March 1, 1938. L. H. GRISELL 2,109,970

FUEL PUMP

Filed Aug. 3, 1935

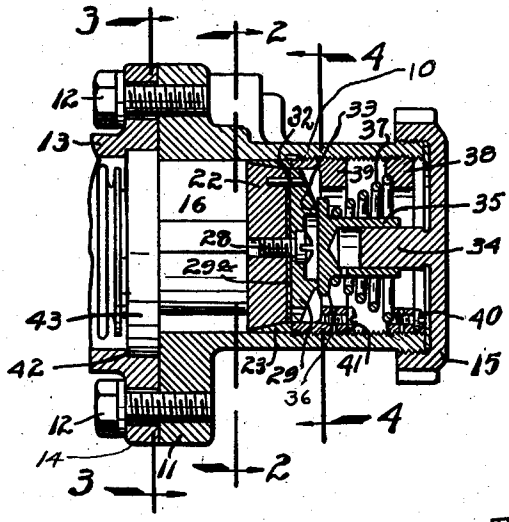

Fig. 1

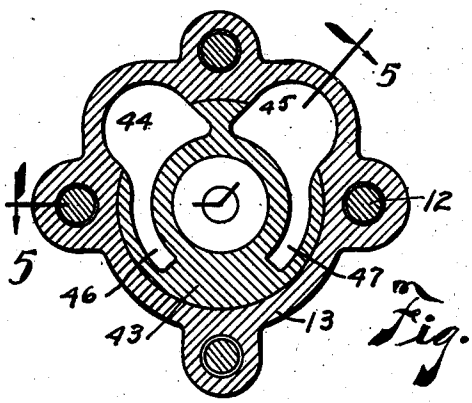

Fig. 3

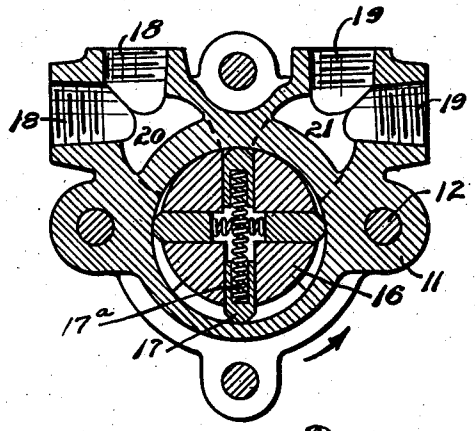

Fig. 2

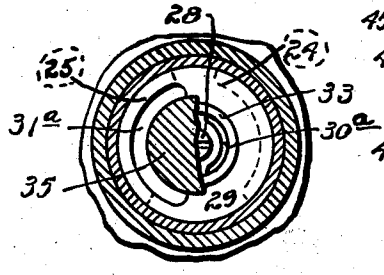

Fig. 4

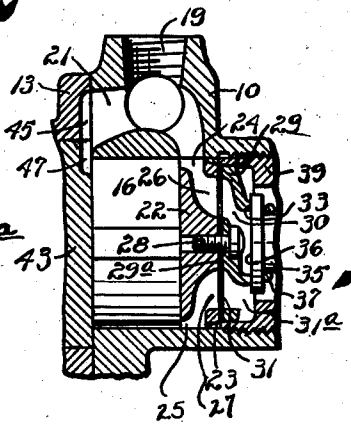

Fig. 5

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FUEL PUMP

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Application August 3, 1935, Serial No. 34,532

10 Claims. (Cl. 103—137)

This application is a continuation in part of my application Serial No. 680,797, filed July 17, 1933, and relates to pumps of new and improved construction which while adaptable for use as fuel pumps for internal combustion engines, may also be employed in many other relations, such as for oil burners, fuel transfer systems, in fact for use generally wherever liquids may be pumped.

Another object of the invention is to provide a pump of small, compact construction capable of being driven by any rotating part of an internal combustion engine, or any machine to which the pump may be connected, consequently when the pump is employed as a fuel pump for an internal combustion engine it may readily be driven from a rotating part of any standard or commercial existing type of engine without necessitating any radical modifications of the engine structure or necessitating the use of a camshaft as a part of the engine construction for the operation of the fuel pump.

