Oct. 17, 1939. E. R. BARRETT 2,176,322

FLUID PUMP

Filed June 28, 1937 2 Sheets-Sheet 1

Fig. 1.

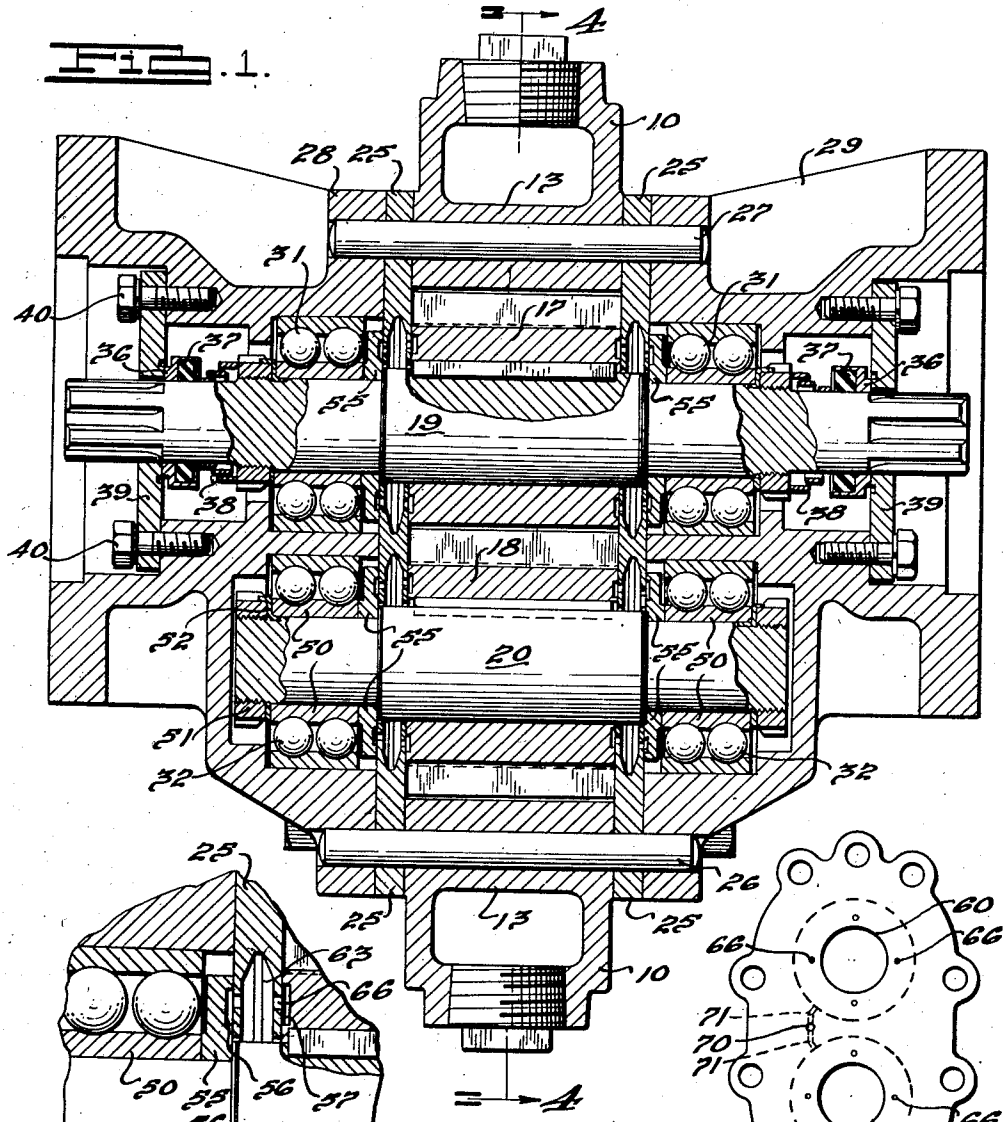

Fig. 3.

Fig. 2.

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Filed June 28, 1937 2 Sheets-Sheet 2

Fig. 4.

