June 19, 1934. H. H. CAMPBELL 1,963,350

PUMP

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Fig. 1.

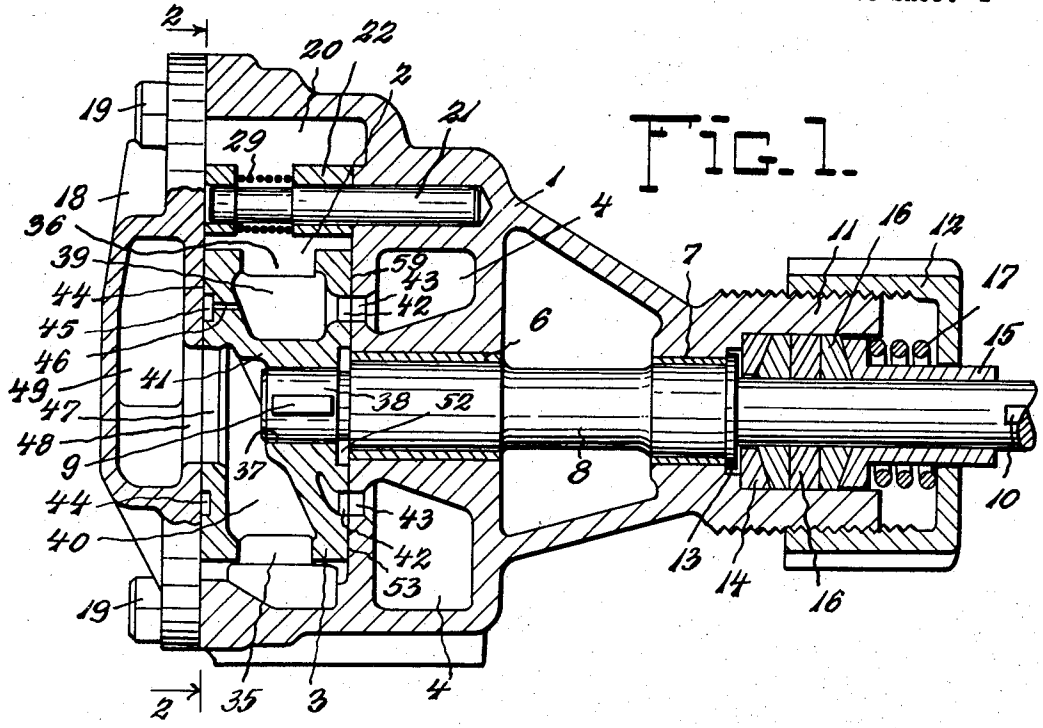
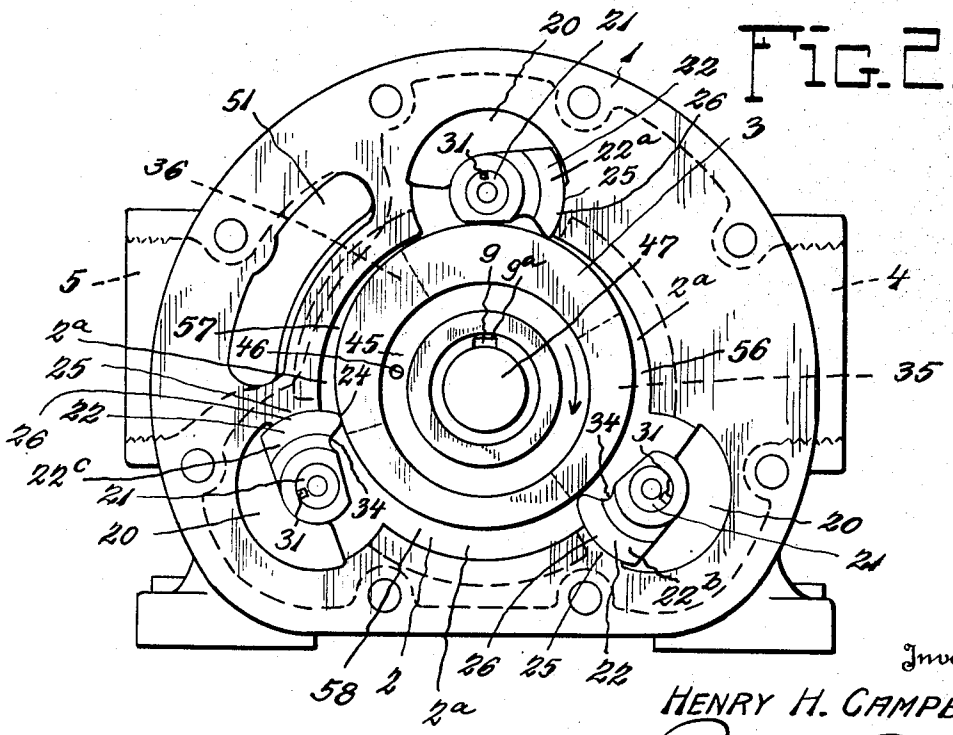


