity of lubricant before the lubricant stream can pass on to the next feeder. After all the feeders have been actuated, lubricant pressure is transmitted through the conduit and causes the reversing device to be actuated to reverse the flow of lubricant through the conduit, whereupon the feeders are again actuated in succession by the lubricant pressure.

In Fig. 1 of the drawings I have shown my distributing apparatus as comprising a lubricant distributing conduit 15, having a series of lubricant feeders 16 therein, and a flow reversing device 17 to which the ends of the conduit are connected. The feeders are of the kind used in lubricating systems of the progressive or series type, and although any one of various specific constructions of feeders may be employed, I prefer to use feeders of the form disclosed in my co-pending application, Serial No. 607,708, filed April 27, 1932. Since the specific construction of the feeders themselves does not constitute a part of the present invention, a detailed description of this device is believed unnecessary. For purposes of the present disclosure, it is pointed out, however, that each feeder is provided with a cylinder which communicates at its ends with the conduit 15, and which is provided intermediate its ends with discharge connections 18 and 19 for delivery of lubricant to desired points. Each feeder also embodies a fluid-flow control device which is reciprocably movable in the cylinder for controlling the passage of lubricant therethrough. When lubricant pressure is admitted to a feeder

at one end thereof, the control device is actuated by the lubricant pressure to deliver a predetermined quantity of lubricant through one of the discharge connections, after which the stream of lubricant is allowed to pass through the feeder and on to the next succeeding feeder in the discharge conduit. After all of the feeders have thus been actuated in succession, the direction of lubricant flow through the conduit 15 is reversed, and lubricant is again admitted to the feeders in succession to cause another predetermined quantity of lubricant to be discharged by each feeder through one of the delivery connections thereof.

The flow control device 17 is preferably constructed as a compact unit, as shown in the drawings, so that it may be mounted at a convenient location on a machine or other apparatus to be lubricated. For example, when the apparatus to be lubricated is a motor vehicle, the flow control device may be mounted at a conveniently accessible point, such as on the dash of the motor vehicle. This flow control device is provided with a lubricant pressure inlet connection, so that lubricant may be supplied thereto from any available source, such as a portable pumping outfit. At this inlet connection I prefer to employ a lubricant fitting 20, of the conventional check valve form, to which a lubricant pressure supply conduit may be detachably connected.

As shown in Figs. 6 and 7 of the drawings, the flow control device is provided with a body or casing 22, having a lubricant pressure inlet passage 23 and a pair of valve cylinders 24 and 25 formed therein. The body is also provided with a pair of delivery passages 26 and 27, which extend transversely of the valve cylinders. These passages communicate, at one end thereof, with the inlet passage 23 and at their opposite end communicate, respectively, with delivery openings 28 and 29 in which the ends of the conduit 15 are connected. The delivery passage 26 communicates with the valve cylinder 24 through the ports 30 and 31 and with the valve cylinder 25 through the ports 32 and 33. The delivery passage 27 communicates with the valve cylinder 24 through ports 34 and 35 and with the valve cylinder 25 through ports 36 and 37.

For controlling these ports of the valve cylinders so as to selectively connect the delivery openings 28 and 29 with the inlet passage 23, I provide a reciprocating valve member 38 in the cylinder 24, and a reciprocating valve member 39 in the cylinder 25. The valve members 38 and 39 are constructed in the form of elongated plungers which project from the cylinders at their open end. The valve member 38 is provided with a pair of peripheral annular grooves 40 and 41, which are spaced longitudinally of the valve member a distance somewhat less than the spacing of the ports 30 and 34. The valve member 39 is likewise provided with a pair of peripheral annular grooves 42 and 43, which are spaced apart longitudinally of the valve member a distance somewhat greater than the spacing of the ports 33 and 37. When the valve members are in the position indicated in Fig. 6, the grooves 40 and 42 register, respectively, with the ports 34 and 35 of the cylinder 24, and the ports 36 and 37 of the cylinder 25, to thereby permit a flow of lubricant through the delivery passage 27 and the opening 29 into the distributing conduit 15.