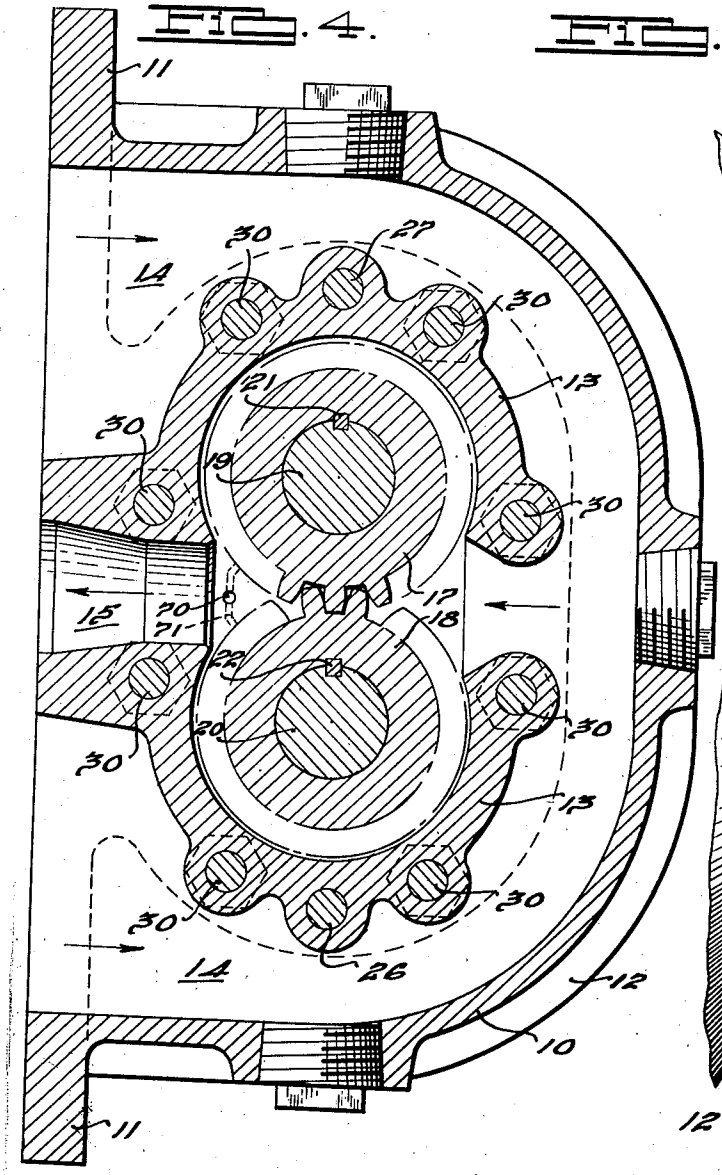
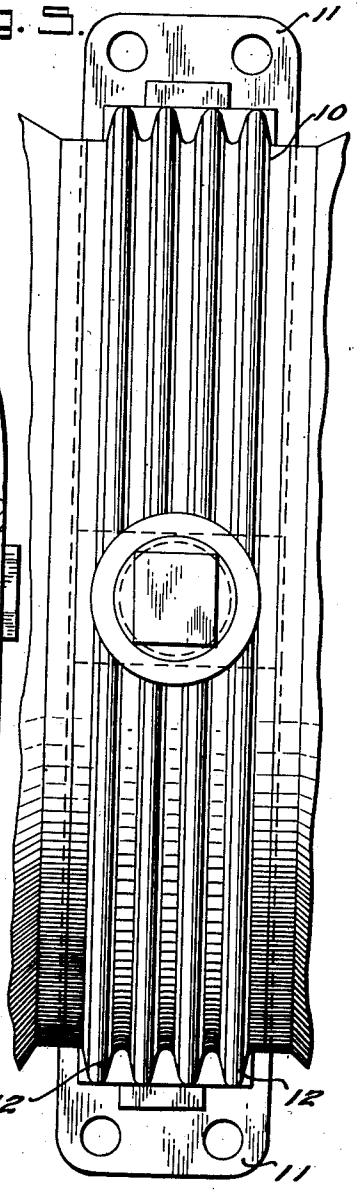


Fig. 5.



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FLUID PUMP

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6 Claims. (Cl. 103—126)

This invention relates to pump constructions. More particularly it relates to a novel and improved type of pump primarily adapted for use in connection with hydraulic systems for supplying fluid under pressure to various hydraulic operating devices.

It is a primary object of the present invention to provide a pump which will operate relatively efficiently at low speeds and maintain substantial uniformity of operation throughout an extremely wide range of speed and load conditions.

Still another object of the present invention is to provide a pump construction which is easily and conveniently attached to the power take-off of a vehicle such, for example, as a tractor and may be mounted in such a manner that the power take-off may conveniently be used for other purposes.