Fig. 2.



Inventor

HENRY H. CAMPBELL.

By Robert Cole

Attorneys

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Fig. 3.

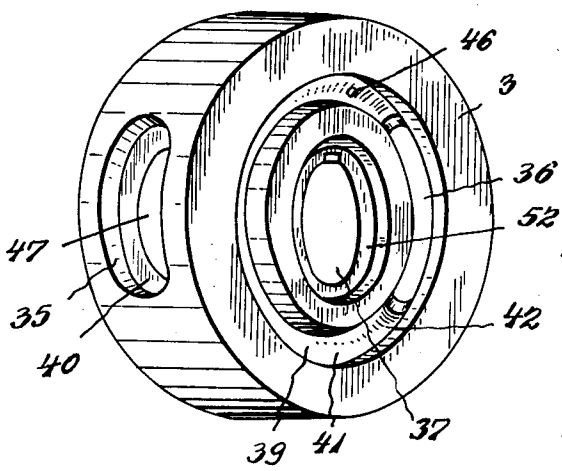


Fig. 4.

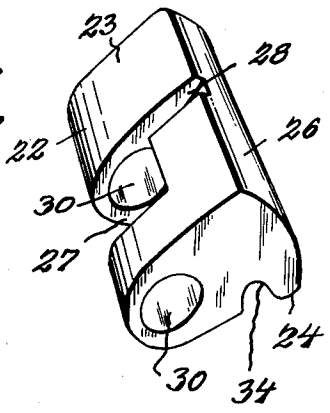


Fig. 5.

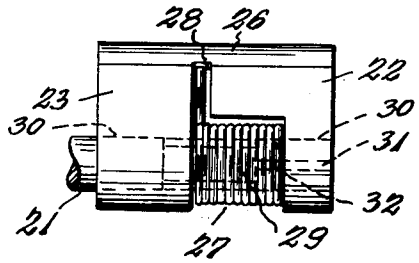


Fig. 6.

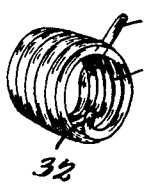
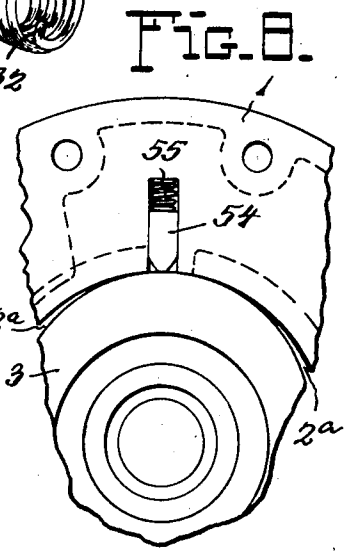


Fig. 8.



