March 31, 1942. J. T. LEONARD 2,277,991

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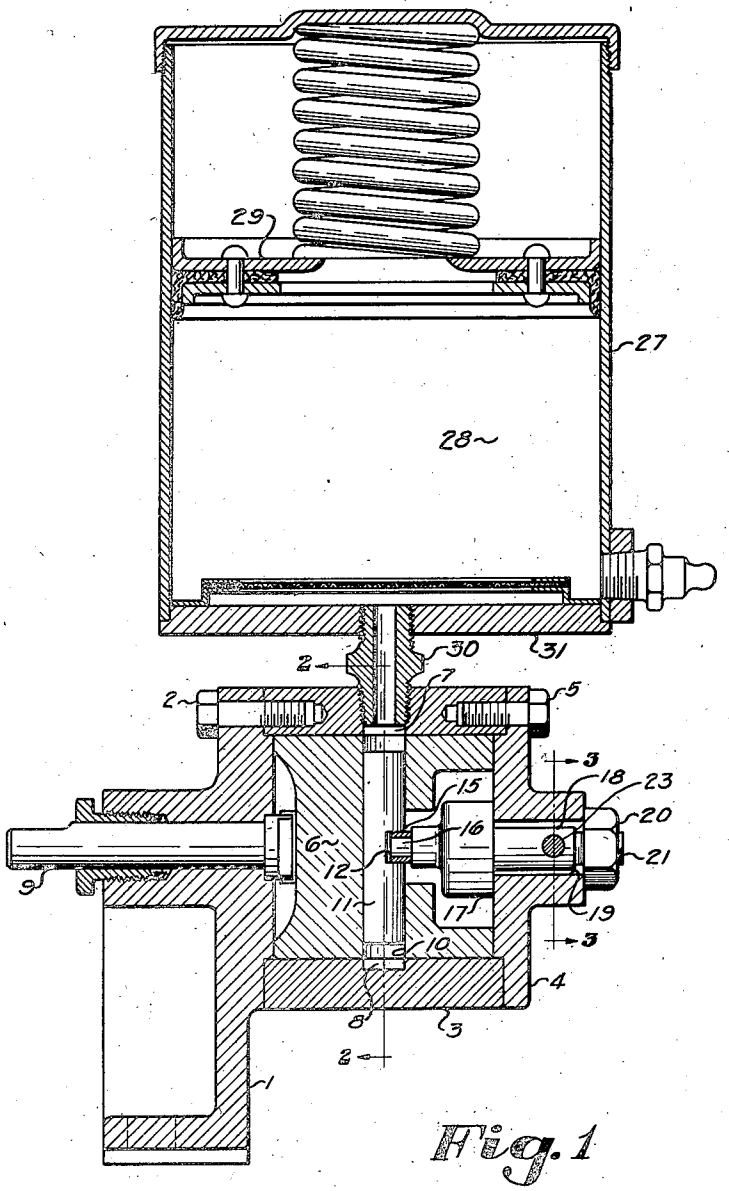


Fig. 1

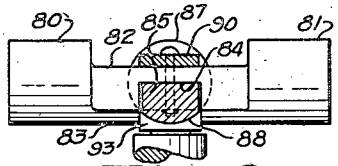


Fig. 8

INVENTOR.
JOHN T. LEONARD
BY Horace B. Fay
ATTORNEY.

