Sept. 13, 1949. L. E. JOHNSON 2,481,754

PUMP

Filed July 27, 1946 2 Sheets-Sheet 1

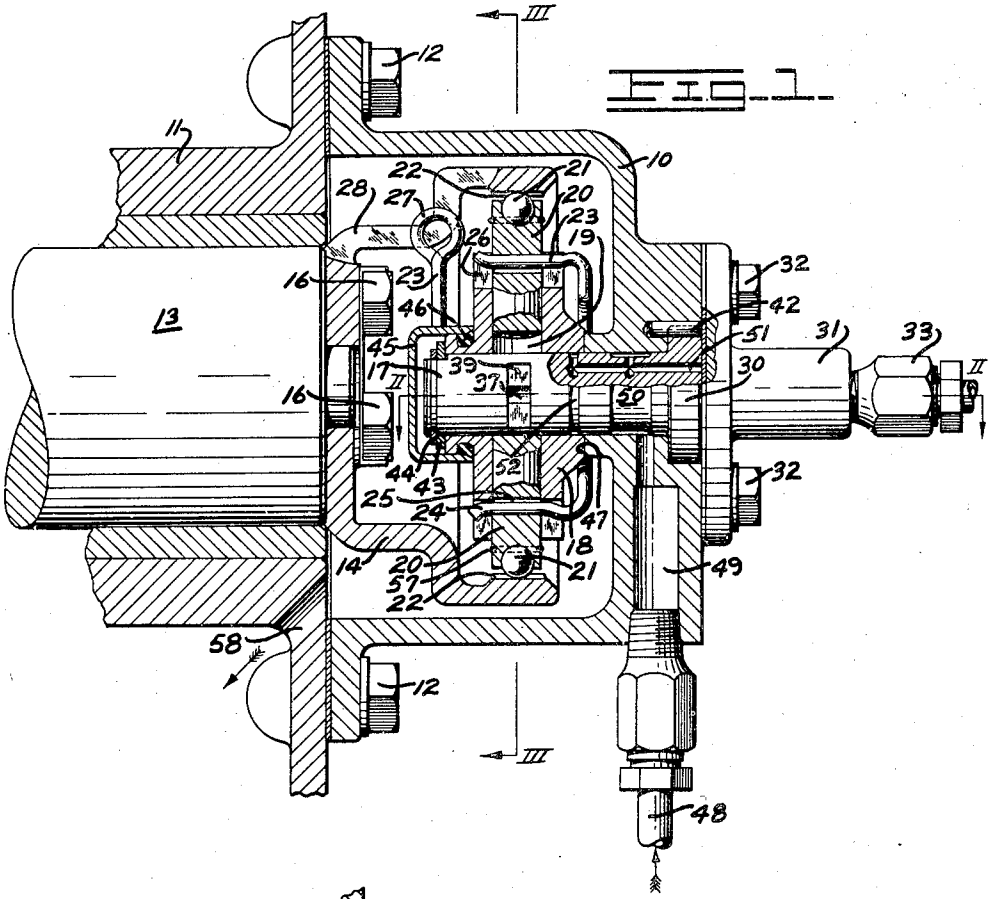



FIG. 1

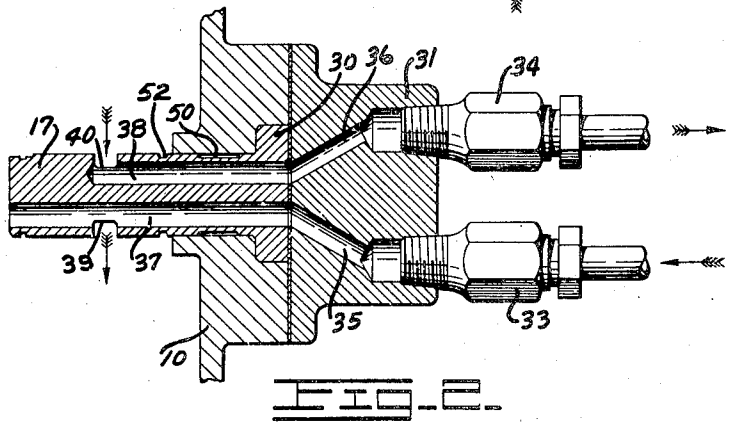



FIG. 2

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Sept. 13, 1949. L. E. JOHNSON 2,481,754

PUMP

Filed July 27, 1946 2 Sheets-Sheet 2

Fig. 3.