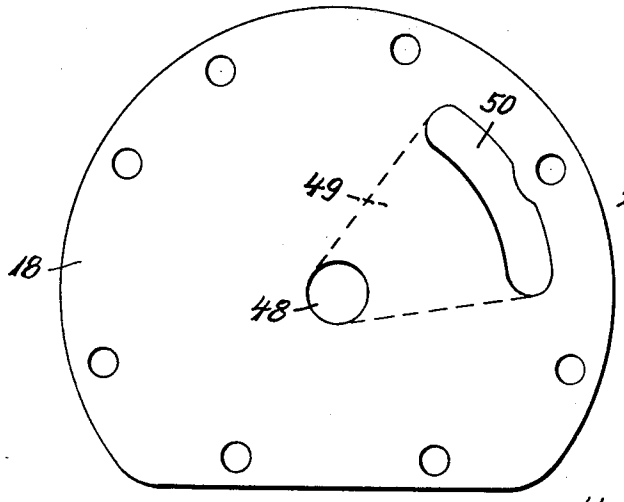


Fig. 7.

Inventor

HENRY H. CAMPBELL.

By Robbins & Robbins

Attorneys

Patented June 19, 1934 1,963,350

UNITED STATES PATENT OFFICE

1,963,350

PUMP

Henry H. Campbell, Cleveland, Ohio

Application February 11, 1932, Serial No. 592,396

2 Claims. (Cl. 103—124)

This invention embodies improvements in rotary pumps and provides a novel construction of a rotary pump which is very efficient in its operation and very simple in its construction rendering it especially suitable for the handling of gasoline, oil, or other liquids.

One of the main objects of the present invention is the provision of a balanced rotor of such a construction as to permit the in and outflow of the liquid directly through the said rotor.

Another object of the invention is the provision of balanced blades not affected by variation in pressure and cooperating with the rotor in such a manner as to perform a constant flow of expelled liquid, thereby increasing very considerably the efficiency of the pump.

A further advantage is the arrangement of the rotor in the housing in such a manner as to eliminate entirely the possibility of damage of the rotor frequently caused in pumps of this character by the presence of foreign matter in the liquid to be handled. The friction between the rotor and pump housing is entirely eliminated and a very quiet and smooth operation results. Therefore in operation of this pump less power will be required and the life of the pump will be considerably increased.

Still another object of this invention is the equalization of the rotor in a lateral direction under operating conditions so as to accomplish a considerable reduction of the friction during operation, preventing any eating of the rotor into the side walls of the housing or cover plate.

The pump is of such construction as to permit operation in either direction, making the same especially adaptable at places where the handling of liquids in both directions over a single pipe line is desirable.

Further advantages will be apparent from the following description and accompanying drawings, in which—

Figure 1 is a longitudinal sectional view of a rotary pump.

Figure 2 is an elevational view of the pump shown in Figure 1, looking in the direction of the arrows, the cover being removed.

Figure 3 is a perspective view of the rotor.

Figure 4 is a perspective view of a blade as employed in this pump construction.

Figure 5 is a plan view of a blade showing the tension spring attached to the blade and blade supporting pinion.

Figure 6 is a perspective view of a blade tension spring.

Figure 7 is an elevational view of the cover for the pump housing.

Figure 8 shows a modified form of a blade construction.

Referring now to the drawings, 1 indicates the housing of the pump which comprises a compartment 2 for the reception of a rotor 3 and which is further provided with an inlet passage 4 and an outlet passage 5. Bearing portions 6 and 7 are provided within the housing 1 and are adapted to receive the shaft 8, one end of which extends into the compartment 2 and carries the rotor or piston 3 which is keyed to the said shaft as shown at 9. The other end of the shaft 8 is adapted to carry driving instrumentalities such as a pulley or the like which may be keyed thereto by means of the key 10. The casing 1 comprises further a threaded extension 11 which is adapted to engage a cap 12. The shaft 8 is provided with an annular extension 13 adapted to retain the said shaft in proper position within the housing of the pump. The said annular extension abuts against the bearing portion 7 at one side while the other side contacts with a packing ring 14. It should be noted that there is a certain play between the bearing portion 7 and the packing ring 14 which will eliminate considerable friction between these parts. A retaining member 15 is adapted to hold the packing material 16 properly in place and the said retaining member 15 as well as the packing ring 14 are of such a configuration as to compress the said packing material 16 toward the shaft 8 and to assure a proper sealing, preventing leakage of liquids handled by said pump on the casing.