A further object is to provide a new and improved construction of a pump of the type wherein a rotor is eccentrically mounted within a pump chamber and the fluid is caused to be impelled by means of one or more vanes seated within the rotor for movement substantially radially thereof and which vanes are spring pressed to cause them to contact yieldingly with the inner wall of the pump chamber.

Another object of the invention is to provide a construction for a pump of the type set forth in which novel means are employed for adjustably sealing one end of the pump chamber.

A further object is to provide a new and improved valve controlled by-pass for insuring the delivery by the pump of fluid at a uniform maximum pressure.

Another object is to provide a pump of the type described which may, by a simple adjustment of one of its parts, be operated efficiently either in clockwise or anti-clockwise direction thereby rendering the pump universal in its application without necessitating any structural changes of the parts of the pump to permit the operation in reverse directions.

A further object is to provide a pump in which all of the parts that function as pump media are so constructed that any wear thereof, or any lost motion which occurs as the result of operation of the pump can be taken up by very simple adjustments.

A still further object is to provide a pump of the type described of simple, compact and sturdy construction that can be manufactured at a relatively low cost by the use of common and simple machining operations and having a minimum number of parts, and in which the design and arrangements of the parts is such that part manufacturing and assembling operations are markedly simplified and so that variations from the manufacturing sizes or dimensions which may occur in the machining of the parts will not affect the efficiency of the pump in operation, thus obviating the necessity for a high degree of accuracy in the machining and manufacture of parts and, as a result, enabling marked savings in manufacture to be effected.

The above and other objects will appear more fully from the following more detailed description and by reference to the accompanying drawing forming a part hereof wherein I have shown by way of illustration, a satisfactory constructional example embodying the principles of the invention.

As shown in the drawing, Fig. 1 is a central longitudinal section through a pump embodying the present invention;

Fig. 2 is a section taken substantially on the line 2—2 of Fig. 1;

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

Fig. 4 is a section taken substantially on the line 4—4 of Fig. 1;

Fig. 5 is a section taken substantially on the line 5—5 of Fig. 3.

As shown in Fig. 1 of the drawing, the pump comprises a main casing 10 having a cylindrical bore. One end of the casing 10 is provided with a peripheral, laterally extending flange 11, provided with suitably spaced, screw threaded apertures into which are adapted to be screwed the bolts 12. The bolts 12 serve to connect to the casing 10 a member 13 preferably made as a casting and which is provided with a bore through which passes the impeller driving shaft, not shown. The member 13 is also provided with a lateral flange 14 through which the bolts 12 pass and which is clamped in contacting engagement with the flange 11; there being sufficient clearance in the flange 11 for the bolts 12 to permit relative lateral adjustment of the casing parts 10, 13.

The end of the casing 10 opposite to the flange 11 is preferably exteriorly screw threaded for the reception of a head or closure plate 15. Mounted within the working chamber of the casing 10, and suitably connected in driving relationship with the driving shaft, preferably by a press fit, is a rotor 16. As will be noted by referring to

Figs. 1 and 2 of the drawing, the rotor 16 is located eccentrically within the working chamber of the pump, and, as shown most clearly in Fig. 2, said rotor is provided with diametrically extending slots in which are slidably received impeller vanes denoted generally by the reference character 17.

In order to insure effective sealing engagement between the vanes 17 and the surface of the pump with which said vanes engage, each of said vanes preferably consists of a pair of similar sections, which engage within the diametrical slots in the rotor with a neat sliding fit. At its inner end each vane section is provided with one or more cylindrical recesses for the reception of compression springs 17*a*, there being one or more springs in parallelism for each vane and serving to force the outer ends of the vane sections into contacting sealing engagement with the bore of the casing 10. The springs for each vane are arranged in staggered relationship to the springs of the other vane so as to operate without interference from one another.