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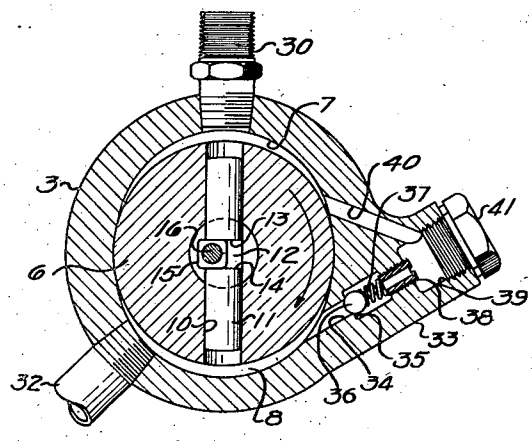


Fig. 2

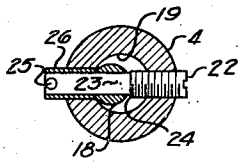


Fig. 3

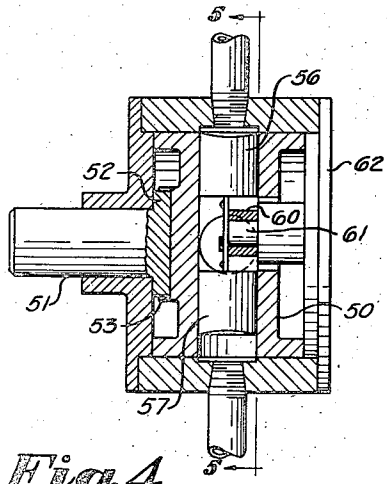


Fig. 4

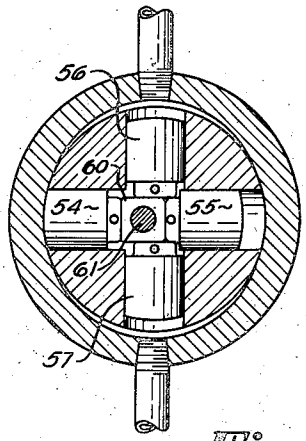


Fig. 5

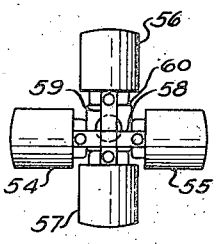


Fig. 6

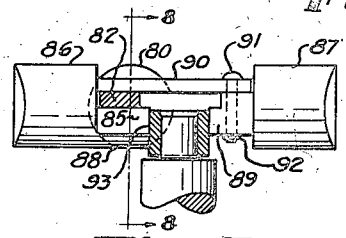


Fig. 7

INVENTOR.
JOHN T. LEONARD
BY Horace B. Fay
ATTORNEY.

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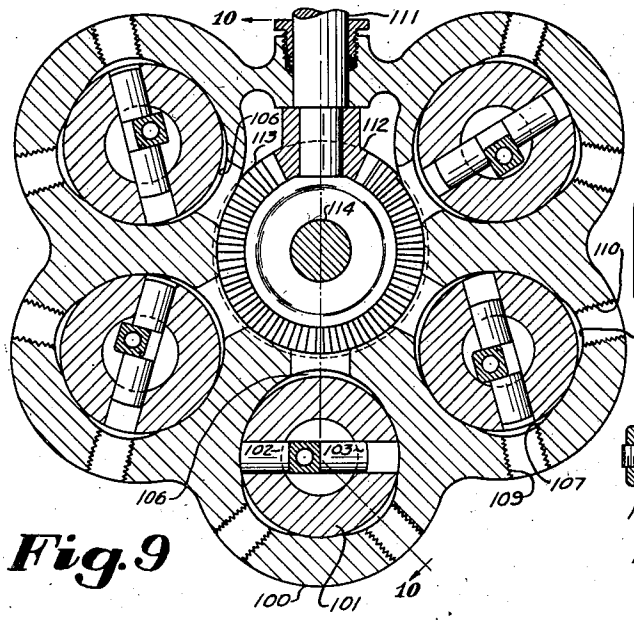


