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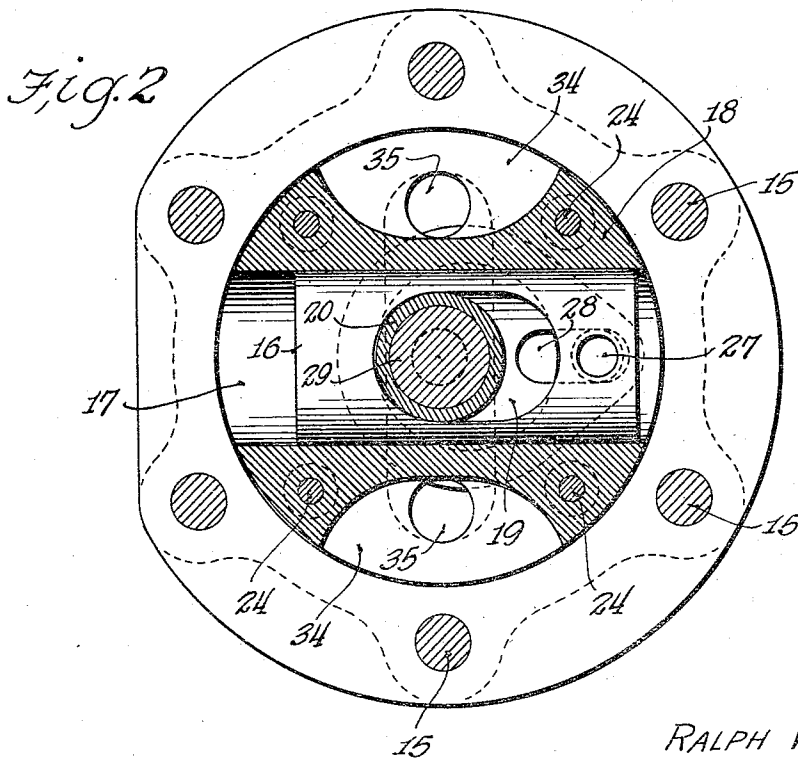
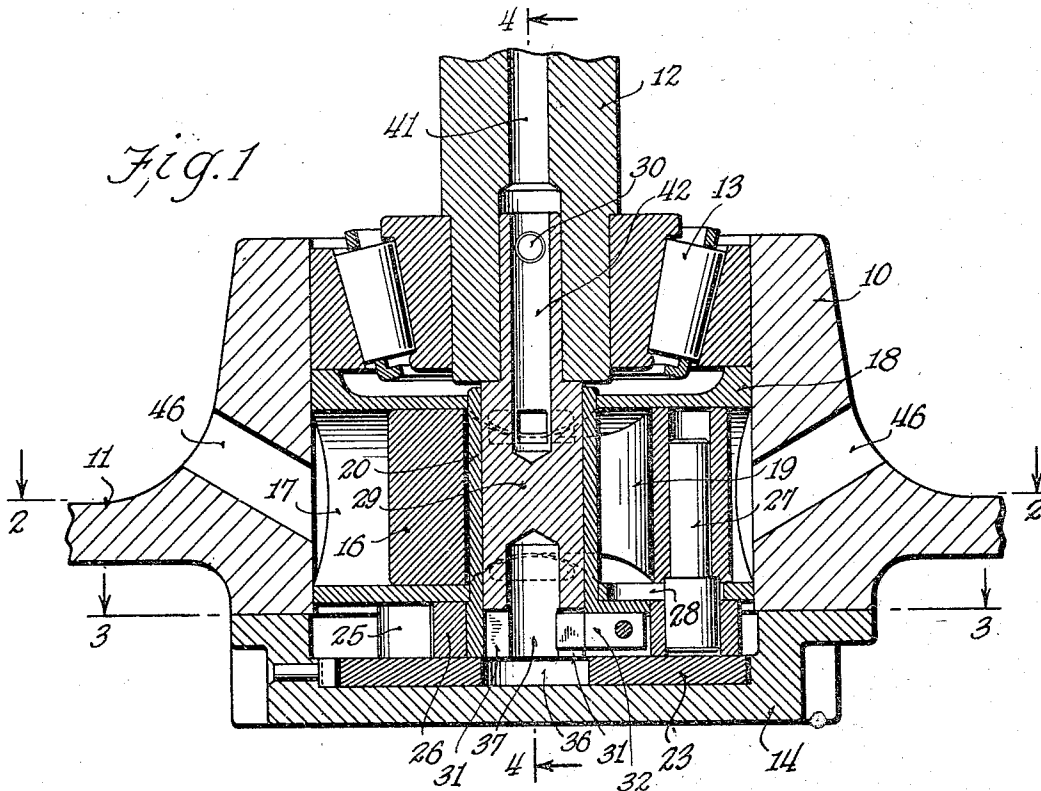
R. WIKEN