As shown in Fig. 2 of the drawing, the casing 10 has formed integrally therewith a pair of internally screw threaded hollow bosses 18, 19 which serve as the inlet and outlet ports of the pump according to the direction of rotation of the rotor 16. For clarity of description it will be assumed that the rotor rotates counterclockwise in the direction of the small arrow shown in Fig. 2. Under these circumstances the boss 18 will be the inlet and the boss 19 the outlet for the pump. The boss 18 is in communication with a conduit 20, and the boss 19 is in communication with a similar conduit 21, the conduits 20, 21 being in communication by means presently to be described with the working chamber in which the rotor 16 is mounted.

Interposed between the head 15 and the side face of the rotor 16 is an end plate 22, said plate being adjustably held against the side face of the rotor 16 by means of a wedging ring 23, said ring 23 being interposed between the bore of the casing 10 and the periphery of the end plate 22 to hold plate 22 rigidly within the casing 10. The plate 22 is preferably cored out to provide a pair of by-pass conduits, Fig. 5, which terminate on the periphery of the plate at the inner (left hand) face thereof in a pair of diametrically opposed arcuate ports, 24, 25, while at the outer face of said plate said conduits terminate adjacent the center of the plate in a pair of arcuate ports 26, 27. Adjustably secured to the outer face of end plate 22, by means of a screw 28, is by-pass valve plate member 29, a gasket 29*a* being interposed between plate 22 and by-pass valve plate 29, to prevent leakage there between. The member 29 is provided with a pair of conduits 30, 31, which at the inner face of said member terminate in a pair of arcuate ports, adapted to be placed in registry with the arcuate shaped ports 26, 27. The conduit 30 of the valve plate member 29 extends substantially radially thereof and terminates at the outer face of said member in a small arcuate port 30*a* which communicates with a shallow cylindrical chamber surrounded by a projecting annular flange formed on the valve plate 29 and which terminates in the annular valve seat 33, while the conduit 31 extends substantially parallel to the axis of the pump and terminates in an arcuate shaped port 31*a* on the outer face of the valve plate member exteriorly of the valve seat 33. One or more dowel pins 32, (Fig. 1) are provided for locating the end plate 22 and valve plate 29 when assembled with their adjacent communicating ports in proper registry. In order that the wedging ring 23 will not interfere with the communication between the ports 24, 25 and conduits 20, 21, those portions of the ring 23 which otherwise would overlie the ports 24, 25 are cut away.

Projecting inwardly from the inner face of the closure head 15 at the center thereof is a cylindrical shaped lug or boss 34 which projects into a similarly shaped bore of a valve member 35 having an enlarged valve seating surface 36 at its inner end adapted to engage with the annular valve seating surface 33 of the valve plate member 29. The valve member 35 is slidably supported upon the boss 34 and is normally held with its sealing surface 36 in sealing engagement with the annular valve seat 33 by means of a coil spring 37, one end of which abuts against the enlarged head 36 and the other end of which abuts against a spring abutment ring 38 screw threaded into the end of the pump casing 10.

Means are provided for holding the end plate 22 and wedging ring 23 in properly adjusted relationship to the rotor 16 and such means comprises an adjusting ring 39 also preferably screw threaded into the end of the casing member 10, said adjusting ring 39 being provided on its inner face with an annular narrow flange, the inner end of which is adapted to engage the thicker end of the wedging ring 23. Both the adjusting ring 39 and the spring abutment ring 38 are kerfed or slotted along a portion of their periphery and through these slotted portions thereof are screwed the locking screws 40 and 41 respectively, which screws, when tightened, will serve to bind the external threads of the rings in the cooperating screw threaded portion of the casing 10 and hold the rings against accidental movement in the well known manner of locking devices of this character.

A portion 13 of the two part casing is constructed to align with and clamp to the casing portion 10. The casing portion 13 is counterbored, as at 42, to receive an end wall sealing plate 43 and its flange 14 is cut away to form a pair of conduits 44, 45 (Fig. 3) longitudinally aligned with the conduits 20, 21, (Fig. 2) in the casing section 10 while the end sealing plate 43 (Fig. 3) has its right hand face (Fig. 5) cut away to form ports 46, 47, which open at the periphery of the end plate to communicate with the conduits 44, 45.