When the valve members have been moved to the position shown in Fig. 7, it will be seen that the groove 41 of the valve member 38, registers with the ports 30 and 31 of the cylinder 24, and the groove 43 of the valve member 39 registers with the ports 32 and 33 of the cylinder 25, to thereby permit the flow of lubricant pressure through the delivery passage 26 and the opening 28 into the opposite end of the distributing conduit 15. It will be noted, however, that when the valve member 38 is in the position shown in Fig. 6, the ports 30 and 31 of the cylinder 24 are closed, and when this valve member is in the position shown in Fig. 7 the ports 34 and 35 are closed.

For moving the valve members 38 and 39 to the positions referred to above, I have constructed the cylinders 24 and 25 so that the inner ends thereof constitute power cylinders 45 and 46, to which lubricant pressure may be admitted from the inlet passage 23 for actuating the valve members. For controlling the supply of lubricant pressure to these power cylinders I employ a pilot valve 47 which, in this instance, comprises a substantially cylindrical valve plug 48, which is rotatably mounted in a recess 49 of the body 22. As shown in Figs. 8 and 9 of the drawings, the recess 49 is made somewhat longer than the valve plug 48, so as to provide an exhaust space or chamber 50, the purpose of which will be described hereinafter.

The pilot valve plug 48 is provided with a transversely extending groove or port 51, and with a pair of axially extending ports 52 and 53 in angularly spaced relation to the ends of the port 51. The port 51 serves as a lubricant pressure supply port, and when the valve plug is in the position shown in Fig. 6, this port connects the inlet passage 23 with the power cylinder 46 through the fluid passage 54. When the valve plug is in the position shown in Fig. 7, the port 51 connects the inlet passage 23 with the power cylinder 45. The axially extending ports 52 and 53 serve as exhaust ports, the port 52 serving to connect the power cylinder 45 with the exhaust chamber 50 when the valve plug is in the position shown in Fig. 6, and the port 53 serving to connect the power cylinder 46 with the exhaust chamber when the valve plug is in the position shown in Fig. 7. From the arrangement just described it will be seen that when the valve plug is rotated, so as to occupy the position shown in Fig. 6, lubricant pressure is admitted to the power cylinder 46 and causes the valve member 39 to be moved to the position thereof illustrated in Fig. 6 and permits lubricant pressure previously admitted to the cylinder 45 to be exhausted or released through the port 52 into the exhaust chamber 50. When the valve plug 48 is rotated to the position shown in Fig. 7, lubricant pressure is admitted to the power cylinder 45 and causes the valve member 38 to be moved to the left to the position illustrated, and allows the lubricant pressure previously admitted to the cylinder 46 to be exhausted through the passage 54 and port 53 into the exhaust chamber 50.

Operative connection with the valve plug 48 may be made by providing the latter with a stem 55, which projects outwardly from the body 22 and to which an actuating lever 56 may be attached. The valve plug may be retained in proper position in the valve chamber 49 by any suitable means, such as the retaining stem 57, provided on the screw plug 58 which forms a closure for the exhaust chamber 50.

To insure positive actuation of both valve members 38 and 39 at the same time, I provide

means for transmitting power from one valve member to the other in the form of the rocker member **60**. As shown in the drawings, this rocker member is pivotally mounted in a bracket **61** and engages the valve members **38** and **39** at the outer end thereof. When lubricant pressure is admitted to the power cylinder **45** to move the valve member **38** to the left, motion is transmitted through the rocker bar **60** to simultaneously shift the valve member **39** to the right, thereby causing the lubricant previously admitted to the power cylinder **46**, to be discharged into the exhaust chamber **50**. Similarly, when the lubricant pressure is admitted to the power cylinder **46** to move the valve member **39** to the left, the rocker member transmits motion to the valve member **38** and causes the power cylinder **45** to be exhausted. If desired, the stroke or travel permitted the valve members may be maintained constant by providing limit screws **62**, which are mounted in the body **22**, as shown in Fig. 8, and extend into grooves **63** provided in the valve members. These screws limit the axial travel of the valve members, and also prevent rotation of these members about their axes, so that the grooves of the valve members will register properly with the various ports of the valve cylinders.

