April 24, 1956 D. C. PETERSON ET AL 2,742,978

LUBRICANT MEASURING VALVE FOR CENTRALIZED LUBRICATING SYSTEM

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Fig. 1.

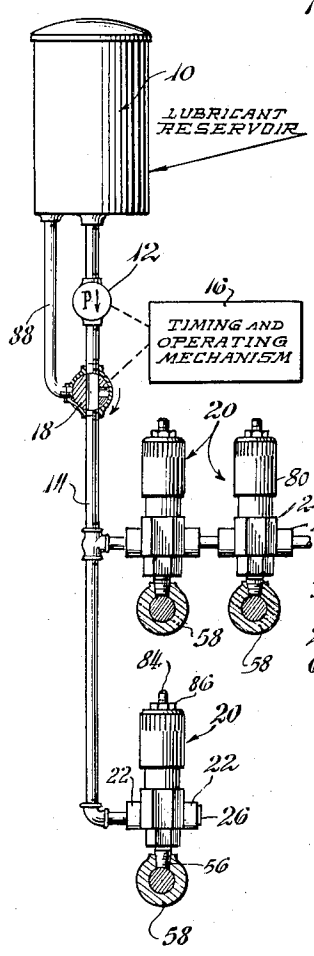
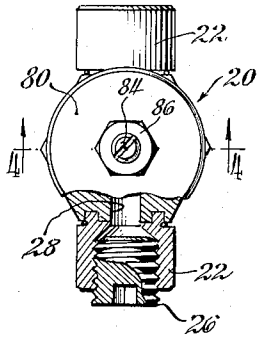


Fig. 3.



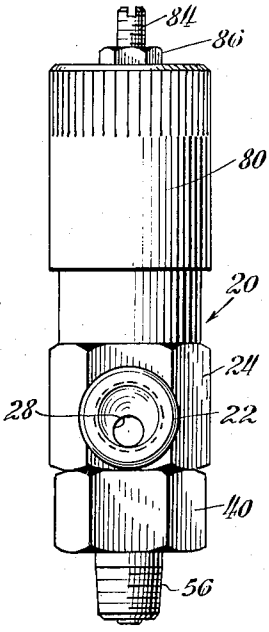


Fig. 2.

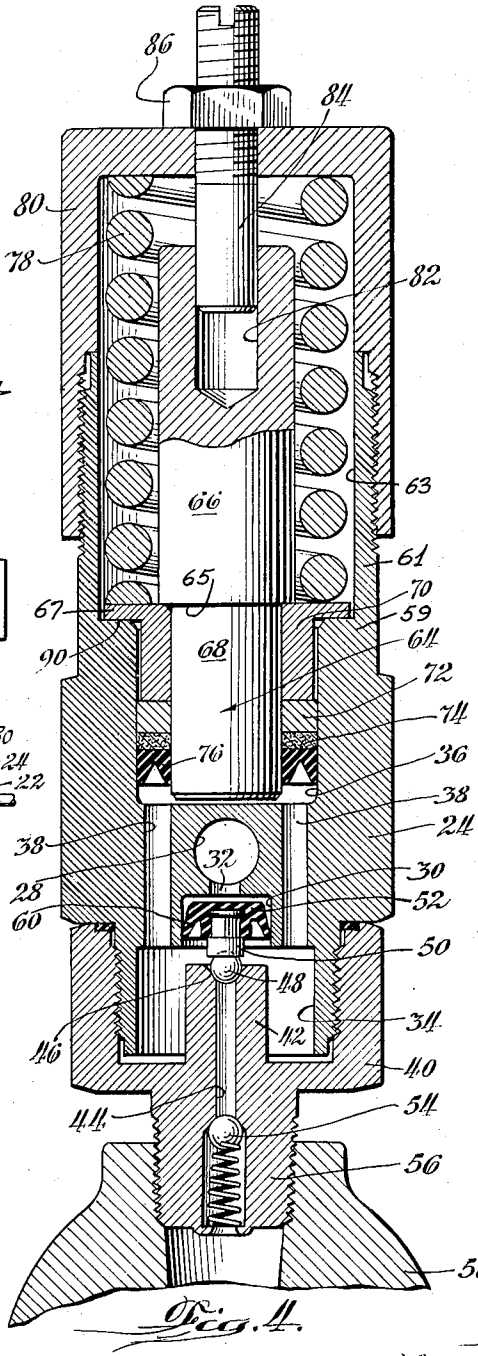


Fig. 4.