It is a still further object of the present invention to provide a pump construction which is substantially symmetrically arranged in order that the position of the pump may be reversed thereby making the pump adaptable to either clock-wise or counterclockwise drive.

An important feature of the present invention resides in the novel and improved sealing means utilized in connection with the gears of the pump in order to provide a tight and effective seal for the axial ends of the gears which seals are effective to compensate for wear and take up lost motion in the mechanism.

Still further the present invention contemplates the provision of a novel and improved type of seal for tightly sealing the axial ends of the pump gears which seal utilizes the pressure of fluid supplied by the pump for maintaining the seals tight, consequently, providing a structure in which the tightness of the seals is controlled in accordance with the discharge pressure existing on the discharge side of the pump thus bringing the seals to maximum efficiency during the times when the discharge load is greatest.

Many other and further objects, advantages, and features of the present invention will become apparent from the following specification when considered in connection with the accompanying drawings forming a part thereof.

In the drawings:

Figure 1 is a transverse sectional view taken through a pump illustrating in detail the mounting of the various parts therein.

Fig. 2 is an enlarged fragmentary sectional view of the improved seal construction.

Fig. 3 is an elevational view of one of the improved sealing plates utilized for closing the axial ends of the pump housing.

Fig. 4 is a vertical sectional view taken substantially on the line 4—4 of Fig. 1 illustrating in detail the interior arrangement of the parts.

Fig. 5 is a front elevational view of the pump housing structure illustrating the exterior configuration thereof.

With more particular reference to the drawings, it will be readily appreciated that the structure disclosed therein illustrates an extremely specific embodiment of the present invention and merely discloses one form thereof which has been found to be a particularly satisfactory application of the improvements of the present invention. However, it will be readily apparent to those skilled in the art that the broad inventive principles disclosed in the application will find broad and practical utility in many and various installations different from that shown and disclosed in the drawings.

The pump housing as a whole comprises a casting 10 which is provided with a flange 11 by which it may be bolted to a valve structure or fluid supply reservoir in sealing relation therewith in order that the intake and exhaust ports may conveniently communicate with suitable inlet and discharge openings in the structure to which the device is secured. The exterior surface of the housing is preferably provided with a plurality of cooling ribs 12 which substantially increase the exposed surface of the housing proper and aid in maintaining the device properly cooled at all times. The housing 10 has integrally formed therewith interiorly thereof wall structures 13 which are spaced from the outer wall of the housing 10 and serve to provide between them and the outer walls, intake ports 14 through which fluid to be pumped may be drawn inwardly through the pump mechanism hereinafter described in detail.

The wall structures 13 are preformed to provide a discharge port 15, the mouth of which lies in substantially the same plane as the face of the flanges 11 in order that the discharge port may be sealed in communication with a suitable outlet port at the time the housing structure as a whole is bolted in position. The housing structures 13 each have an interior configuration adapted to receive and closely house pump gears 17 and 18 which are mounted on shafts 19 and 20, respectively, and which gears are arranged in intermeshing engagement so that as the shafts 19 and 20 are rotated, fluid will be drawn through the

ports 14 and discharged through the port 15 as is conventional in gear pumps of this generic type.

The gears 17 and 18 are keyed to their respective shafts by means of conventional keys 21 and 22, respectively. The axial ends of the gear housings 13 are closed by means of improved sealing plates 25 which are positioned with respect to the pump housing by means of dowel pins 26 and 27 which dowel pins are sufficiently long so that they serve the purpose of positioning castings 28 and 29, respectively, arranged on the outboard side of each of the plates. The housing as well as the plates and castings are provided with a plurality of registering apertures adapted to receive bolts 30 which may be drawn up to lock the parts in assembled relation. The castings 28 and 29 each carry a series of ball bearings, 31 for the shaft 19 and a second set of ball bearings, 32 for the shaft 20.

While it is immaterial which of the shafts 19 and 20 is driven, in the construction shown, the drive is adapted to be transmitted to the apparatus through the shaft 19 which, as is illustrated, is considerably longer than the shaft 20 and has the ends thereof splined to provide suitable driving connections. The ends of the shaft 19 pass outwardly through the castings 28 and 29. In order to preclude the escape of oil at this point seals may be provided comprising metallic rings 36 sealed to the shaft 19 by means of springs 38 into contact with plates 39 which surround the shaft 19 and are bolted to the casting by means of screws 40. From this construction, it will be seen that access may conveniently be had to the splined ends of the shaft 19 yet at the same time sealing this shaft with respect not only to the housing 10 but with respect to the castings 28 and 29.

