Jan. 13, 1959 E. K. BENEDEK 2,868,136

PUMP

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Fig. 1

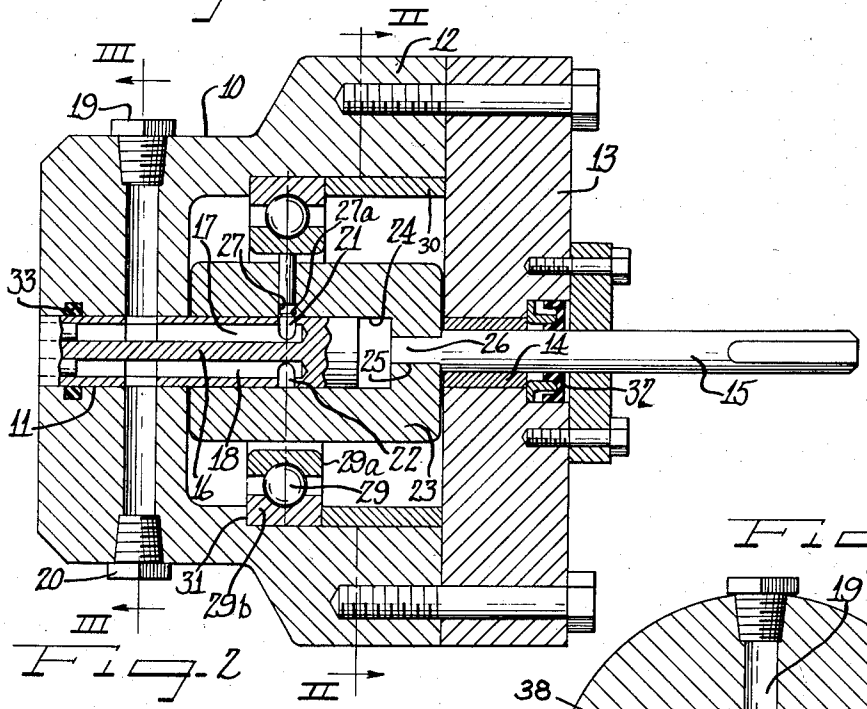


Fig. 2

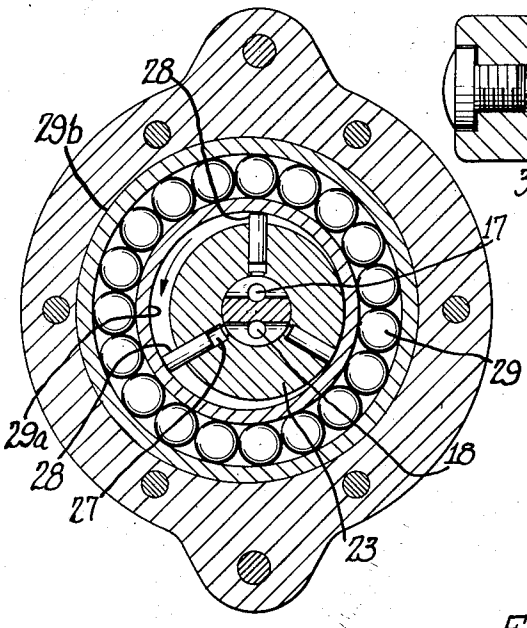
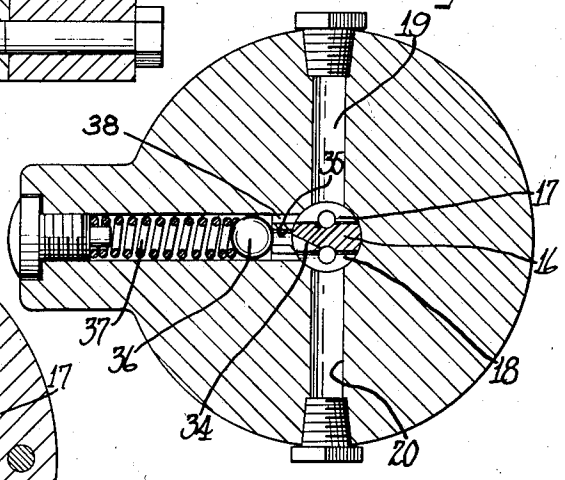


Fig. 3



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1 Claim. (Cl. 103—161)

The present invention relates to pump construction and, more particularly, relates to radial piston type pumps constructed to provide a substantially constant outlet pressure and capable of simple modification to vary its capacity.