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Fig. 8.

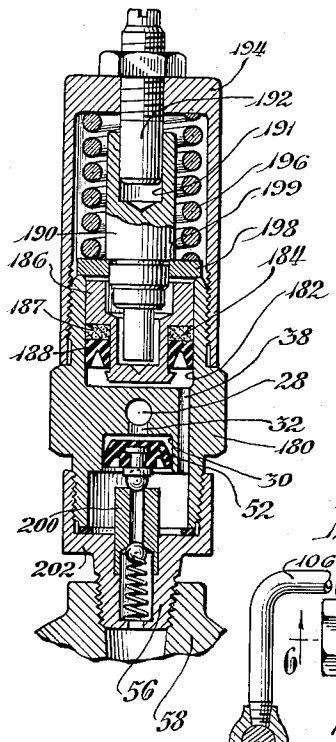


Fig. 5.

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Fig. 6.

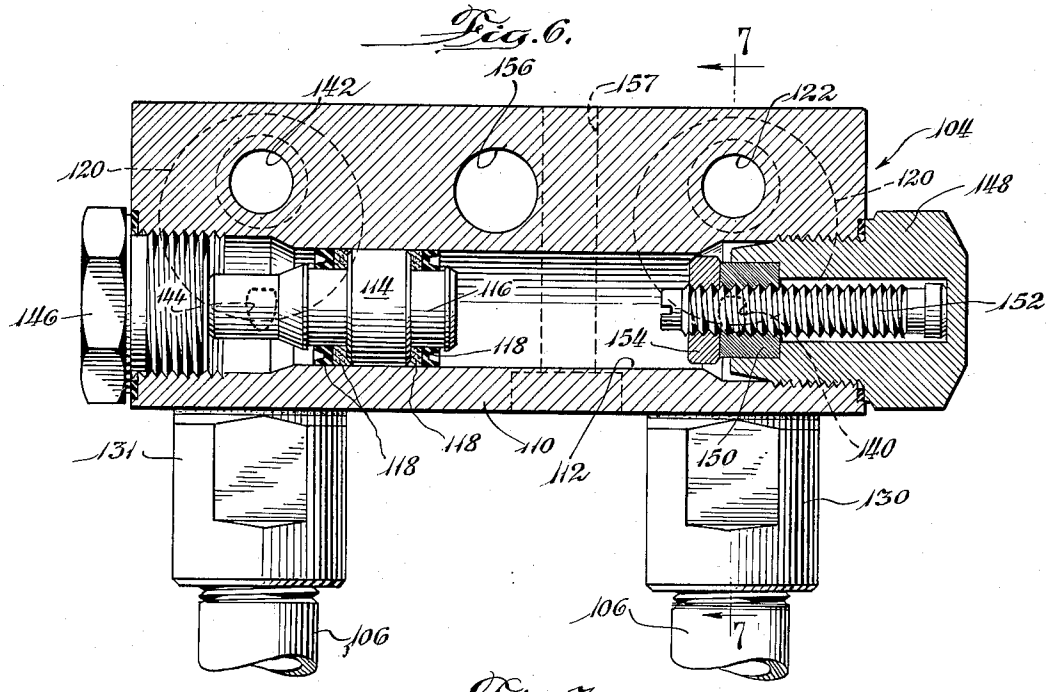


Fig. 7.