The manner in which the device is assembled and operates is as follows:

Before the castings 13, 10 are clamped together and the adjustable by-pass plate 29 is secured to the outer face of the end plate 22 by means of the locking screw 28, gasket 31 is interposed between the end plate and the by-pass plate to prevent fluid leakage there between. The casing 13 with the rotor and impeller shaft carried thereby are then bolted to the casing 10 and the casing adjusted laterally to insure proper axial alignment thereof so as to secure free rotation of the rotor without binding within the working chamber provided in the casing 10. The end plate 22 is then placed within the casing 10 and the wedging ring 23 is inserted between the bore of the casing 10 and the periphery of the end plate 22. The adjusting ring 39 is then screw threaded into the bore of the casing 10 with its reduced inner end in engagement with the thicker end of the wedging ring 23 and the end plate 22 is adjusted axially of the casing to hold it

with a neat fit against the side face of the rotor. The locking screw 41 in the ring 39 is then tightened thus binding the threads of the ring 39 on the casing threads and holding the parts in adjusted position. The coil spring 37 is then slipped over the valve member 35, one end of said spring abutting against the enlarged portion 36 of the valve member and the valve member and spring placed in the casing with the enlarged portion thereof seating upon the valve seat 33.

Abutment ring 38 is then screw threaded into the bore of the casing 10 in engagement with the coil spring 37 and the ring 38 adjusted to place a predetermined tension on said spring. The closure head is then screwed on the casing with cylindrical shaped lug 34 extending into the bore of the valve member 35.

In operation let it be assumed that rotation is imparted to the impeller shaft in a counterclockwise direction as indicated by the arrow in Fig. 2 of the drawing and that the bosses 18, 19 are connected respectively by suitable pipes to a supply of the fluid to be pumped and the point the fluid is to be delivered. As the vanes 17 sweep past the arcuate port 46 suction will be induced in said port and within the working chamber of the pump between the vane and the upper edge of the rotor at the point where the latter contacts with the inner wall of the bore of the casing 10. Fluid will be sucked into the working chamber of the pump in the left hand side thereof through the port 46, conduits 44, 20 and inlet 18 (Fig. 2) the fluid filling the crescent shaped working chamber and following up the movement of the vane. As the diametrically opposite end of the vane then sweeps past the port 46 it will cut off the crescent shaped chamber in front of its leading edge from the suction line and will impel or force the fluid which has filled said chamber through the port 47, conduits 45, 21 and outlet 19, the above operation being characteristic of pumps of this particular type. Should pressure of the fluid being delivered by the pump tend to increase beyond a certain maximum amount, as determined by the adjustment of the spring 37, a certain portion of the fluid will be by-passed, this being accomplished as follows: It will be noted that the port 24 of the end wall 22 is located in alignment with the outlet port 21 and will be subjected to the same pressure as the fluid forced through said outlet. The port 24, its respective conduit and port 26 and conduit 30 of the valve plate member 29 will therefore be filled with fluid under the same pressure as the fluid within the outlet, or delivery, side of the pump. Should this pressure become greater at any time than the pressure exerted by the spring 37, the valve 36 will be lifted off its seat 33, thus permitting communication to be established between the ports 30*a*, 31*a* and a portion of the fluid will then be by-passed from port 30*a* to port 31*a* directly from the pressure side to the suction side of the pump. After the pump has been in operation for some time the end plate 22 may be readjusted to take up the wear by simply removing the adjusting ring 39 and loosening the wedge 23. The plate 22 then may be moved in and adjusted and the wedging ring 23 may then be replaced to hold the end wall in proper adjusted position as desired. To regulate the amount of pressure desired to operate the valve 35 the abutment ring 38 may be advanced or retarded within the bore of the casing 10 to permit the adjustment on the tension of the spring 37.

