Jan. 26, 1943. E. F. JIRSA 2,309,195

PUMP AND VALVE ASSEMBLY.

Filed March 14, 1941 2 Sheets-Sheet 1

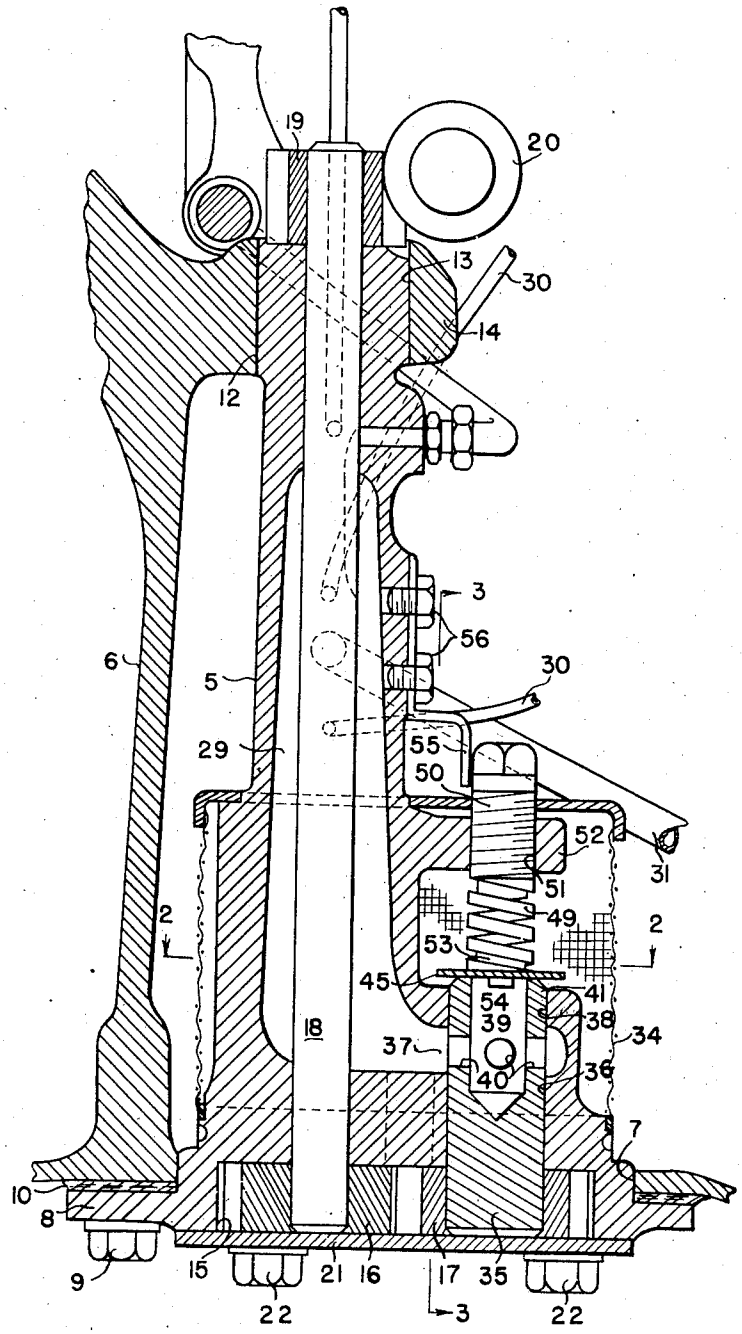


FIG. 1

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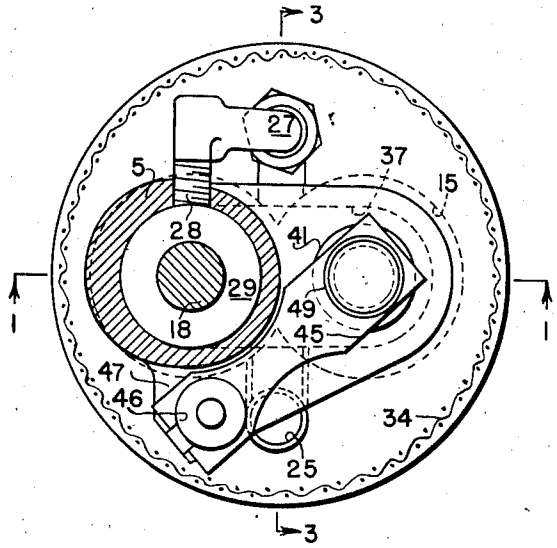