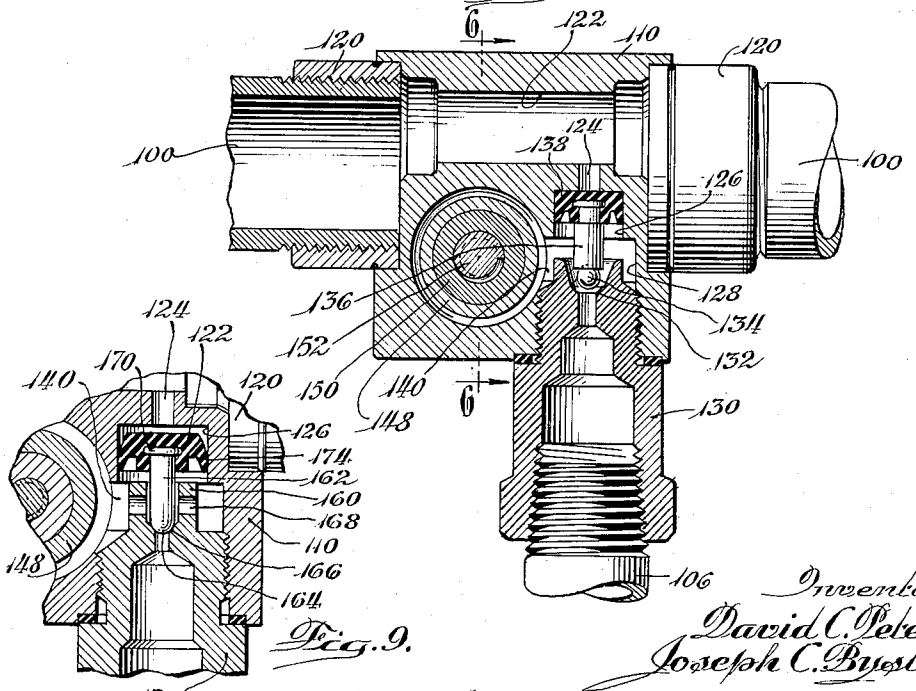


Fig. 9.

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United States Patent Office 2,742,978 Patented Apr. 24, 1956

2,742,978

LUBRICANT MEASURING VALVE FOR CENTRALIZED LUBRICATING SYSTEM

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Application August 17, 1950, Serial No. 180,048

1 Claim. (Cl. 184—7)

Our invention relates generally to lubricant measuring or feeder valves adapted for use as parts of centralized lubricating systems.

In the past most commercially used measuring or feeder valves for centralized lubricating systems have been constructed with valves and piston or plunger parts which had to be accurately fitted. The production methods employed included not only machining but grinding and lapping operations. It was necessary to have very accurate close fits between the parts to prevent leakage of lubricant and otherwise to insure satisfactory operation of the measuring valves.

It is a primary object of our invention to provide an improved measuring valve which may be manufactured by ordinary manufacturing and machining processes, without requiring elaborate grinding, lapping and polishing operations, but which will nevertheless operate satisfactorily over a long useful life without leakage, and which may, therefore, be produced at lower cost.

A further object of our invention is to provide an improved measuring valve for centralized lubricating systems which may be machined from bar stock and which may be quickly and easily assembled by relatively unskilled labor and will nevertheless operate satisfactorily over a long period of time.

Other objects will appear from the following description, reference being had to the accompanying drawings, in which:

Fig. 1 is a diagrammatic representation of a portion of a centralized lubricating system of the single supply line type;

Fig. 2 is an elevational view and Fig. 3 is a plan view of an improved measuring or feeder valve usable as a part of the single line system shown in Fig. 1;

Fig. 4 is an enlarged central vertical cross-sectional view taken on the line 4—4 of Fig. 3;

Fig. 5 is a diagrammatic representation of a second type of lubricating system, namely, a two-line system in which lubricant under pressure is alternately supplied to the two lines while the other line is vented;

Fig. 6 is an enlarged vertical longitudinal sectional view taken on the plane of the line 6—6 of Fig. 7 showing a valve usable in the two-line system of Fig. 5;

Fig. 7 is a sectional view taken on the line 7—7 of Fig. 6;

Fig. 8 is a central vertical sectional view of a modified form of the measuring valve shown in Fig. 4; and

Fig. 9 is a fragmentary sectional view of a modified form of inlet and outlet valve structure for use in the measuring valve shown in Figs. 6 and 7.

Referring to Fig. 1, the single supply line lubricating system comprises a lubricant reservoir 10 from which the lubricant is withdrawn by a pump 12 and supplied under pressure to a conduit 14 at periodic intervals determined either manually or by a suitable timing and operating mechanism 16. During the interval that lubricant under pressure is not being supplied to the conduit 14, the latter

is vented to the lubricant reservor, and hence substantially to atmospheric pressure, by rotation of a two-way valve 18 clockwise 90° from the position in which it is shown in Fig. 1, the valve 18 being either manually operated or operated in suitable timed sequence by the timing and operating mechanism 16. A plurality of measuring or feeder valves 20 are suitably connected to the conduit 14. The conduit connections are made through suitable bushings 22 which are brazed or otherwise suitably secured to a generally cylindrical body 24 of each measuring valve. The measuring valve 20 at the end of the conduit 14, or any branch thereof, has one of its bushings 22 closed by a plug 26, as indicated in the lowermost measuring valve 20 shown in Fig. 1.