The construction of the end plate 22 and wedging ring 23 not only has marked advantages from the standpoint of furnishing a convenient means for regulating and adjusting the end plate but it also has important advantages from the standpoint of reducing manufacturing costs as it is not necessary to hold the machining tolerances of the diametrical dimensions of the working chamber bore and end plate within narrow limits, it being obvious that variations in such dimensions can be readily compensated for in the initial assembling of the parts by adjustment of the wedging ring. Moreover, the ring may be made of any suitable non-ferrous material such as brass, copper or any other material that will be resistant to rust or to the action of any corrosive substances in the liquid being pumped, thus insuring ready disassembling of the parts after long periods of service.

Again, it is highly important to prevent edge leakage from the working chamber between the perimeter of the end plate and the bore of such chamber and were such result sought to be achieved by a close fit of the end plate in the bore the precision machining that would be required would materially increase production costs and if any corrosion in use should occur with such very close fitting parts it would be practically impossible to remove the end plate without seriously damaging the bore. The prevention of edge leakage is important because if this should occur fluid is permitted to flow directly from the pressure side to the suction side of the pump thus decreasing efficiency and if such leakage is great enough preventing priming of the pump at low speeds. Thus by using a non-ferrous material such as brass or copper or any other suitable material having similar sufficiently yielding or compressible properties the ring may be slightly compressed upon forcing it into position thus insuring a most effective seal against such edge leakage.

As the rotor 16 is preferably a separate piece suitably connected to its driving shaft as by a press fit, the rotor can be made of any non-ferrous material resistant to rust or other corrosive action.

If it is desired to operate the pump in a reverse or clockwise direction so that conduit 20 becomes the outlet and conduit 21 the inlet, the valve plate 29 is reversed so that the port 30 aligns with port 27 and port 31*a* with port 26. In case of a back pressure, sufficient to lift the valve 35, as described above, the fluid will then by-pass through ports 25, 27, into port 30*a* to ports 31*a*, 26 and 24 to conduit 21.

In the parent case Serial No. 680,797, filed July 17, 1933, there was disclosed a pump structure of the type wherein one end of the rotor was sealed by an end plate, said end plate being held by a screw threaded adjusting means against the side face of the rotor and which plate was provided with valve controlled by-pass conduits. To that extent the parent application and this application disclose common subject matter. The present case discloses a pump structure of the type where one end of the rotor is sealed by an end plate, said end plate being adjustably held against the side face of the rotor by means of a wedging ring being held by the screw threaded ring 39 in proper adjusted position thus providing a simple means for holding the end plate in the desired position and also simplifying the manual adjustment of the plate to suit the particular conditions in each pump assembled. The present case also provides a simple and efficient means

for yieldably holding the by-pass valve in registry with said end sealing plate assembly. Although the pump is designed primarily for use as a fuel pump for internal combustion engines, the principles of construction are not limited to this specific use, it being understood that the pump may be constructed for use in any relation that may be desired. By constructing the pump as herein disclosed and using a rotary pump instead of a reciprocating one, it becomes possible to drive the pump by any rotationg part of an internal combustion engine, for example, by connecting it with a fan drive, the drive for the oil pump, or generator, or any other readily accessible, externally located, rotating part of any standard internal combustion engine. While I have described a satisfactory constructional example of a pump embodying the principles of my invention it will be understood that the invention is not limited to the specific constructional details herein described and illustrated in the drawing, but that many changes, variations and modifications may be resorted to without departing from this invention.

I claim:

1. A rotary pump of the type wherein a rotor is mounted within a working chamber defined by the casing of said pump characterized by the provision of an end plate with a beveled periphery mounted within said chamber and in contacting sealing engagement with one end face of said rotor, means for locking said end plate in sealing engagement with an end wall of said rotor comprising a ring of wedge shaped cross section releasably wedged between the walls of the working chamber and the beveled periphery of said end plate.

2. A rotary pump of the type wherein a rotor is mounted within a working chamber defined by the casing of said pump characterized by an end plate having portions defining relief ports therethrough, a ring of wedge shaped cross section for holding said end plate rigidly within the casing of said pump, and an adjustable screw threaded ring member adapted to abut against said wedge shaped ring for moving said wedge shaped ring thereby to wedge the end plate rigidly within the casing.