Fig.9

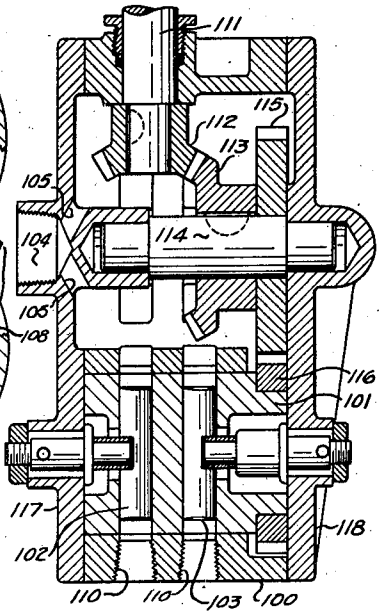


Fig.10

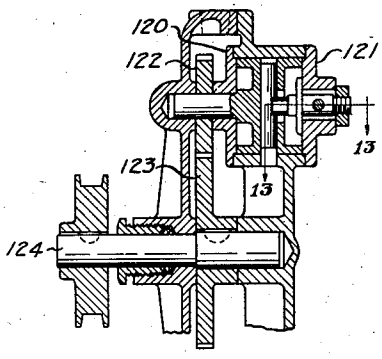


Fig.12

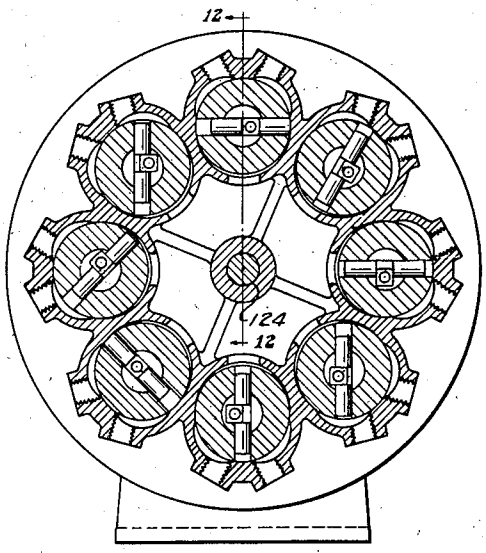


Fig.11

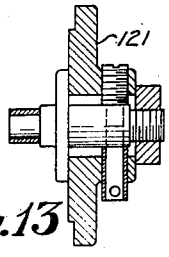


Fig.13

INVENTOR.
JOHN T. LEONARD
BY
Horace B. Fay
ATTORNEY.

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2,277,991

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John T. Leonard, Bryan, Ohio

Application September 26, 1939, Serial No. 296,632

4 Claims. (Cl. 103—160)

This invention relates, as indicated, to pumps, but has reference more particularly to pumps of the rotary piston type.

A primary object of the invention is to provide a pump which is of compact, inexpensive construction, and which is designed to operate against exceedingly high fluid pressures.

Another object of the invention is to provide a pump which will deliver fluids in a substantially uninterrupted flow.

Another object of the invention is to provide in pumps of the character described means for adjusting the stroke or displacement of the pistons.

A further object of the invention is to provide a pump having a multiplicity of discharge openings, whereby the pump may be especially adapted for use as a lubricator.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings, forming a part of this specification, and in which like numerals are employed to designate like parts throughout the same,

Fig. 1 is a vertical cross-sectional view of the simplest form of pump embodying the novel features of the invention;

Fig. 2 is a fragmentary cross-sectional view, taken on the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary cross-sectional view, taken on the line 3—3 of Fig. 1;

Fig. 4 is a fragmentary view, similar to Fig. 1, but showing a modified form of pump;

Fig. 5 is a cross-sectional view, taken on the line 5—5 of Fig. 4;

Fig. 6 is a plan view of the pistons of the pump shown in Figs. 4 and 5, and illustrating the manner in which the pistons are connected with each other;

Fig. 7 is a view showing a somewhat different manner of connecting the pistons with each other;

Fig. 8 is a cross-sectional view taken on the line 8—8 of Fig. 7;

Fig. 9 is a cross-sectional view through a cluster pump embodying the principal features of the invention;

Fig. 10 is a cross-sectional view, taken on the line 10—10 of Fig. 9;

Fig. 11 is a view similar to Fig. 9, but showing a modified form of cluster pump;

Fig. 12 is a fragmentary cross-sectional view, taken on the line 12—12 of Fig. 11; and

Fig. 13 is a fragmentary cross-sectional view, taken on the line 13—13 of Fig. 12.