The body 24 is provided with a diametrically drilled passageway 28 which communicates with the bushings 22. As shown in Fig. 4, this passageway communicates with a short cylinder 30 by a port 32. The lower end of the body has a central bore 34 which communicates through a pair of passageways 38 with the inner end of a cylindrical bore 36 extending axially downward into the body. A cap 40 is threaded to the lower end of the body 24 and is provided with a central portion 42 having an outlet passageway 44 extending through it, the upper end of the passageway providing a seat 46 for an outlet valve 48 secured to or forming a part of the metal insert 50 of a cup-like piston 52. The lower end of the passageway 44 is preferably closed by a spring pressed ball check valve 54 and the cap 40 is provided with an externally threaded shank 56 for attachment to a bearing 58, or other part to be lubricated.

The piston 52 is preferably molded from a synthetic rubber-like composition which will not deteriorate due to contact with lubricating oils and greases and the impurities which may be found therein. The piston 52 is molded around or is bonded to the insert plug 50 and has a flange portion 60 which resiliently engages and seals against the cylindrical wall of the short cylinder 30. This flange is sufficiently soft and flexible that, upon any substantial difference in pressure between the inlet port 30 and the bore 34, it or portions thereof will flex radially inwardly to permit relatively free flow of lubricant from the inlet passageway 28 and port 32 to the bore 34, and hence through passageways 38 to the lower end of the bore 36.

The diameter of the bore 36 is substantially less than that of the valve body 24 leaving a cylindrical wall 59 of substantial radial thickness surrounding the bore to sustain the pressure of lubricant introduced into the bore through the passageways 38. Moreover, the radial thickness of the body wall 59 encircling the bore 36 is sufficient to provide a sturdy cylindrical shell 61 on the upper end of the body 24 after enlarging the outer end of the bore 36 by a downwardly extending counterbore 63. An annular shoulder 90 formed by the body 24 at the lower end of the counterbore is spaced upwardly from the inner end of the bore 36.

A piston 64 reciprocable in the bore 36 comprises a generally cylindrical metal stem 66 having a lower portion 68 of reduced diameter extending below the counterbore 63 into the bore 36. The piston stem 66 forms a downwardly facing annular shoulder 65 at the upper end of the reduced diameter portion 68. A cylindrical sleeve 70, encircling the piston stem section 68 in abutting relation to the shoulder 65, extends downward into the bore 36. The sleeve 70 is brazed or otherwise rigidly secured to the piston stem 66. A radial collar 67 integral with the end of the sleeve 70 adjacent the piston stem shoulder 65 overlies the shoulder 90 at the base of the counterbore 63.

The lower end of the sleeve 70 stops short of the lower end of the piston stem section 68 to provide a radially thin cylindrical space for a seal between the piston stem

and the adjacent cylindrical wall of the bore **36**. As shown, the diameter of the piston section **68** is substantially two-thirds that of the bore **36**, thus minimizing the radial thickness of the structure used to prevent escape of lubricant past the piston stem.

The packing around the stem section **68** includes a metal backing ring **72** encirling the stem in abutting relation to the lower end of the sleeve **70** and having a fairly close fit with the cylindrical wall of the bore **36**. A second ring **74**, which may be made of fiber, leather, or the like, and a flexible V-grooved annular packing ring **76** encircle the piston portion **68** successively below the first ring **72**. The ring **76** is preferably made of an oil or grease resistant synthetic rubberlike material.

A relatively heavy coil spring **78** is compressed between the collar **67** and the upper end of a cap **80** screwed on the upper end of the valve body **24**. The cap **80** is centrally recessed to form an upward continuation of the counterbore **63** in the valve body **24**. The larger diameter of the counterbore **63** as compared to the bore **36** provides ample space for the spring **78** which should be of substantial size to provide the necessary downward force on the radial collar **67**. It is noteworthy that the collar **67** together with the sleeve **70** form a cylindrical enlargement on the piston **66** which transmit downward force of the spring **78** to the piston stem and the packing encircling the lower end of the stem. The upper end of the stem **66** is provided with an axial bore **82** for the reception of a stroke adjusting stud **84** which is threaded in the cap **80** and may be locked in adjusted position by a lock nut **86**. In addition to serving as an upper limit stop for the stroke of the piston structure **64**, the stud serves as a guide for the piston structure, maintaining it centralized in the cylindrical bore **36** and preventing canting thereof.