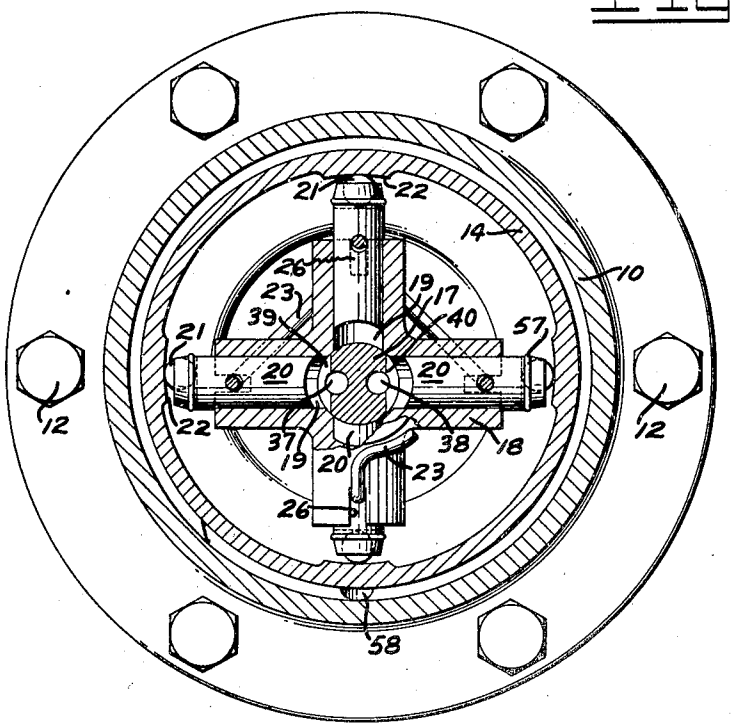



Fig. 4.

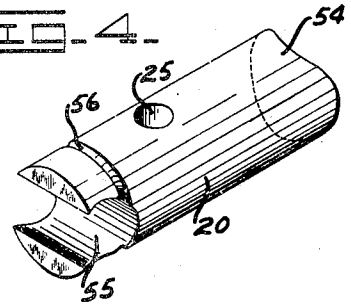
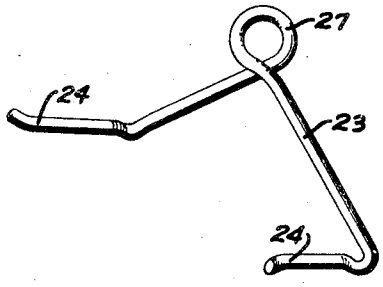



Fig. 5.




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# UNITED STATES PATENT OFFICE

2,481,754

## PUMP

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3 Claims. (Cl. 103—161)

1

The present invention relates to rotary pumps and is disclosed herein in its application as a fuel pump for an internal combustion engine, though its adaptability to other uses will be apparent from the following detailed disclosure.

It is an object of the invention to provide an improved pump of the rotary type in which radially disposed pump plungers reciprocate as a result of the differential spacing which occurs due to rotation of eccentrically disposed members. Other objects of the invention are to provide improved driving connections, anti-friction means, and sealing means for pumps of this kind. Further and more specific objects and advantages of the invention are made apparent in the following specification wherein reference is made to the accompanying drawings.

In the drawings:

Fig. 1 is a longitudinal sectional view of a pump embodying the present invention illustrated as driven by the cam shaft of an internal combustion engine;

Fig. 2 is a horizontal sectional view of a part of the pump shown in Fig. 1 and taken on the line II—II of Fig. 1;

Fig. 3 is a transverse section taken on the line III—III of Fig. 1;

Fig. 4 is an isometric view of one of the plungers of the pump; and

Fig. 5 is an isometric view of one of a pair of springs which form parts of the pump.

The pump as shown in Figs. 1 and 2 is disposed in a housing 10 which is illustrated as secured to the fuel pump housing of an internal combustion engine of the compression ignition type. A portion of the fuel pump housing is shown at 11 and the pump housing 10 is shown as secured thereto by means of cap screws 12. This positioning of the pump enables it to be driven by the fuel pump cam shaft, a portion of which is shown at 13 of the engine, though other drive connections will be made when the pump is used in a different environment.

Within the housing 10 a rotary cup-shaped member 14 is secured to the end of the shaft 13 by which it is driven by means of cap screws 16. A stationary shaft or pump stator 17 is supported by the housing 10 in a manner presently to be described, and extends into the housing to support a rotatable cylinder block 18. The block 18 has four equally spaced radially disposed cylinder bores 19, each of which carries a pump plunger 20 for reciprocation therein in a radial direction. The outer ends of the pump plungers engage the inner periphery of the rotary cup 14,

2

each plunger carrying a hardened ball 21 which contacts a pad 22 formed inside the cup. The pads 22 are equally spaced about the inner periphery of the cup. A pair of springs 23, one of which is shown in Fig. 5, are provided with parallel spaced fingers 24 arranged to be inserted through transverse bores 25 of the plungers 20. Each spring acts with an opposed pair of plungers normally to urge them outwardly with their balls 21 in contact with the pads 22. The sides of the cylinders in the block member 18 are notched for reception of the springs as indicated at 26 to permit inward movement of the plungers. The springs 23 are provided with loops intermediate their ends and the loop 27 on one of the springs is engaged during assembly in a slot 28 (see Fig. 1) formed in the wall of the rotary cup 14. This engagement of the spring loop 27 with the rotary cup forms a driving connection between the cup and the rotary cylinder block so that these parts rotate in unison. The axis of the stator 17 about which the cylinder block rotates is eccentrically disposed with relation to the cup 14 so that upon rotation of these members the plungers 20 which are normally urged outwardly are each moved through a complete reciprocal stroke once for each rotary cycle.