Referring to that form of the invention shown in Figs. 1, 2 and 3, the pump is seen to comprise a pedestal or base 1, to the upper portion of which is secured as by screws 2, a cylinder 3, constituting a housing for the pump, a cover 4 being secured to the outer end of the cylinder, as by means of screws 5. Disposed within the cylinder 3 is a rotor 6, this rotor having a circular cross-section, but the upper and lower central portions of the inner wall of the cylinder being relieved to provide spaces 7 and 8 respectively, between the rotor and said inner wall, which spaces gradually diminish in depth as the ends thereof are approached. These spaces, it may be noted, extend nearly half the circumference of the cylinder.

The rotor 6 is driven by means of a stub shaft 9 which is independent of the rotor, but the inner end thereof is provided with a key which extends into a slot or keyway in the rotor, whereby the rotor is driven. The shaft 9 is journalled in the pedestal 1 and may be continuously driven in any suitable manner, as will be readily understood by those skilled in the art to which this invention relates.

The rotor 6 has a bore 10 extending diametrically therethrough, in which is disposed a piston 11, which, it may be noted is somewhat shorter than the diameter of the rotor, and is provided centrally of its length with a recess 12 having flat side walls 13 and 14.

The piston 11 is adapted to be reciprocated by means of a square shuttle 15 which is disposed in the recess 12 of the piston in offset relation to the axis of the rotor and with opposite sides thereof in abutment with the sides 13 and 14 of said recess. The shuttle is journalled on a pin 16, which extends from a support 17 which is mounted on the cover 4 in the following manner: The support 17 has an extension 18 of reduced diameter which extends into an opening 19 extending axially through the cover, this opening being of considerably larger diameter than the extension 18. The support 17 is retained in position by means of a nut 20 which is secured to the threaded extremity of the extension 18.

Means are also provided for varying the stroke of the piston 11, as by shifting the shuttle 15 along the recess 12. For this purpose a screw 22 is provided, which is threadedly mounted in the cover 4, as shown in Fig. 3, and which has an extension or shank 23 of reduced diameter, forming a shoulder 24. The shank 23 extends

through the extension 18 of the support 17, and has pinned thereto, as by means of a pin 25, a sleeve 26, which is slidable in an aperture in the cover 4, as the screw 22 is turned. The extension 18 is locked against movement along the shank 23 of the screw 22 by virtue of the fact that it engages the shoulder 24 and the sleeve 26 at diametrically opposite points of the extension.

The pump, as thus described, is adapted for many uses, but has been especially designed for the feeding and distribution of lubricants. To this end, a lubricant reservoir 27 is provided, as shown in Fig. 1, having a lubricant chamber 28, the lubricant in this chamber being under compression by means of a spring-loaded plunger 29. An outlet 30 extends from the bottom 31 of the reservoir and is connected to the cylinder 3 of the pump, and conducts the lubricant from the lubricant chamber to the space 7 within the pump. The pump is also provided with an outlet conduit 32 which conducts the lubricant from the space 8 within the pump to any desired point of use.

Means are also provided for relieving the pressure within the pump in case it exceeds a safe maximum. For this purpose, the cylinder 3 is provided with an extension 33 which extends substantially tangentially therefrom. Extending axially through this extension is a passageway 34, which extends from the space 8 within the pump, and which is counter-bored to provide a seat 35 for a ball valve 36, which is normally pressed against the seat to close the passageway by means of a coil spring 37, the other end of which bears against a hollow screw 38, which may be adjusted to vary the pressure of the spring and the point at which the valve will open. The screw 38 communicates with an enlarged cavity 39, from which a passageway 40 extends and communicates this cavity with the space 7 within the pump. A closure plug 41 is provided for closing the cavity 39.