FIG. 2

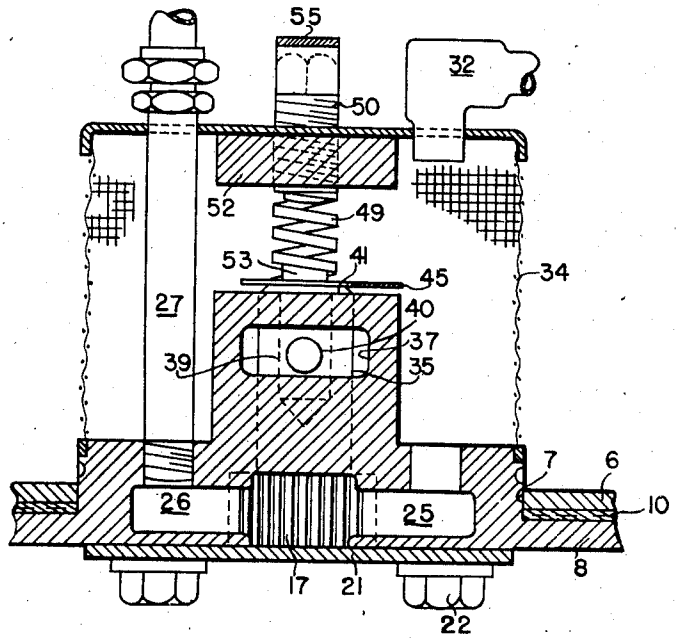


FIG. 3

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2,309,195

UNITED STATES PATENT OFFICE

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PUMP AND VALVE ASSEMBLY

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Application March 14, 1941, Serial No. 383,355

6 Claims. (Cl. 103—42)

The present invention relates generally to pump and valve assemblies, with particular reference to those used in lubricating systems for internal combustion engines and the like, although I do not intend my invention to be limited to this particular use.

Lubricating oil pumps are usually of the constant displacement type, such as gear pumps or the like, and are provided with a pressure reservoir or header into which lubricating oil is pumped under pressure and from there distributed to various parts of the engine. The pressure in the reservoir or header is maintained constant by supplying to the reservoir an excess quantity of oil and providing a relief valve, backed by a spring set at a definite pressure. As the demand for oil from the header fluctuates, the spring-backed valve permits a greater or lesser quantity of oil to escape, and thus holding the pressure in the header substantially constant.

The relief valve usually takes the form of an annular seat through which oil can flow from the header under control of a leaf spring valve closure member or spring loaded ball adapted to cover the annular seat, but yieldable to pressure of the oil within the header. In the event that a small grain of carbon or grit becomes lodged under the valve closure spring or ball at a time when there is a heavy demand for oil, the valve cannot completely close, with the result that the pressure in the header decreases so that insufficient oil is supplied to the bearings. Occasionally it is necessary to disconnect the pump and remove it from the crank case of the engine for the purpose of cleaning the grit out from under the valve spring.

It is the principal object of this invention, therefore, to provide a valve which is entirely self-cleaning and prevents the valve from being held open for any appreciable length of time by a piece of carbon or grit.

A further object of my invention relates to the provision of a simple, compact and inexpensive pump and valve arrangement embodying the self-cleaning feature.

These and other objects and advantages of my invention will be apparent after a consideration of the following description in which reference is had to the drawings appended hereto, in which

Figure 1 is a sectional elevational view taken along a center line of a lubricating pump and valve unit embodying the principles of the present invention, as indicated by a line 1—1 in Figure 2;

Figure 2 is a sectional plan view taken along a line 2—2 in Figure 1; and

Figure 3 is a sectional elevational view taken along a line 3—3 in Figure 1 and Figure 2.