In the operation of the lubricating system shown in Figs. 1–4, the two-way valve **18** being in the position shown in Fig. 1, the pump **12** is operated to supply lubricant under pressure to the conduit system **14**, and thus to the passageways **28** of the various measuring valves **20** which are connected to the conduit. Lubricant under pressure may flow from the passageways **28** through the port **32** of each measuring valve, thereby exerting pressure upon the upper face of the piston **52** and forcing the latter downwardly a short distance to cause the ball check valve **48** firmly to engage its seat **46** and thus close the outlet passageway **44**.

Lubricant flowing past the flange **60** of the piston **52** may flow upwardly through the passageways **38** into the cylindrical bore **36** thereby pushing the piston **64** upwardly and compressing the coil spring **78**. A charge of lubricant measured by the stroke of the piston structure **64**, as great as permitted by the stroke adjusting stud **84**, will thus be accumulated in the cylinder **36**.

After all of the measuring valves **20** have thus been charged with the desired quantity of lubricant, the valve **18** is manually or automatically rotated clockwise through an angle of approximately 90°, thereby to connect the conduit **14** with a vent conduit **88**, and permitting the pressure in the conduit **14** to drop substantially to atmospheric pressure. As this occurs, the spring pressed piston structure **64** of each of the various measuring valves will move downwardly under the action of its compressed coil spring **78** and thereby force the pistons **52** upwardly so as to cover and close their ports **32** and raise their valves **48** from the seats **46**. Lubricant may then flow outwardly through the passageways **44** and past check valves **54** to the bearings **58**. The downward motion of each of the piston structures **64** is limited by engagement of its flanged collar **67** with the shoulder **90** at the base of the counterbore **63**. Thus each bearing or other part to be lubricated is supplied with a charge of lubricant determined by the adjustment of its measuring piston stroke limiting stud **84**.

It will be noted that the stroke of the piston **52** is very short so that but a very minute quantity of lubricant need be returned to the conduit **14**, and hence to the lubricant reservoir **10**, at the time that the piston is moved upwardly to close the inlet port **32**. However, the stroke of the piston **52** is sufficiently long to provide a passageway of adequate size between the ball valve **48** and its seat **46** when the valve is in open position.

In Figs. 5–7 there is disclosed a modified form of the invention in which the measuring valves are of the double acting type and are connected in a two-line system. In Fig. 5 the system is shown as having a lubricant reservoir **10** from which lubricant is withdrawn and discharged by a pump **12** to either of two lubricant supply conduit lines **100** and **101**, depending upon the position of a flow-reversing valve **102**, the latter, as well as the pump **12**, being operated periodically either manually or by a timing and operating mechanism **16** of any suitable construction. When the valve **102** is in the position shown, lubricant is pumped into conduit **100** and lubricant may flow from the conduit **101** through the vent pipe **88** to the reservoir. When the valve **102** is moved to position at right angles to that in which it is shown in Fig. 5, the flow from the pump is directed into conduit **101** and conduit **100** is vented to the reservoir through the vent pipe **88**. A plurality of double acting measuring valves **104** is suitably connected to the conduits **100** and **101** and may be connected by conduits **106** to bearings **108**. Although only two measuring valves **104** are shown in Fig. 5, it will be understood that the illustrated valves are representative of practically any desired larger number of such valves which may be desired for a particular installation.

Referring more particularly to Figs. 6 and 7, each of the measuring valves **104** comprises a body or block **110** having a measuring cylinder **112** formed therein. A piston **114** having a metal center portion **116**, provided at both sides with suitable packing rings **118**, is freely reciprocable in the cylinder **112**. Suitable connecting bushings **120** are brazed or otherwise suitably secured to the body **110** and communicate with the passageway **122**. An inlet port **124** leads from the passageway **122** to the upper end of a short cylinder **126** which extends to a counterbore **128**. The counterbore **128** is threaded to receive a connecting fitting **130** to which the pipe or conduit leading to one of the bearings may be connected. This fitting **130** includes an outlet valve seat **132** for a ball valve **134** formed at or secured to the end of the stem **136** which forms an insert for a piston **138** made of a suitable relatively soft flexible material such as a synthetic rubber compound which resists deterioration when in contact with oils and greases. The bore **128** intersects the enlarged end portion of the cylinder **112** to provide an inlet port **140** (Fig. 6).