The operation of the pump will now be briefly described.

With the parts positioned as shown in Figs. 1 and 2, lubricant will enter the space 7 within the pump, the rotor continuously rotating in the direction indicated by the arrow in Fig. 2. At this point the piston 11 is at the mid-point of its stroke, and is moving downwardly, drawing the lubricant from the space 7 into the bore 10. This movement of the piston continues until the rotor has moved 90° in a clockwise direction from the position shown in Fig. 2. On continued movement of the rotor, the piston moves in a reverse direction from that just described, and the lubricant, which is under considerable pressure, is discharged into the space 8 and thence into the conduit 32. As the lubricant is being thus discharged, another charge of lubricant enters the space 7 and is being drawn into the bore 10 by the other end of the piston. There are thus two suction impulses for each revolution of the rotor, and, since the rotor rotates at a high speed, the discharge of lubricant is in the form of a smooth flow.

The pump is designed for high pressure work, and is capable of working against a pressure of 10,000 pounds per square inch.

As previously stated, the reciprocation of the piston results from engagement of the piston by the eccentric shuttle 15 as the rotor turns. By using a shuttle which is independent of the support 17, this shuttle may be made of a wear-resistant material, the use of which for the entire support might be prohibitive from the standpoint of cost. Moreover, by using a square shuttle, a surface instead of a line contact with the piston is provided, which is eminently desirable from the standpoint of wear and the life of the pump. The adjustment of the shuttle position is highly desirable in that it provides a simple means of varying the piston stroke or displacement, it being noted that the elements provided for this purpose are at all times accessible and visible.

In the event that the pressure of the lubricant exceeds a safe minimum, the ball valve 36 will be lifted off its seat, and the lubricant returned to the main supply by way of the passage 40 and space 7.

In that form of the invention shown in Figs. 4, 5 and 6, the rotor 50 is driven by means of a stub shaft 51 which is independent of the rotor, but is provided with a key 52 which extends into a slot or keyway 53 in the rotor, whereby the rotor is driven. In this case, instead of a single piston, two sets of pistons are provided, one set, 54 and 55, extending at right angles to the other set 56 and 57. The pistons 54 and 55 are connected to each other by means of a link 58 and the pistons 56 and 57 by means of a link 59. The pistons are reciprocated by means of a shuttle 60, which is mounted on a support 61 extending from the cover 62 of the pump in offset relation to the axis of the rotor. With this pump, four suction impulses are provided for each revolution of the rotor, with the result that a more even or uniform flow of the lubricant is provided than is obtainable with the pump which has previously been described.

In that form of the invention shown in Figs. 7 and 8, the arrangement of pistons is similar to that shown in Figs. 4, 5 and 6, but in this case, the sets of pistons are not interconnected by means of separate links. Instead, the pistons 80 and 81 of one set of pistons are joined by a connecting portion 82, having flat sides and top and a rounded bottom 83, the central portion of this connecting portion being recessed as at 84 for the reception of an extension 85 of the piston 86 of the other set of pistons, comprising said piston 86 and a piston 87. The extension 85 has a flat top and sides and a rounded bottom 88. The piston 87 has an extension 89, and the piston 86 has a bar 90 extending therefrom, which is connected to the extension 89, as by means of a pin 91, the lower end of the pin having an annular recess for the reception of a snap ring 92, whereby the pin is retained in position. As noted in Fig. 7, the square shuttle 93, is disposed between the extension 85 and the extension 89 of one set of pistons, and between the side walls of the recess 84 of the interconnecting portion 82 of the other set of pistons. This form of the invention is desirable from the standpoint of low cost and convenience of assembly.