The basic principle of operation of the radial type pump has, of course, long been understood in the art. I am of course aware of prior art pump structures wherein a drive member is rotatably mounted on a fixed pintle and carries a plurality of radially extending bores in which reciprocatable pistons are mounted. I am also, of course, aware of the fact that numerous means and methods of reciprocating the pistons have been provided in the prior art, among which is the expedient of positively actuating the pistons by means of a circular cam mounted eccentrically of the axis of rotation of the drive member. The present invention is an improvement over these prior art devices and provides a great simplification and hence reduction in expense over those pumps heretofore known.

In the pump construction of the present invention, a single conventional ball or roller bearing having an inner and outer race separated by rolling balls or rollers, is provided for actuating the reciprocating pistons, and the pistons themselves are constructed of conventional hardened roller bearings slidable axially along their length as a result of forces applied against the ends thereof by the inner race of the above mentioned bearing. By utilizing those conventional parts in a novel manner and in combination with other simplified structural components, applicant has been able to provide an unusually efficient pump capable of manufacture at a minimum of cost.

It is therefor an object of the present invention to provide a novel and improved radial piston type pump.

Another object of the present invention is to provide a novel piston type pump wherein the pistons comprise free floating cylindrical members.

Still a further object of the present invention is to provide a novel fuel pump or the like having radially movable reciprocal pump pistons and wherein reciprocation of the pistons is accomplished by the positioning thereof within the inner race on an anti-friction roller bearing mounted eccentrically of the pump drive.

A feature of the present invention is the provision of a pump capable of manufacture from cylindrical parts almost exclusively.

Another feature of the present invention is a novel piston actuating and carrying block mounted for rotation on a fixed pintle and positioned within the inner race of an anti-friction bearing for the reciprocation of the pistons without positive driving connection therewith.

Still another object of the present invention is to provide a simplified radial-type fluid pump for operation at a substantially constant maximum output pressure.

Still other features and objects of the present invention will at once become apparent to those skilled in the art from a consideration of the attached drawings wherein:

Figure 1 is a side elevational view in cross-section illustrating the assembly of a pump constructed according to the present invention.

Figure 2 is a cross-sectional view taken along the line II—II of Figure 1 and illustrating applicant's novel piston and piston actuation mechanism, and

Figure 3 is a cross-sectional view taken along the line III—III of Figure 1 illustrating applicant's simplified outlet pressure control.

As shown on the drawings:

As may be seen from consideration of Figures 1 through 3, the pump of the present invention comprises a housing **10** having a pintle support aperture **11** at one end thereof and having a flange **12** at the opposite end for the attachment of a closure end plate **13**. The end plate **13** carries a cylindrical bearing **14** for supporting a rotatable drive shaft **15**.

A conventional non-rotatable cantilever type pintle **16** is rigidly secured within the aperture **11**, preferably by means of a shrink or press fit. As may be seen from Figures 2 and 3, the pintle is provided with a pair of longitudinally extending bores **17** and **18** for conducting fluid from the pump inlet **19** to the outlet **20** via the suction and pressure pumping chambers **21** and **22** respectively.

The pumping mechanism of the pump comprises a rotatable cylinder block **23** having a bore **24** therein for rotatable cooperation with the pintle **16**. The block **23** is preferably machined from a cylindrical bar for purposes of cost minimization and is provided with a generally polygonal aperture **25** at the right hand end thereof for cooperation with a similar polygonal shaped end **26** on the drive shaft **15**.

The cylinder block **23** is provided with a plurality of radially extending cylinder bores **27** in which reciprocable pistons **28** are slidably mounted. In the inexpensive pump unit contemplated, it is preferred that the pistons **28** comprise hardened needle or roller bearings of a selected conventional size but it will, of course, be understood that other materials may be satisfactorily used.

Sliding movement of the pistons **21** is limited by an abutment shoulder **27*a*** in the bottom of each cylinder **27**. This abutment prevents the pistons **28** from dropping into the slotted chambers **21** and **22** when the pump is not in operation.

The pistons **28** are forced radially inwardly toward the pintle **16** by means of the eccentric action of the internal bearing race **29*a*** of the ball bearings **29**. The external race **29*b*** is fixably secured in the housing **10** by means of an annular spacer ring **30** and an abutment shoulder **31**. The circular bore in which the outer race **29*b*** sits is, of course, eccentric to the axis of rotation of the cylinder block **23** and, depending upon the eccentricity the length of the effective piston stroke varies. It will be understood that while for sake of simplicity the pump of the present invention is illustrated with a fixed eccentricity, nevertheless, adjustment may be accomplished if so desired by mounting the outer race **29*b*** in a block slidable transversely of the pintle **16**.