Referring now to the drawings, the lubricating pump and valve unit comprises a unitary housing 5 disposed in a generally vertical position in the lower part of a crank case 6 of an internal combustion engine. The crank case 6 is apertured at 7 in the bottom thereof to receive the housing 5, the latter being provided with a circumferentially extending flange 8 which bears against the bottom of the crank case 6 and is bolted thereto by means of bolts 9. A gasket 10 is provided under the flange 8 to prevent leakage of oil from the crank case.

The housing 5 is generally tubular in form and has a cylindrical upper portion 12 adapted to be received within an aperture 13 in a bracket 14 formed integrally with the crank case 6, and thus the housing is rigidly held within the crank case.

The lower end of the housing 5 is provided with a pump chamber 15, within which are fitted a pair of intermeshing gears 16, 17, constituting a gear pump of the conventional constant displacement type. The gears 16, 17 are rotated by means of a drive shaft 18 which extends vertically through the housing 5 and projects from the upper end thereof and is connected with a drive gear 19 disposed in meshing arrangement with a suitable driving worm 20, from which power is obtained from the internal combustion engine for driving the pump. The pump chamber 15 is closed by a cover plate 21, removably attached to the lower end of the housing 5 by bolts 22, thus providing easy access to the gears.

Oil is supplied to the pump through an intake passage 25 formed in the lower part of the housing, and is carried by the teeth of the gears 16, 17 around the circumference of the pump chamber 15 in well-known manner and is discharged through a discharge duct 26 to which is connected a conduit 27 extending vertically from the discharge duct 26. The conduit 27 is connected by means of a fitting 28 in communication with a high pressure reservoir or header 29 within the housing 5, and from the reservoir 29 the oil is led through supply ducts 30, which are connected in communication with the reservoir, to various bearings in the internal combustion engine. Oil is also forced through a duct 31 from the reservoir 29 to a suitable oil filter

(not shown), from which the oil is returned to a fitting 32 (see Figure 3), into the top of a screened intake enclosure 34 which protects the intake duct 25 from the larger pieces of carbon and grit which may be in the bottom of the crank case.

Coming now to that part of the structure with which my invention is more particularly concerned, the pump gear 17 is provided with a shaft 35 which is fixed thereto and rotatable therewith. The shaft is journaled in a bearing portion 36 in the housing 5 and extends upwardly through a horizontally extending passage 37 at one side of the lower end of the resvoir chamber 29 and disposed in communication therewith, and the upper end of the shaft 35 projects outwardly of the housing 5 and is journaled in a second bearing portion 38 in the housing. The upper end of the shaft 35 is provided with an axially extending recess 39 connected in communication with the passage 37 by means of a plurality of apertures 40 in the shaft 35. The recess 39 defines an annular valve seat 41 at the upper end of the shaft 35.

A leaf spring valve closure member 45 is disposed in engagement with the annular valve seat 41, and extends horizontally to a supporting bolt 46 by means of which the leaf spring closure member 45 is supported at its opposite end on a lug 47 extending outwardly from the housing 5. The closure member 45 is biased toward seating engagement with the annular seat 41, not only by the elasticity in the leaf spring 45 itself but by means of a coiled compression spring 49, which bears against the upper side of the leaf spring 45 and extends upwardly therefrom and reacts against the lower end of a set screw 50, which is threadably engaged within a threaded aperture 51 in a lug portion 52 extending outwardly and forming an integral part of the housing 5. A centering core 53 is attached to the leaf spring 45 for holding the lower end of the coil spring 49 in proper position against the valve closure, and has a short stem 54 extending downwardly through a suitable aperture in the valve closure 45. By turning the set screw 50, the force of the compression spring 49 can be increased or decreased, to adjust the pressure of the closure member 45 against the valve seat 41, and thus to adjust the pressure which will be maintained within the reservoir 29. The set screw 50 is secured in adjusted position by means of a bracket 55 engaging the head of the set screw 50 and supported by a pair of bolts 56 attached to the side of the housing 5.