For moving the pilot valve **47** to control the fluid pressure actuation of the valve members **38** and **39**, I provide the body **22** with a power cylinder **65**, having a piston **66** reciprocably mounted therein, which piston may be operably connected with the lever **56** of the valve plug **48**, as by means of a piston rod **67** extending through the packing gland **68**. The power cylinder **65** is provided with fluid ports **69** and **70** adjacent the ends thereof, for the admission and exhaust of the lubricant pressure which actuates the piston **66**. The port **69** communicates with a passage **71** which extends transversely in the body **22** and which communicates with the valve cylinder **24** through the port **72** and with the valve cylinder **25** through the port **73**. The port **70** communicates with a passage **74** which also extends transversely of the body and which communicates with the cylinder **24** through the port **75** and with the cylinder **25** through the port **76**.

In addition to controlling the delivery passages **26** and **27**, the valve member **39** functions as an admission valve for the power cylinder **65**, and controls the supply of pressure lubricant to this cylinder through the ports **69** and **70**. Likewise, the valve member **38** functions as an exhaust valve for the power cylinder **65** and controls the exhaust or discharge of lubricant from this cylinder through the ports **69** and **70**. To this end the valve member **39** is provided with a pair of peripheral grooves **77** and **78**, which are spaced longitudinally of this valve member a distance somewhat less than the spacing of the ports **73** and **76**. As shown in Figs. 6 and 7, the peripheral grooves **77** and **78** are provided with extension recesses or grooves **79** and **80**, which are formed in the valve member **39** to extend longitudinally thereof. These extensions are made of such length that the extension **79** always provides a communication between the port **33** and the groove **77**, regardless of the different positions which the valve member may assume, and likewise, the extension **80** provides communication between the port **37** and the groove **78**. Thus when the valve member **39** is in the position shown in Fig. 6, lubricant pressure transmitted through the passage **27** and the conduit **15** will be admitted to the power cylinder through the port **69**, by reason of the registration of the groove **77** with the port **73**. Admission of lubricant pressure into the left hand end of the power cylinder **65** will cause the piston **66** to be moved toward the right, as seen in Fig. 7, to thereby shift the pilot valve **47** to the position illustrated in Fig. 7. When the valve member **39** occupies the position shown in Fig. 7, lubricant pressure transmitted through the passage **26** and the conduit **15** will be admitted to the power cylinder **65** through the groove **78** and the port **70**, to thereby cause the piston **66** to be moved toward the left and the pilot valve shifted back to the position illustrated in Fig. 6.

To permit the valve member **38** to function as an exhaust valve for the power cylinder **65**, I provide this valve member with peripheral grooves **82** and **83**, which are spaced apart longitudinally of the valve member a distance somewhat less than the spacing of the ports **72** and **75**, so that when the valve member is in the position shown in Fig. 6, the groove **83** will register with the port **75**, but the port **72** will be closed, and when the valve member is in the position shown in Fig. 7, the groove **82** will register with the port **72** but the port **75** will be closed. When the groove **82** registers with the port **72** it connects this port with a port **84** to thereby provide communication between the left end of the power cylinder and the exhaust chamber through the passage **85**. When the groove **83** registers with the port **75** it connects this port with a port **86**, to thereby establish communication between the right hand end of the power cylinder and the exhaust chamber **50** through the passage **85**. From this arrangement it will thus be seen that the opposite ends of the power cylinder **65** are alternately connected with the conduit **15** and with the exhaust chamber **50**, so that the piston **66** will be reciprocated by lubricant pressure transmitted through the conduit **15**.

As explained above, the power cylinders **45** and **46**, and the power cylinder **65**, are exhausted into the chamber **50**, and to utilize the lubricant delivered into this chamber, I provide the latter with an outlet passage **87** to which a conduit **88** may be connected for supplying lubricant to a desired point, such as to the universal joint of the propeller shaft, when the fluid distributing apparatus is applied to a motor vehicle.