The stator 17 has an enlarged head 30 at its outer end which is held in a suitable recess formed in the housing 10 by means of a cap member 31 (see Figs. 1 and 2) secured in place by cap screws 32. Intake and discharge fittings 33 and 34 respectively are connected with the cap 31 and communicate through passages 35 and 36 therein with longitudinal passages 37 and 38 in the stator 17. The passages 37 and 38 intersect notches 39 and 40 respectively cut in opposite sides of the stator and the position of the stator is such that each of the four plungers 20 moves outwardly or on a suction stroke as it passes the notch 39 which communicates with the intake passage and inwardly or on a pressure stroke as it passes the notch 40 which communicates with the discharge passage. Consequently, the pump is constantly drawing liquid in through the intake passage and constantly pumping it out through the discharge passage as long as it continues in rotation. The stator 17 is held in its proper fixed position by a pin 42 shown in Fig. 1 which passes through a notch in its head 30 and enters a receiving bore in the end of the housing 10.

The rotary cylinder block 18 is held against endwise removal from the stator 17 by a washer 43 and snap ring 44, both of which are enclosed

by a cup 45 preferably press fitted over an extended cylindrical part of the cylinder block and sealed around its edges by a sealing ring 46. The opposite end of the rotary cylinder block engages a shoulder 47 formed inside of the housing 10. Any tendency of the liquid being pumped to escape at the shoulder 47 is counteracted by the fact that the intake passage 37 extends all of the way through the stator 17 and communicates with the interior of the cap 45 to create a reduced pressure therein tending to urge the cylinder block by which the cap is carried to the right, as viewed in Fig. 1, or into close contact with the shoulder 47. As a further precaution against fuel oil escaping at this point, lubricating oil under pressure may be directed through a line 48 which is connected with a bore 49 in the pump housing 10. The bore 49 communicates with a groove 50 which circumscribes the stator 17, and drilled passages shown at 51 in Fig. 1 communicate the lubricating oil under pressure to a groove 52 also circumscribing the stator 17 and establishing pressure between the relatively rotating surfaces of the stator and the clyinder block to oppose the pressure of the pumped oil tending to leak toward the shoulder 47.

The details of construction of the plungers 20 are best shown in Fig. 4 wherein one of the plungers is shown as having an end 54 concavely formed to correspond with the cylindrical shape of the stator 17. The bore 25 which receives the end of the spring 23 is formed on an axis parallel to that from which the concave end 54 is cut so that the spring serves to prevent rotation of the plunger in its cylinder and positions the plunger with its concave end in proper registry with the cylindrical surface of the stator 17. The opposite end of each plunger is provided with a cylindrical bore 55 intersecting its end and with a snap ring groove 56 intersecting the bore 55. The bore 55 receives the anti-friction ball 21 which contacts the pad 22 as previously described and permits slight movement of the ball necessary to maintain a contact point of low friction. A snap ring 57 shown in Figs. 1 and 3 is fitted into each of the grooves 56 to prevent escape of the balls 21.

With the construction shown the simple spring members 23 serve as a driving connection between the rotary cup and the cylinder block and serve to urge the plungers outwardly with constant resilient tension as well as to hold them against rotation in their respective cylinders. The simple construction of hte plungers and the cylinder block enables the parts to be lap fitted with ease to provide a pump capable of producing high pressure. The possibility of leakage of the fuel oil being pumped is very small but any oil which might leak through the joint formed at the shoulder 47 would be received by the pump housing 10 and may be drained into the crank case of the engine through a drain port such as indicated at 58.



I claim:

1. A pump comprising a stator having intake and discharge passages, a cylinder block rotatable on the stator and carrying radially arranged reciprocable plungers cooperating with said passages, an eccentrically disposed rotary drive member surrounding the cylinder block to limit outward movement of the plungers, and springs engaging opposed pairs of plungers to urge them outwardly into contact with the drive member, one of said springs having a part engaging the drive member to form a driving connection with the cylinder block.

2. A pump comprising a stator having intake and discharge passages, a cylinder block rotatable on the stator and carrying radially arranged reciprocable plungers cooperataing with said passages, an eccentrically disposed rotary drive member surrounding the cylinder block to limit outward movement of the plungers, each plunger having a transverse opening therein, and springs each having opposed ends engaging in the openings of opposed plungers to urge the plungers outwardly and to prevent their rotation in the cylinder block one of said springs having a part engaging the drive member to form a driving connection with the cylinder block.

3. A pump comprising a stator having intake and discharge passages, a cylinder block rotatable on the stator and carrying radially arranged reciprocable plungers cooperating with said passages, an eccentrically disposed rotary drive member surrounding the cylinder block to limit outward movement of the plungers, each plunger having a transverse opening therein, and springs disposed exteriorly of the cylinder block and each having opposed ends engaging in the openings of opposed plungers to urge the plungers outwardly and to prevent their rotation in the cylinder block one of said springs having a part engaging the drive member to form a driving connection with the cylinder block.

LLOYD E. JOHNSON.


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