In operation, the cylinder block **23** is rotated by the shaft **15** relative to the pintle **16**. This rotation will cause a centrifugal force to be applied against the pistons **28** urging them radially outwardly against the internal ring **29*a*** of the bearing **29**. The outward force will cause the pistons to move outwardly where possible drawing fluid from the inlet **19** and causing a frictional drive between the outer ends of the pistons **28** in the internal bearing race **29*a***. This frictional contact will cause the bearing race **29*a*** to rotate with the cylinder block **23** since the friction between the bearing races **29*a*** and **29*b*** is very small. As a result of the eccentricity of the ball bearing **29**, on one side of the pintle **16** the pistons will be permitted to move outwardly and on the opposite side

thereof, the bearing **29***a* will force the pistons inwardly to pump fluid from the outlet **20**.

Lubrication of the entire device is achieved through the slight leakage permitted around the external wall of the pistons **28**. This leakage oil fully lubricates all of the relatively few moving parts and is prevented from egress of the shaft **15** by means of the seal **32**. Since the pintle **16** is preferably pressed into the housing bore **11**, there is substantially no leakage at the bore **11**. However, in order to render leakage absolutely impossible, a safety O-ring **33** is preferably provided.

While it has been found that the pump operates extremely satisfactorily as above described, it is also within the scope of the present invention to provide compression springs for urging the pistons **28** radially outwardly. Such springs may be positioned between the piston stop abutment **27***a* and the pistons **28** to provide a substantially positive suction stroke in pump applications in which the cylinder block **23** is intended to rotate at a relatively low angular velocity.

From the above description it will be apparent that applicant has provided a novel and extremely simple radial piston-type pump. Through the construction herein shown conventional bearings may be utilized for the pump piston actuation, as well as for the pump pistons themselves. Further, assembly of the device is exceedingly simple since no mechanical connections are necessary between the various rotating parts. This absence of connections also eliminates any noise which often has become excessive in prior art pumps and which is, of course undesirable. This is particularly true when pumps of the type herein disclosed are to be utilized as fuel pumps for oil furnaces, vehicles and other similar types of apparatus which must necessarily run in the hearing presence of people.

An extremely simple and yet highly effective pressure limiter is provided in the pump of the present invention as may be seen in Figure 3. There, the pintle **16** is provided with a slight transverse channel **34** leading to a radially directed port **35**. A check valve in the form of a ball bearing **26** is resiliently urged against the outer end of the port **35** by means of a spring **37**. Upon the attainment of the desired pump operating pressure, the check valve ball **36** will unseat permitting fluid to flow from the passageway **18** to the passageway **17** through the relief port **38**. In this manner, a very simple pressure relief valve is provided, capable of manufacture from a single radial bore, thereby eliminating the necessity for a plurality of closure plugs and other similar devices ordinarily utilized in connection with pump valve structures.

It will be apparent, therefor, that I have provided a novel and highly efficient pump having an absolute minimum of moving parts and utilizing a maximum of standard parts readily available at mass produced or volume prices. As will be apparent, the pump of the present invention may be manufactured with an absolute minimum of tools and, in situations where the bearings are readily available, rotary machining equipment such as lathes are practically the only tools necessary for construction of this device.

It will be understood that variations and modifications may be made to the above identified structure without departing from the scope of the novel concepts of the present invention and it is not, therefore, intended that the application be limited except as necessitated by the scope of the appended claim.

What is claimed is:

A radial piston pump comprising a fixed pintle having inlet and outlet ports therein, a cylinder block rotatably mounted on said pintle, a plurality of radially extending bores in said block for sequential cooperation with said inlet and outlet ports, a cylindrical piston freely slidable in each of said bores, a roller bearing positioned around said cylinder block with the inner race thereof in abutting relation with the outer ends of said pistons, a fixed housing supporting said pintle and roller bearing in eccentric relation to each other, a radial passage extending through said housing to a point adjacent said pintle and having a diameter overlapping extensions of said inlet and outlet ports, and separate apertures connecting said passage with the respective inlet and outlet, said aperture connecting said outlet to said passage being substantially concentric of the axis of said passage and said aperture connecting said inlet to said passage being eccentric of the axis of said passage and a spring pressed check valve in said passage and normally closing the aperture leading to the outlet to provide a high pressure bypass from said outlet to said inlet said passage providing the guide for said valve with the spring of said spring pressed valve being positioned concentric of the axis of said passage and the check valve having its outer surface guided by the walls of the passage for concentrically contacting and closing the aperture connecting the passage and the outlet.

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