In the operation of my fluid distributing apparatus, lubricant pressure is supplied to the fluid control means through the connection **20**, as by temporarily attaching a lubricant supply conduit to the latter. The lubricant forced into the inlet passage **23** is transmitted to one end of the distributing conduit **15** through the delivery passage **27** when the valve members are in the position illustrated in Fig. 6. After the stream of lubricant has traversed the distributing conduit and has actuated the feeders **16** therein, the lubricant pressure returns through the conduit and is supplied to the power cylinder **65** through the groove **77** of the valve member, and through the port **69**. The piston **66** is thereupon moved toward the right to shift the pilot valve **48** to the position illustrated in Fig. 7. In this position the pilot valve admits pressure lubricant to the cylinder **45** and causes the valve members **38** and **39** to be shifted to the position shown in Fig. 7. When the valve members are in this position, lubricant pressure is supplied to the opposite end of the conduit **15** through the deliv-

ery passage 26, and the lubricant pressure returning through the conduit, enters the power cylinder 65, through the groove 78 of the valve member 39, and through the port 70. The lubricant pressure thus admitted to the cylinder 65 moves the piston 66 toward the left and shifts the pilot valve back to the position illustrated in Fig. 6, whereupon lubricant pressure is admitted to the power cylinder 46 and shifts the valve members 38 and 39 back to the position shown in Fig. 6. It will be understood, of course, that as long as lubricant pressure is supplied through the fitting 20, the valve members of the control means will be actuated to intermittently reverse the direction of flow of lubricant through the distributing conduit.

It may be desirable to provide a removable cover 90 around the pivoted lever 60, which cover may be retained in place by frictional engagement with the body 22 or by any other suitable means. It may also be desirable to provide incating means, such as the sight glasses 91 in the conduit 15, for observing the direction of lubricant flow, although successful operation of the device may also be indicated by visible movement of the pilot valve lever 56, or by audible sounds produced by the movement of the parts.

It will now be readily seen that I have provided a novel and improved form of fluid distributing apparatus, wherein the direction of flow through a distributing conduit is intermittently reversed by flow-reversing means which is actuated by the pressure of the fluid being distributed. It will also be seen that in the apparatus which I have provided, the valve means of the flow-reversing device is actuated by the pressure of the fluid to be distributed, and such pressure fluid actuation of the valve means is controlled in response to pressure transmitted through the distributing conduit. If, for any reason, pressure is not transmitted through the distributing conduit, the device cannot function and the operator will immediately know that the apparatus is out of order or that the lubricant pressure supply has been interrupted.

It is pointed out further that the fluid distributing apparatus of my invention is not only efficient and reliable in operation, but is of simple and compact form, which permits it to be conveniently mounted upon a motor vehicle or other machine having various points to which fluid is to be distributed. From the construction and arrangement herein disclosed, it will also be noted that my distributing apparatus involves the use of parts which can be cheaply manufactured and easily assembled, resulting in a device which can be very economically produced.

While I have illustrated and described the apparatus of my invention in a detailed manner, it should be understood, however, that I do not intend to limit myself to the precise details of construction and arrangements of parts illustrated and described, but regard my invention as including such changes and modifications as do not involve a departure from the spirit of the invention and the scope of the appended claims.

Having thus described my invention what I claim is:

1. In apparatus of the character described the combination of a body having a plurality of cylinders therein, including a pair of valve cylinders and a power cylinder, said body also having a plurality of fluid passages therein including a pressure fluid inlet passage and an exhaust passage, a fluid delivery conduit having the ends thereof connected to said body, pistons operable in said pair of cylinders and provided with valve elements for selectively connecting the ends of said conduit with said inlet passage to thereby control the direction of fluid flow through said conduit, a control valve for alternately connecting the ends of the cylinders of said pair with said inlet passage while the end of the cylinder not connected with said inlet passage is connected to said exhaust passage whereby said pistons are actuated by fluid pressure, a plunger in said power cylinder for actuating said control valve, and valve elements on said pistons for connecting one end of said power cylinder with said conduit and the other end of said power cylinder with said exhaust passage whereby said plunger is actuated by pressure fluid being returned to said body through said conduit.

2. In apparatus of the character described, the combination of a body having a plurality of cylinders therein including a pair of valve cylinders and a power cylinder, said body also having a plurality of fluid passages therein including a pressure fluid inlet passage and an exhaust passage, a fluid delivery conduit having the ends thereof connected to said body, pistons operable in said pair of cylinders and provided with valve elements for selectively connecting the ends of said conduit with said inlet passage to thereby control the direction of fluid flow through said conduit, a control valve for alternately connecting the ends of the cylinders of said pair with said inlet passage while the end of the cylinder not connected with said inlet passage is connected to said exhaust passage whereby said pistons are actuated by fluid pressure, power transmitting means cooperating with said pistons to cause simultaneous movement thereof, a plunger in said power cylinder for actuating said control valve, and valve elements on said pistons for connecting one end of said power cylinder with said conduit and the other end of said power cylinder with said exhaust passage whereby said plunger is actuated by pressure fluid being returned to said body through said conduit.