The conduit **101** is suitably connected to a passageway **142**, which corresponds to the passageway **122**, and has the same type of outlet and valve mechanism as shown in Fig. 7 for supplying lubricant to a bearing connected with fitting **131**. The fitting **131** may be identical with fitting **130**. The lubricant supplied through the passageway **142** flows past a piston, identical with the piston **138**, and may then flow into the left-hand (Fig. 6) end of the measuring cylinder **112** through an inlet port **144**.

The left-hand end of the cylinder **112** is closed by a threaded plug **146**, which also forms a stop engaged by the metallic portion of the piston **114** to limit the leftward stroke of the piston. The right-hand end of the cylinder **112** is closed by a hollow plug **148** which has a nut **150** brazed or otherwise suitably secured therein for the reception of a stroke adjusting screw **152**, the latter being clamped in adjusted position by a lock nut **154**. It will be clear that upon removing the plug **148** the screw **152** may be adjusted to different positions to determine the stroke of the piston **114** and thus the quantity of lubricant discharged during each operating cycle. The body **110** is preferably provided with a pair of holes **156** and **157** for the reception of bolts or studs

by which the measuring valve may be attached conveniently to the machine or apparatus to which the lubricating system is applied. The hole **156** may also be used for the reception of a bolt by which a plurality of measuring valve bodies may be secured together.

As previously indicated, the lubricant under pressure is alternately supplied to the conduits **100** and **101**, while the conduit not being supplied with lubricant is vented to the reservoir. For example, when lubricant under pressure is being supplied to the conduit **100**, it may flow through passageway **122** and port **124** to the short cylinder **126** and force the piston **138** downwardly to bring the outlet valve **134** into firm engagement with its seat **132**. Thereafter the rubber-like piston **138** will be deformed sufficiently to permit flow of lubricant past it through the port **140** into the right-hand end of the measuring cylinder **112**, thereby forcing the piston **114** leftwardly to the position in which it is shown in Fig. 6, and thus discharging to the bearing, through the outlet fitting **131**, the lubricant which was contained in the cylinder **112** to the left of the piston **114**. A suitable time interval after all of the measuring valves **104** have thus been operated to supply measured quantities of lubricant to one of each of the pairs of bearings associated with the valves, the timing and operating mechanism **16** will become effective to render the pump **12** operative, and to reverse the position of the valve **102**. The conduit **100** is thus vented to the lubricant reservoir while at the same time lubricant under pressure is discharged into conduit **101**. In each of the measuring valves **124** the lubricant will then be supplied through its inlet port **144** to the left-hand end of the measuring cylinder **112**, and the piston **114** will be forced rightward until arrested by engagement of the metal stem thereof with the head of the adjusting screw **152**, meantime discharging th lubricant content to the right of the piston **114** to the bearing connected to the fitting **130**. It will be understood that as soon as pressure develops beneath the piston **138**, and the passageway **122** is vented to the reservoir, the piston **138** will be forced upwardly to the position in which it is shown in Fig. 7 and the valve **134** will therefore be raised from its seat **132** to permit flow of the lubricant from the right-hand end of the cylinder **112** to the bearing connected to the fitting **130**.

In order to assure more reliable operation under adverse conditions, the controlling piston and valve mechanism for the measuring valve of Figs. 5, 6 and 7 may be constructed in the manner shown in Fig. 9, in which reference characters of previously described elements have been applied to the corresponding parts. In this figure the fitting **130**–*a* is provided with an inner extension **160** providing a loosely fitting guide for the stem portion of insert **162**. The lower end of this insert is spherically shaped to provide an outlet valve **164**, for engagement with a generally conical outlet valve seat **166**. The extension **160** is provided with transversely drilled ports **168** to facilitate flow of lubricant past the valve **164** when the latter is unseated. The headed end **170** of the insert **162** fits snugly in a complemental cavity in the flexible piston **172**. The flange **174** of this piston is conformed so as yieldingly to engage the wall of the short cylinder **126** and to flex easily when lubricant under pressure is supplied through the inlet port **124**. Since the stem of the insert **162** is guided by the extension **160**, the possibility that the piston **172** might be distorted and displaced from its operative position, under adverse conditions of lubricant viscosity and pressure, is avoided.