Interposed between the retaining member 15 and the cap 12 there is a pressure spring 17 which applies the necessary pressure to the retaining member 15 as necessary to keep the packing 16 in proper sealing condition. The pressure of the spring 17 may be varied by turning of the cap 12 which is in threaded connection with the extension 11 of the casing 1.

The compartment 2 of the casing 1 is closed by means of a cover plate 18 which is held in air-tight engagement with the casing 1 by means of screws 19. The housing 1 is further provided with a plurality of blade compartments 20 arranged around the periphery of the compartment 2. These blade compartments 20 are of a circular configuration and lead into the pump compartment 2. Within the said blade compartments and fixed within the housing 1 are blade supporting pins 21 equally disposed from each other and adapted to carry blades 22.

The said blades, a detailed view of which is shown in Figure 4, are composed of a body portion 23 comprising a contacting surface 24 which is of a slightly curved configuration, so as to assure a proper contact with the rotor 3. The blade compartments 20 are further provided with extensions 25 which properly engage a curved portion 26 of the blades 22 and provide a liquid-tight seal between the said blades and the housing 1 at this point.

The body portion 23 of the blades 22 is pro-

vided with a recess 27 and a groove 28 adapted for reception of a spring 29. The body portion 23 is further provided with bores 30 adapted to slide over the blade supporting pins 21 and to permit free rotation of the blades thereon. The pins 21 are provided with a groove 31 as shown in Figure 5 adapted to receive the free end 32 of the springs 29 while the other free end of the spring 29, as indicated at 33 in Figure 6, fits into the groove 28 within the body portion 23 of the blade 22 so that the spring applies a tension to the said blades, holding the same in tight engagement with the rotor 3 as shown in Figure 2.

It should be noted that during assembling of the blades and rotor, it is necessary to rotate the blades in a direction such that the springs will be compressed to a certain extent. The rotor is then inserted and the pressure of the spring will then turn the blades until they are brought into engagement with the rotor.

The blades 22 are also provided with a longitudinally extending groove 34 which is utilized for purposes explained later on.

The rotor 3, a detail of which is shown in Figure 3, is made out of one piece and is of a circular configuration. The outer periphery of the rotor is provided with two slots 35 and 36, one being the inlet port, the liquid being dispelled through the other port. The rotor 3 is further provided with a bore 37 which is displaced somewhat with respect to the center of the rotor. The said bore receives the free end 38 of the shaft 8 and is keyed thereto by means of the key 9 as previously described.

A diagonal wall 41 divides the rotor 3 into two compartments, 39 and 40, and it should be noted that the port 35 leads into the compartment 40 while the port 36 leads into the compartment 39. The compartment 39 is connected with the passage 4 of the housing 1 by means of an annular opening 42 in the rotor 3 and an annular opening 43 in the pump housing 1, so that liquid may pass through the passage 4 into the said compartment 39 within the rotor from which it enters the pump compartment 2. On the opposite side of the rotor 3 abutting against the cover 18, as indicated at 44, there is an annular recess 45 which is connected with the compartment 39 of the rotor 3 by means of a small passage 46 so that the liquid entering the compartment 39 may also enter the recess 45 to thereby equalize the pressure on both sides of the rotor 3. The compartment 40 of the rotor 3 leads into a circular opening 47 of the said rotor and is adapted to register with the opening 48 in the cover 18 and to permit the flow of liquid from the compartment 40 to the said openings 47 and 48 into a passage 49 within the cover plate 18 from where it passes through an elongated opening 50 and a corresponding elongated opening 51 into the housing 1 and the outlet 5 of the pump housing, from where it is passed over a pipe line, not shown, to its place of disposition.

A keyhole 9*a* connects the compartment 40 within the rotor 3 with an annular recess 52 of the said rotor so as to equalize the pressure at the side 53 of the rotor against the pressure exerted at the diagonal wall 41 of the compartment 40. This equalization of the pressure on both sides of the rotor will be more plainly discussed later on.