With the pressure of the spring 49 set at a predetermined value, as long as there is an excess of oil flowing through the discharge duct 27 of the pump into the reservoir 29, there is a flow of oil through the apertures 40 and the recess 39 out through the annular valve seat 41 under the valve closure 45, the pressure of oil being sufficient to force the leaf spring 45 away from seating engagement with the valve seat 41. If the oil pressure in the reservoir 29 drops below the predetermined value at which the spring 49 is set, the latter forces the closure 45 against the valve seat and prevents further escape of oil through the relief valve until the pressure within the chamber 29 rises once more to the predetermined value.

Since the shaft 35 is rigidly connected to the gear 17, it rotates therewith and thus causes the annular valve seat 41 to rotate relative to the leaf spring 45. This rotation is continuous as long as the pump is operating and produces a grinding action between the valve seat and valve closure 45 which readily dislodges any particles of grit or carbon that may tend to lodge therebetween.

A slightly more aggressive wiping action of the valve seat 41 against the closure 45 can be produced, if so desired, by offsetting the recess 39 slightly with respect to the axis of rotation of the shaft 35.

I do not intend my invention to be limited to the details shown and described in connection with this embodiment, except as limited by the claims which follow.

I claim:

1. In combination, a housing, a valve seat member journaled for rotation in said housing and having a recess therein disposed in communication with the interior of said housing and defining a valve seat outside the latter, a leaf spring closure member mounted outside said housing and biased into seating engagement with said valve seat but movable away from the latter to open the valve, and means for rotating said seat member relative to said closure member.

2. In combination, a housing, a shaft journaled in said housing and projecting outwardly thereof, said shaft having a recess in the outer end thereof disposed in communication with said housing and defining an annular valve seat at the end of the shaft, a leaf spring closure member mounted outside said housing and biased into seating engagement with said valve seat but movable away from the latter to open the valve, and means for rotating said seat member relative to said closure member.

3. In combination, a housing including a pressure chamber, a valve seat member journaled for rotation in said housing and having a recess therein disposed in communication with said chamber and defining an annular valve seat outside the latter, a closure member mounted adjacent said valve seat, yieldable means for biasing said closure member toward seating engagement with said seat but permitting the closure member to yield to a predetermined pressure within said chamber to open the valve, and means for rotating said valve seat member relative to said closure member.

4. In combination, a housing including a pressure chamber, a shaft journaled in said housing and projecting outwardly thereof, said shaft having a recess in the outer end thereof disposed in communication with said chamber, and defining an annular valve seat at the end of the shaft, a closure member mounted adjacent said valve seat, yieldable means for biasing said closure member toward seating engagement with said seat but permitting the closure member to yield to a predetermined pressure within said chamber to open the valve, and a gear pump including a pair of intermeshing gears, one of said gears being attached to said shaft to drive the same, means for driving the other gear, and duct means connecting the discharge side of said pump with said chamber.

5. In combination, a housing including a pressure chamber, a valve seat member journaled for rotation in said housing and having a recess therein disposed in communication with said chamber and defining an annular valve seat outside the latter, a leaf spring closure member mounted outside said housing and biased into seating engagement with said valve seat but movable away from the latter to open the valve, and

means for rotating said seat member relative to said closure member, said last named means comprising a gear pump including a pair of intermeshing gears, one of said gears being attached to said shaft to drive the same, means for driving the other gear, and duct means connecting the discharge side of said pump with said chamber.

6. In combination, a housing including a pressure chamber, a shaft journaled in said housing and projecting outwardly thereof, said shaft having an axially extending passage therein from the outer end and communicating within the housing with said pressure chamber, an annular valve seat at the outer end of said shaft, a closure member adapted to cooperate with said valve seat but movable away from the latter to open the valve, spring means for biasing said closure member toward seating engagement with said seat but permitting the closure member to yield to a predetermined pressure within said chamber to open the valve, and means for rotating said shaft relative to said closure member.

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