For use under adverse operating conditions the measuring valve of Figs. 1–4 may be constructed in the manner shown in Fig. 8, in which the body **180** has a bore **182** for a piston structure **184**. The piston structure comprises a generally cup-shaped metal body **186**, guided in the bore **182**, and having a suitable packing consisting of a backing washer **187** of leather or the like, and a V-ring **188**, preferably of a suitable synthetic rubber compound. A piston stem **190**, the lower end of which is of reduced diameter, fits freely into the cup-shaped body **186** and normally abuts against the bottom thereof. The upper end of the stem **190** is provided with a bore **191** for the reception of a guiding and piston stroke limiting stud **192** which is adjustably secured in the customary manner in a top cap **194** which is threaded to the body **180**. A spring **196** is compressed between the cap **194** and the metal washer **198** which normally is forced against the upper end of body **180** and abuts a shoulder **199** on the stem **190**.

The body **180** is provided with an inlet passageway **28**, inlet port **32**, short cylinder **30**, passageway **38**, piston **52**, insert **50** and valve **48**, as in the previously described embodiment. The seat for the outlet valve **48** and the check valve **54** are formed at the ends of a tubular seat member **200** driven into a complementary bore in the lower cap **202**.

The measuring valve shown in Fig. 8 operates in the manner of the embodiment of Figs. 1–4. It will be noted, however, that the piston structure **184** is free to align itself in the bore **182** and that the piston stem **190** is likewise self-aligning with respect to the stud **192**. This is a desirable feature which is of advantage during manufacture and assembly of the valve, because the tolerances relative to concentricity of the various machined surfaces may be increased, and because it insures that the stem and piston structure will not bind due to irregular wear. The piston **184** and stem **190** will therefore be freely reciprocable after extended use of the valve.

When lubricant under pressure flows into the pressure accumulator cylinder **182** the upper end of the cup-shaped piston body **186** engages the washer **198** and the upward movement of the piston structure is resisted by the compressed spring **196** until such movement is limited by the adjustable stud **192**, thereby accurately determining the charge of lubricant which will be supplied to the connected bearing upon relief of the pressure of the lubricant supplied to the measuring valve.

In the several forms of the invention the parts may be manufactured using customary commercial machine tool tolerances. None of the metal parts need fit together with any high degree of accuracy because the seals between all relatively moving metal parts, with the exception of the outlet valves **48**, **132** and **164**, are effected by engagement of the relatively soft flexible rubber parts with the metal parts.

In all forms of the invention the measuring valves may be readily assembled by employing simple methods and tools. Most of the parts may be machined from bar stock on automatic screw machines with the result that the cost of manufacturing the valves is very low.

While we have shown and described several embodiments of the invention, it will be apparent to those skilled in the art that the invention may be embodied in numerous other forms, all coming within the scope of the claim which follows:

We claim:

A lubricant measuring and pressure accumulator device for use as a part of a measuring valve of a centralized lubricating system, comprising, in combination, means forming a body having a large diameter cylindrical recess formed at one end thereof and a smaller diameter cylindrical recess formed as a continuation of the large diameter recess at the inner end thereof, the body forming an annular shoulder at the juncture of the small diameter recess with the large diameter recess, a cylindrical piston stem in the larger diameter recess defining an inwardly facing shoulder thereon and having a portion of reduced diameter extending from the shoulder into the smaller recess, a sleeve secured to the smaller diameter portion of said piston stem in abutting relation to the shoulder thereon, the sleeve having a radial collar thereon overlying the shoulder on the body to limit movement of the stem into the smaller diameter recess, the portion of the stem of reduced diameter being of sufficient size to cover a large portion of the end area of the smaller diameter

recess, a packing encircling the smaller diameter end of the stem to form a seal between the latter and the smaller diameter recess, a cap secured to said body and having a cavity formed as a continuation of said larger recess, a coil spring enclosed within said larger recess and continuation thereof with its ends bearing against said collar and said cap, an axial bore formed in the outer end of the piston stem, and a motion limiting and alignment stud adjustably positioned in said cap and extending slidably into the piston stem bore to limit outward motion of the stem.

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