The blades 22 while in contact with the rotor 3 divided the compartment 2 into a plurality of sub-compartments 2*a*. The compartment 2 is somewhat enlarged at the spaces between the blades 22 so as to increase the volume of the sub-compartments 2*a*.

In Figure 8 there is shown a modification of a blade construction which can also be used in connection with the construction previously disclosed. In this figure there is shown a blade 54 extending over the full width of the rotor 3 and firmly held against such rotor by means of one or a plurality of pressure springs 55.

The pump is driven by a motor or the like, which transfers rotation to the pulley connected to the shaft 8 by means of the key 10 as previously described. This will cause rotation of the shaft 8 and the rotor 3. On account of the eccentric mounting of the rotor 3, the same will rotate in such a manner as to thereby decrease or increase the sub-compartments 2*a* in a successive operation. The blades 22 remain at all times in close contact with the rotor and oscillate under the compression of the spring 29 to respond to the different positions of the rotor. The inlet 4 of the pump which is connected with a pipe line leads to a source of liquid from where it is withdrawn by the suction of the rotor and whereby it is forced to enter into the sub-compartments 2*a* in a successive order. The liquid is then expelled from the sub-compartments 2*a* in a continuous flow through the opening 47 in the rotor over 48 into the passage 49, from where it is forced into the outlet 5 to which is connected the pipe line leading to a point to which the liquid is thereby delivered.

To explain more clearly the suction and expelling operation of the pump, reference is made to Figure 2 wherein the rotor is shown in expelling position, expelling the liquid from one of the sub-compartments 56, the outlet port 35 being positioned within the sub-compartment 56 during this expelling operation. At the same time the expelling operation takes place in the compartment 56, there will be a suction caused within the sub-compartment 57 created by the expansion of the volume of said compartment on account of the eccentric mounting of the rotor 3. Liquid will be forced from the inlet 4 to pass through the annular openings 42 and 43, into the compartment 39 of the rotor, from where it passes to the port 36 into the said compartment 57. The suction action will continue until the port 36 has passed the blade 22*a*, whereupon a corresponding suction action will take place within the compartment 56 and after the port 36 has passed the blade 22*b*, the same suction operation will be performed within the sub-compartment 58. The expelling operation, which has been previously described with respect to the sub-compartment 56, travels directly ahead of the suction operation so that before the suction is created in one of the sub-compartments, a complete discharge of the liquid in the respective sub-compartment has taken place. In other words, after the liquid from the compartment 56 is expelled, and the port 36 becomes connected with this compartment, the suction will take place. At this time the port 35 will be within the sub-compartment 58 from where the liquid is expelled through the said opening 47 of the rotor 3 into the opening 48 of the cover passage 49, then through the elongated openings 50 and 51 to the outlet 5. After the liquid from the sub-compartment 58 has been expelled and the port 35 has passed the blade 22*c*, suction will take place in this compartment as previously described, while the expelling of the liquid in the sub-compartment 57 is performed. The ports 35 and 36 are disposed directly opposite each other on the rotor 3 and are of such

length as to overlap their operations to a certain extent as necessary to prevent any back-pressure within the pump.

Considering now the sub-compartment 56 in Figure 2, it will be noted that during the expelling, or so called compression action, of the said compartment, the blade 22b will be entirely balanced with respect to the pressure in the said compartment. The liquid contacts on both sides with the body portion 23 of the blade and the pressure applied to said body portion on opposite sides equalizes itself, so that no additional force pressing the said blade against the rotor in addition to the spring pressure is created.

The surface reduction on one side of the blade by the contacting surface 24, which would lessen the surface of the side, is taken care of by the groove 34 which is of such a configuration as to provide additional surface space which has been lost by the contact between the rotor and the said blade. This is a very distinctive advantage as there will be no increase of friction between the rotor and the blade and a long life of blades and rotor is assured.