Figs. 9 and 10 illustrate, in a fragmentary way, a cluster rotary piston lubricator embodying the principle features of the invention. In this form of the invention, a housing 100 is provided, having a multiplicity of circumferentially-spaced rotors 101. Each rotor has a pair of pistons 102 and 103 mounted therein for reciprocal movement, the pistons being spaced laterally from each other, as shown in Fig. 10, but with their axes parallel. Lubricant is fed through a central passageway 104 and branch passages 105 into spaces 106, which correspond with the space 7 in that form of the invention shown in Figs. 1,

2 and 3, and is discharged into spaces 107 and 108 and out through ports 109 and 110. By providing two discharge ports for each piston, a total of twenty outlets is provided, such an arrangement being particularly desirable for automobile lubricating systems, wherein it is desired to lubricate a large number of points at substantially the same time.

For the purpose of rotating the rotors in synchronized relation, mechanism is provided, consisting of a drive shaft 111 having a bevel pinion 112 secured thereto, which is in mesh with a bevel gear 113 keyed to a shaft 114. The shaft 114 has also keyed thereto a gear 115, and this gear drives gears 116 which are keyed to the rotors 101.

The pistons 102 and 103 are adapted to be reciprocated by means of shuttles which are mounted on the covers 117 and 118 eccentrically of the rotors. The manner of mounting the shuttles and the adjusting means therefor are substantially the same as employed in that form of the invention shown in Figs. 1, 2 and 3, and need not therefore be further described.

Figs. 11, 12 and 13 show a rotary piston cluster having sixteen outlets, which is similar in some respects to that form of lubricator shown in Figs. 9 and 10, but in this case, each rotor has only a single piston, and separate covers 120 and 121 are employed for each rotor. The pinions 122 which drive the rotors are disposed exteriorly of the rotor housings and are driven in unison by a central gear 123, which is keyed to a drive shaft 124.

It is to be understood that the form of my invention, herewith shown and described, is to be taken as a preferred example of the same, and that various changes in the shape, size and arrangement of parts may be resorted to, without departing from the spirit of my invention, or the scope of the subjoined claims.

Having thus described my invention, I claim:

1. In a device of the character described, a housing, a rotor rotatable therein, a piston reciprocable diametrically of said rotor, shuttle means for reciprocating said piston, said housing having an opening therein, said shuttle means freely projecting through said opening and having an opening therethrough, a screw threadingly engaging said housing, projecting through said last named opening and having a shoulder for engaging one end of said last-named opening, and a collar carried by said screw for engaging the other end of said last-named opening.

2. In a device of the character described, a housing, a rotor rotatable therein, a piston reciprocable diametrically of said rotor, means for reciprocating said piston, said housing having an opening therein, said reciprocating means having a portion which extends into said opening and which portion has an opening therethrough which is transverse to the opening in said housing, said reciprocating means including means for varying the stroke of said piston, said last-named means comprising a screw threadedly mounted in said housing, said screw having an extension of reduced diameter extending through said transverse opening and forming with said extension a shoulder which engages said portion of the reciprocating means, and a sleeve secured to said extension and engaging said portion of the reciprocating means at a point diametrically opposite to that at which said shoulder engages said portion of the reciprocating means.

3. In a device of the character described, a main housing comprising spaced walls, a plurality of circumferentially spaced cylinders projecting through one wall of said housing and terminating short of the other wall, separate covers for each end of said cylinders, a rotor in each cylinder, each carrying a shaft journaled in the wall opposite to the cylinder carrying wall, a gear on each shaft between the cylinder and said last mentioned wall, and a gear located in said main housing and engaging the shaft carried gears for driving said rotors.

4. In a device of the character described, a main housing having aligned bores in the walls thereof, a plurality of cylindrical housings carried by one wall of the main housing and circumferentially spaced about said main housing equidistantly from the bores in said housing and adapted to receive a rotor, each of said cylindrical housings having an aperture through the wall thereof communicating with said main housing and separate covers for each cylindrical housing.

JOHN T. LEONARD.