It will be noted that the shaft 20 is considerably shorter than the shaft 19 and that the axial ends of this shaft are completely enclosed within the castings 28 and 29 thus obviating the necessity of any sealing means for this shaft whatsoever. It will be noted that each of the ball bearing assemblies, generally designated as 31 and 32, include an inner raceway 50 which is retained in predetermined axial position on the shaft with which it is associated, by means of a screw collar 51 which may be threadably received upon the shaft and locked against rotation by means of a conventional lock washer 52. These raceway members 50 serve to support in predetermined axial position upon the shafts 19 and 20, sealing rings 55, the purpose and function of which will hereinafter become more clear. It has been found particularly desirable to provide the shafts 19 and 20 of enlarged diameter in their axial central portions in order to provide shoulders against which the sealing rings 55 may be clamped by means of the raceway elements 50 thus positively locking these sealing rings 55 in predetermined position upon the shafts with which they are associated.

Each of the sealing rings 55 is provided with an annular groove or channel 56 in the axial face thereof which is presented toward the gears carried by the shafts 19 and 20. Likewise, the gears 17 and 18 each have a continuous channel or groove 57 in the axial faces thereof which groove is of substantially the same general size and shape as the grooves in the sealing rings 55. The plates 25 have apertures 60 and 61 therein adapted to receive the enlarged central portions of the shafts 19 and 20, respectively, and the interior surface of these plates in these apertures is recessed to provide relatively deep channels 63 opening toward the axis of the shafts which they surround.

These channels 63 are so formed as to provide a pair of relatively thin slightly flexible walls, one of these walls being adjacent one of the gears and the other of the walls being adjacent one of the sealing rings 55. A plurality of apertures 66 may be provided through these walls to establish communication between the channels 63 and the channels 56 and 57. The sealing plates are each drilled to provide a bore 70 which communicates with a pair of branch bores 71 which branch bores each communicate with one of the channels 63. It will be noted that the bore 70 is located on the discharge or high pressure side of the pump.

It will be apparent that when the shaft 19 is driven, it will serve to effect rotation of the intermeshing gears 17 and 18 thus forcing fluid through the pump housing and discharging the same through the port 15. A small portion of the fluid will pass through the bore 70 in each of the plates 25 and thence through the branch bores 71 into the channels 63. As has been explained above, the fluid filling the channels 63 may pass through the ports 66 into both the channels 56 and 57 formed respectively in the sealing rings 55 and the axial faces of the gears 17 and 18. After the pump has been running a short time, it will be apparent that the oil being pumped by the apparatus will substantially fill the channels 63 in each of the plates as well as the channels 56 in each of the sealing rings and the channels 57 in the axial faces of each of the gears. It will be apparent that the surface area to which the fluid is exposed on the interior walls of the channels 63 is substantially greater than the area to which this fluid is exposed on the exterior walls of these channels. Consequently, the fluid pressure will cause the walls of the channel 63 to tend to move away from each other thus forcing these walls into tight sealing engagement with the sealing rings 55 and axial faces of the gears, effecting a tight seal for the axial ends of the gears at all times.

Due to the fact that these walls of the channel 63 are relatively thin and slightly flexible, the existence of this differential fluid pressure will maintain this tight sealing engagement at all times during the operation of the pump and will serve to compensate for wear as the same takes place.

This sealing engagement is regarded as a particularly important feature of the present invention and is of particular significance in connection with pumps of the generic type disclosed herein because it will be noted that it is inherent that the forces serving to seal the axial ends of the pump will be greatest when the pump is operating under the most severe loads, consequently, greatly increasing the efficiency of the apparatus during the time when such efficiency is most essential.

The converse is likewise true and it may be readily appreciated that during phases of operation in which the discharge pressure is relatively low, considerably less pressure will be effective to obtain the sealing effect thus eliminating wear on the parts during the times when maximum operating efficiency is not necessary.

It will further be appreciated from the disclosure described above that the pump construction as a whole is generally symmetrical in configuration and is of relatively short axial length. It will be seen that both ends of the shaft 19 are provided with splines to facilitate the connection

of driving or driven members thereto and, consequently, the pump may be conveniently mounted in cooperation with the power take-off of a truck, tractor, or other vehicle and conveniently used for the operation of fluid pressure responsive devices. It will be seen that due to the fact that both ends of the shaft 19 are splined, the pump may be operated with equal efficiency by means of a power take-off which rotates in either clock-wise or counterclock-wise direction and that the device shown may be attached in operative relation to the power take-off utilizing either end of the shaft 19 for the purposes of such connection. Further, it will be appreciated that once the device has been mounted in position, one end of the shaft 19 will be free and other power operated device may be connected thereto if desired.