3. In apparatus of the character described, the combination of a body having a plurality of cylinders therein, including a pair of valve cylinders and a power cylinder, said body also having a plurality of fluid passages therein including a pressure fluid inlet passage and an exhaust passage, a fluid delivery conduit having the ends thereof connected to said body, fluid measuring and dispensing devices connected in series relation to each other in said conduit for operation in succession by pressure fluid delivered through the conduit, pistons operable in said pair of cylinders and provided with valve elements for selectively connecting the ends of said conduit with said inlet passage to thereby control the direction of fluid flow through said conduit, a control valve for alternately connecting the ends of the cylinders of said pair with said inlet passage while the end of the cylinder not connected with said inlet passage is connected to said exhaust passage whereby said pistons are actuated by fluid pressure, a plunger in said power cylinder for actuating said control valve, and means including valve elements associated with said pistons for connecting one end of said power cylinder with the return end of said conduit and the other end of said power cylinder with said exhaust passage whereby said plunger is actuated by pressure fluid being returned to said body through said conduit.

4. In apparatus of the character described, the combination of a body having a plurality of cylinders therein including a pair of valve cylinders and a power cylinder, said body also having a plurality of fluid passages therein including a pressure fluid inlet passage and an exhaust passage, a fluid delivery conduit having the ends thereof connected to said body, fluid measuring and dispensing devices connected in series relation to each other in said conduit for operation in succession by pressure fluid delivered through the conduit, pistons operable in said pair of cylinders and provided with valve elements for selectively connecting the ends of said conduit with said inlet passage to thereby control the direction of fluid flow through said conduit, a control valve for alternately connecting the ends of the cylinders of said pair with said inlet passage while the end of the cylinder not connected with said inlet passage is connected to said exhaust passage whereby said pistons are actuated by fluid pressure, power transmitting means cooperating with said pistons to cause simultaneous movement thereof, a plunger in said power cylinder for actuating said control valve, and means including valve elements associated with said pistons for connecting one end of said power cylinder with the return end of said conduit and the other end of said power cylinder with said exhaust passage whereby said plunger is actuated by pressure fluid being returned to said body through said conduit.

5. In a device of the character described, the combination of a body having a pair of cylinders therein provided with a plurality of pressure fluid inlet and outlet ports, pistons movable in said cylinders, a valve for alternately admitting pressure fluid to said cylinders to actuate the pistons therein, a conduit having the ends thereof connected to said body and to certain of said ports, valve elements movable with said pistons and arranged to control said inlet and outlet ports so that pressure fluid is transmitted through said conduit alternately in opposite directions, and a plunger for actuating said valve, said plunger being actuated by pressure fluid returning to said body through said conduit.

6. In a device of the character described, the combination of a body having a pressure fluid inlet passage and a plurality of fluid distributing passages including a pair of delivery passages and an exhaust passage, said body also having a plurality of cylinders therein provided with ports communicating with said delivery passages, valve members in said cylinders for selectively connecting said delivery passages with said inlet passage, a control valve for alternately connecting the ends of said cylinders with said inlet passage while the end of the cylinder not connected with said inlet passage is connected to said exhaust passage whereby said valve members are actuated by pressure fluid from said inlet, a plurality of fluid measuring and dispensing devices, means connecting said devices in series between said delivery passages, and means for actuating said control valve, the last mentioned means being responsive to pressure fluid being returned to said body by said connecting means after operation of the devices of said series.

7. In a device of the character described, the combination of a body having a pressure fluid inlet passage and a plurality of fluid distributing passages including a pair of delivery passages and an exhaust passage, said body also having a plurality of cylinders therein provided with ports communicating with said delivery passages, valve members in said cylinders for selectively connecting said delivery passages with said inlet passage, a control valve for alternately connecting the ends of said cylinders with said inlet passage while the end of the cylinder not connected with said inlet passage is connected to said exhaust passage whereby said valve members are actuated by pressure fluid, power transmitting means cooperating with said valve members to cause simultaneous movement thereof, a plurality of fluid measuring and dispensing devices, a conduit connecting said devices in series between said delivery passages, and means for actuating said control valve, the last mentioned means being responsive to the pressure of fluid being returned to said body through said conduit after operating the devices of said series.