The rotor 3 is dynamically balanced so as to limit any centrifugal action created, which would result on account of the eccentric mounting of the rotor. Furthermore, the said rotor is balanced in a lateral direction within the rotor compartment 2 by utilization of the suction and compression of the pump. To explain this clearly, it will be obvious that the rotor 3 has a tendency during suction operation to move toward the wall 59 of the housing 1 and this lateral displacement of the rotor will be increased by the expelling of the liquid from the rotor compartment 40 which also tends to move the rotor toward the wall 59 so that the rotor would come in a direct metal to metal contact, which will very likely cause the destruction of the side wall 59 of the casing 1 or of the rotor at the point of contact with the said side wall because the two metals will eat into each other. To prevent this and to cause a kind of floating action of the rotor within the compartment 2, the compartment 39 of the rotor is connected by means of a small passage 46 with the annular recess 45, thus equalizing the suction at both sides of the rotor with respect to the wall 59 of the casing 1 and the cover plate 18. The pressure within the compartment 40 tending to move the rotor against the wall 59 of the casing will be equalized in a like manner as the liquid passes from this compartment over the keyhole 9a to the annular recess 53 so that a perfect floating of the rotor between the wall 59 and cover plate 18 is accomplished.

It will be understood that the rotor is at all times in smooth contact with the wall 59 and the cover plate 18 as necessary to give liquid-tight seal, but there will always be a very slight play between said members, which may be negligible, but it will be clearly understood that the life of the rotor will be considerably shortened if the equalization of suction or pressure is not taken care of, and under these circumstances the beforementioned disadvantages will occur. The provision of the equalization means will assure a smooth and quiet operation of the pump. The friction will be considerably lessened and a smaller source of power than generally necessary, may be used.

The liquid will be expelled from the pump in a continuous flow as the expelling operation within one compartment overlaps into the expelling operation of the successive compartments and this increases very considerably the operation of the pump and makes the same especially adaptable for conditions which require a continuous and steady discharge of liquid. The pump may be operated in either direction and this gives the advantage that liquid may be passed over a single pipe line in either direction without the necessity of a by-pass pipe or the like.

It should be understood that while there are shown three blades in the drawings, any plurality of blades may be used, and the compartment 2 may be divided into any plurality of sub-compartments. The blades may be of a construction as shown in Figure 8, which has been previously described, and their function would be practically the same as described with reference to the blades 32, but of course the blades 54 will not be balanced in a manner as disclosed with respect to the blades 22. The blades may be made from metal or any composition which will be suitable for their purpose. The construction of the pump is very simple and permits the manufacture of the same at a very low cost.

It will be apparent from the foregoing description that various changes in the details of construction of this device may be made without departing from the inventive concept, which changes will readily suggest themselves to those skilled in the art. It will be accordingly understood that it is intended and desired to embrace within the scope of this invention such modifications and changes as may be necessary to adapt it to varying conditions and uses.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A pump of the character described, comprising a housing having inlet and outlet conduits, a cylindrical rotor eccentrically mounted within the housing and having peripheral and radial faces, a diagonal wall within the rotor arranged at an angle to the peripheral and radial faces and axis of the rotor defining wedge-shaped compartments within the rotor on opposite sides of the diagonal wall, the rotor having ports in its periphery communicating with the wedge-shaped rotor compartments and adapted to be brought into communication with the inlet and outlet conduits, and a plurality of blades within the housing and contacting with the periphery of the rotor for controlling the admission and propulsion of liquid through the said housing and rotor.

2. A pump of the character described, comprising, in combination, a housing provided with inlet and outlet passages, a shaft within the housing, a cylindrical rotor eccentrically mounted on said shaft within the housing and spaced from the housing about its periphery, the rotor being divided interiorly into inlet and outlet passages, a plurality of movable blades pivoted to the housing and contacting with the rotor, resilient means between the housing and blades for urging the blades into contact with the rotor and to maintain the blades in contact with the rotor during rotation of the same for producing a plurality of compartments controlling admission and expulsion of fluid through the housing.

HENRY H. CAMPBELL.