3. A rotary pump of the type wherein a rotor is mounted eccentrically within a working chamber defined by the casing of said pump, an end plate rigidly mounted within said chamber and having portions defining relief ports therethrough, a by-pass valve plate adjacent said end plate and having cooperatively arranged portions defining continuations of said ports therethrough, an end sealing cap having a boss portion secured thereto and extending inwardly therefrom, said sealing cap being secured to one end of said casing, a ring member secured in said casing, a by-pass valve member telescopically mounted on said boss portion and a spring interposed between said ring member and said by-pass valve member to hold said by-pass member in yieldably sealed contacting relationship with said valve plate.

4. A rotary pump of the type wherein a rotor is mounted eccentrically within a working chamber defined by the casing of said pump, an end plate rigidly mounted within said chamber, a wedging ring interposed between said end plate and said working chamber, a by-pass valve comprising a valve plate adjacent said end plate, an end sealing cap having a boss portion secured thereto and extending inwardly therefrom, said sealing cap being secured to one end of said casing, a pair of ring members adjustably mounted in said casing one of said ring members abutting against said wedging ring to hold the same rigidly in place, a by-pass valve member telescopically mounted on said boss portion and a spring interposed between the other of said ring members and said by-pass valve member to hold said by-pass valve member yieldably with a predetermined pressure in sealed contacting relationship with said valve plate.

5. A rotary pump of the type wherein an impeller is mounted eccentrically within a working chamber defined by the casing of said pump, an apertured end plate rigidly mounted within said casing, a by-pass valve comprising an apertured valve plate secured to said end plate, an end sealing cap having a boss portion secured thereto and extending inwardly therefrom, said sealing cap being secured to one end of said casing, an adjusting ring mounted in said casing and a spring interposed between said ring and said by-pass valve member whereby by adjustment of said ring the effective tension of said spring may be regulated.

6. A rotary pump of the type wherein a rotor is mounted within a working chamber defined by the casing of said pump characterized by the provision of an end plate with a beveled periphery mounted within said chamber and in contacting sealing engagement with one end face of said rotor, means for locking said end plate in sealing engagement with an end wall of said rotor comprising a ring of wedge shaped cross section releasably wedged between the walls of the working chamber and the beveled periphery of said end plate and means for holding said ring in adjusted position.

7. A rotary pump of the type wherein a rotor is mounted within a working chamber defined by the casing of said pump characterized by the provision of an end plate with a beveled periphery mounted within said chamber and in contacting sealing engagement with one end face of said rotor, means for preventing edge leakage between said end plate and the bore of said working chamber comprising a ring of wedge shaped cross section encircling the beveled periphery of said end plate and interposed between said periphery and said bore and adjustable means for forcing and holding said wedge shaped ring thereby to clamp said end plate in adjusted position in said working chamber.

8. A rotary pump of the type wherein a rotor is mounted within a working chamber defined by the casing of said pump characterized by the provision of an end plate mounted within said chamber and in contacting sealing engagement with one end face of said rotor, means for locking said end plate in sealing engagement with an end wall of said rotor comprising, a ring of wedge shaped cross section and a locking ring movable axially in said chamber for engaging the edge of said wedge shaped ring to force the same laterally thereby to wedge between the walls of the working chamber and the periphery of said end plate.

9. A rotary pump of the type wherein a rotor is mounted within a working chamber defined by the casing of said pump characterized by the provision of an end plate mounted within said chamber and in contacting sealing engagement with one end face of said rotor, means for locking said end plate in sealing engagement with an end wall of said rotor comprising, a ring of wedge shaped cross section and means to force said

wedge shaped ring longitudinally between the walls of the working chamber and the periphery of said end plate thereby to exert a radial clamping action independent of the longitudinal movement of said end plate.

10. In a rotary pump, a rotor, a casing having a working chamber, outlet and inlet passages and outlet and inlet ports located at one end of said rotor and communicating with said passages, an end plate rigidly mounted within said chamber and having inlet and outlet ports and passages located at the opposite end of said rotor and communicating with said first named passages, a valve plate adjacent said end plate and having by-pass conduits defining continuations of the inlet and outlet passages of said end plate and a by-pass valve for controlling passage of fluid through said conduits.

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