8. In a device of the character described, the combination of a body having a pressure fluid inlet passage and a plurality of fluid distributing passages including a pair of delivery passages and an exhaust passage, said body also having a pair of valve cylinders therein provided with ports communicating with said delivery passages, pistons in said cylinders provided with valve elements for selectively connecting said delivery passages with said inlet passage, a control valve for alternately connecting the ends of said cylinders with said inlet passage while the end of the cylinder not connected with said inlet passage is connected to said exhaust passage whereby said pistons are actuated by pressure fluid from said inlet, a power cylinder, a plunger in said power cylinder for actuating said control valve, a plurality of fluid measuring and dispensing devices, a conduit connecting said devices in series between said delivery passages, and valve elements on the first mentioned pistons for selectively connecting the ends of said power cylinder with said delivery passages and with said exhaust passage whereby said plunger is actuated by pressure fluid being returned to said body through said conduit after operation of the devices of said series.

9. In apparatus of the class described, a body having a pressure inlet and a plurality of outlets and an exhaust, a primary valve means adapted to alternately connect the inlet with the respective outlets, secondary valve means adapted to control said primary valve means by directing pressure thereto from said inlet and from the primary valve means to said exhaust, and connecting means between said outlets and the secondary valve means including valve elements of the primary valve means, said secondary valve means including means operable in response to pressure transmitted through the connecting means.

10. In apparatus of the class described, a body having a pressure fluid inlet and a plurality of of outlets and an exhaust, a primary valve means operable to alternately connect the inlet with the respective outlets, secondary valve means adapted to control said primary valve means by directing pressure thereto from said inlet and from the primary valve means to said exhaust, a conduit having the ends thereof connected to said outlets and through which pressure fluid is adapted to be returned to said body by being forced through the conduit alternately in opposite directions, means responsive to pressure fluid being returned to said body through said conduit for actuating said secondary valve, and valve means rendered effective by actuation of said primary

valve means for controlling said pressure responsive means

11. In apparatus of the class described, a body having a pressure fluid inlet and a plurality of outlets and an exhaust, a primary valve means adapted to alternately connect the inlet with the respective outlets, said primary valve means including a pair of valve cylinders with piston valves operable therein, secondary valve means adapted to control said primary valve means by alternatively connecting the ends of the valve cylinders with said inlet while the end of the cylinder not connected with said inlet passage is connected to said exhaust whereby said pistons are actuated by pressure fluid from said inlet, pressure fluid responsive means for actuating said secondary valve means, a conduit having the ends thereof connected to said outlets and through which pressure fluid is adapted to be returned to said body by being forced through the conduit alternately in opposite directions, and valve means rendered effective by actuation of the primary valve pistons to operatively connect said pressure fluid responsive means with said conduit and said exhaust whereby the pressure fluid responsive means is actuated by pressure fluid being returned to said body through the conduit.

12. In apparatus of the class described, a body having a pressure fluid inlet and a plurality of outlets and an exhaust, a primary valve means adapted to alternately connect the inlet with the respective outlets, said primary valve means including a pair of valve cylinders and a pair of piston valves operable therein, secondary valve means adapted to control said primary valve means by alternately connecting the ends of the valve cylinders with said inlet passage while the end of the cylinder not connected with said inlet passage is connected to said exhaust passage whereby said pistons are actuated by pressure fluid from said inlet, a conduit having the ends thereof connected to said outlets and through which pressure fluid is adapted to be returned to said body by being forced through the conduit alternately in opposite directions, pressure fluid responsive means for actuating said secondary valve means, and connections between said pressure fluid responsive means and said conduit and exhaust including valve means rendered effective by actuation of the primary valve pistons whereby one of said primary valve pistons controls the supply of pressure fluid to said pressure fluid responsive means from said conduit and the other valve piston controls the discharge of fluid from said pressure fluid responsive means to said exhaust.

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