From the foregoing, it will be appreciated that the apparatus will find broad practical utility for use in connection with the operation of various hydraulic actuating mechanisms commonly associated with trucks and tractors and is of particular practical importance in this field because of the extremely high efficiency obtained by the device throughout an extremely wide range of operation conditions. As is well understood in connection with devices of this general character, the power take-off mechanisms by which pumps of this general character are usually driven, rotates at a speed directly proportional to the speed of the motor. Due to the fact that the motor of the tractor or truck is primarily utilized for propelling the same, the discharge of oil from the pump cannot always be regulated by regulating the speed of the motor and, consequently, it is necessary to provide a pump construction in which adequate discharge pressures may be maintained throughout an extremely wide range of engine operation.

While but one specific embodiment of the invention has been illustrated and described above, many other and further modifications thereof falling within the scope of the invention as defined in the subjoined claims will be clearly apparent to those skilled in the art.

What is claimed is:

1. In a pump structure, a shaft, a pump gear locked thereon, a wall structure adapted to engage the axial face of said gear and having an aperture therein to receive said shaft, a sealing ring locked on said shaft and adapted to engage the outboard side of said wall structure, the edge of said wall structure around said aperture being formed to provide a channel therein facing toward said shaft, and means for supplying fluid pressure to said channel to urge said wall structure into sealing engagement with the adjacent axial faces of said sealing ring and gear.

2. In a pump structure, a shaft, a pump gear locked thereon, a wall structure adapted to engage the axial face of said gear and having an aperture therein to receive said shaft, a sealing ring locked on said shaft and adapted to engage the outboard side of said wall structure, the edge of said wall structure around said aperture being formed to provide a channel therein facing toward said shaft, and means for urging the side walls of said channel away from each other to force the same into sealing engagement with the adjacent axial faces of said gear and sealing ring.

3. In a pump structure, a shaft, a pump gear locked thereon, a wall structure adapted to engage the axial face of said gear and having an aperture therein to receive said shaft, a sealing ring locked on said shaft and adapted to engage the outboard side of said wall structure, the edge of said wall structure around said aperture being formed to provide a channel therein facing toward said shaft, and means establishing communication between the discharge side of said pump and the interior of said channel whereby to expand the side walls of said channel into sealing engagement with the adjacent axial faces of said sealing ring and gear whereby the sealing force will be substantially proportional to the discharge pressure of said pump.

4. In a pump construction, a shaft, a pump gear locked thereon, a wall structure adapted to engage the axial face of said gear and having an aperture therein to receive said shaft, a sealing ring locked on said shaft and adapted to engage the outboard side of said wall structure, the edge of said wall structure around said aperture being formed to provide a channel therein facing toward said shaft, a duct having one end opening in said plate on the discharge side of said pump and the other end opening into said channel whereby fluid pressure from the discharge side of said pump may expand the walls of said channel into sealing engagement with the adjacent axial faces of said gear and sealing ring.

5. In a pump construction, a shaft, a gear locked thereon, a plate having its inboard face adapted to engage the axial face of said gear and having an aperture therein adapted to receive said shaft, a sealing ring locked on said shaft and adapted to engage the outboard surface of said plate, the edge of said plate adjacent said aperture being bifurcated to provide a channel therein facing toward the axis of rotation of said shaft, and means for supplying fluid pressure to said channel to expand the walls thereof into sealing engagement with the adjacent axial faces of said sealing ring and gear.

6. In a gear pump construction, a shaft, a gear locked thereon, a plate having the inner surface thereof adapted to engage the axial face of said gear and having an aperture therein adapted to receive said shaft, a sealing ring locked to said shaft and having one axial face thereof adapted to engage the outer surface of said plate, said plate having the marginal edge thereof adjacent said aperture bifurcated to provide relatively flexible wall structures each having the outer surface thereof engaging an axial face of said gear and sealing ring, thus forming a channel therebetween facing toward the axis of rotation of said shaft, the axial faces of said gear and sealing ring adjacent said plate being provided with annularly extending channels therein, said wall structures having ports establishing communication between the channel in said plate and said last mentioned channels, and means for supplying fluid under pressure to all of said channels.

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