2,303,969

PUMP

Filed Aug. 3, 1940

2 Sheets-Sheet 1



INVENTOR.
RALPH WIKEN
BY *Ralph Wiken*
ATTORNEY.

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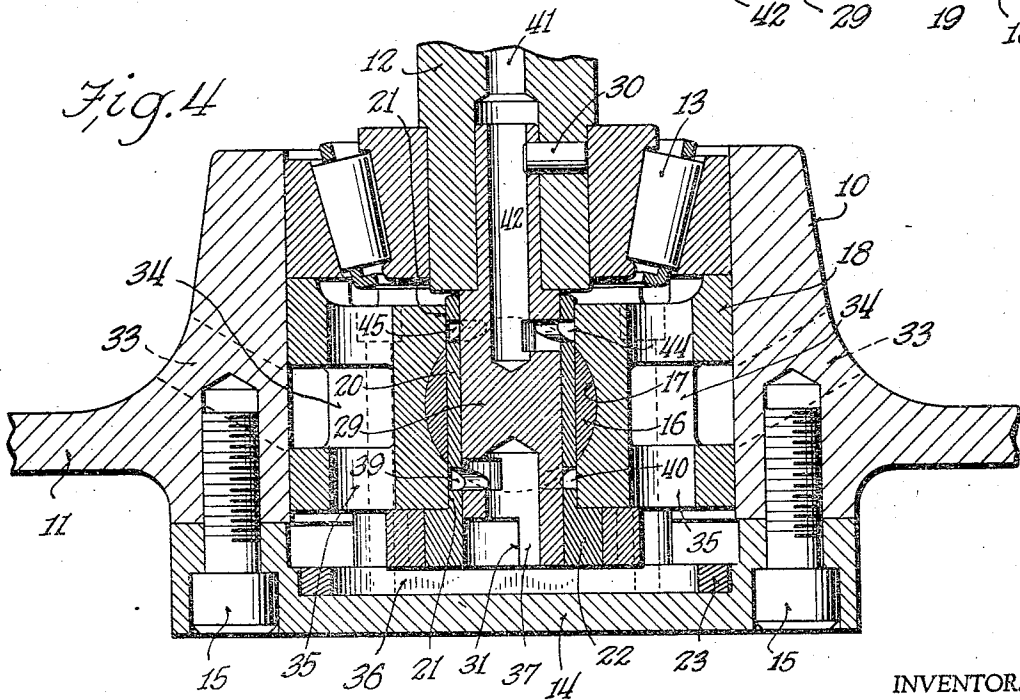
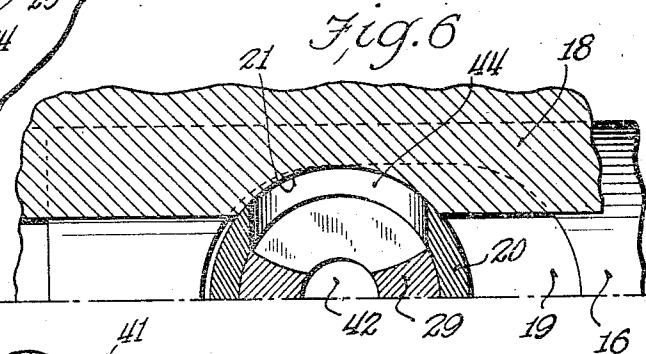
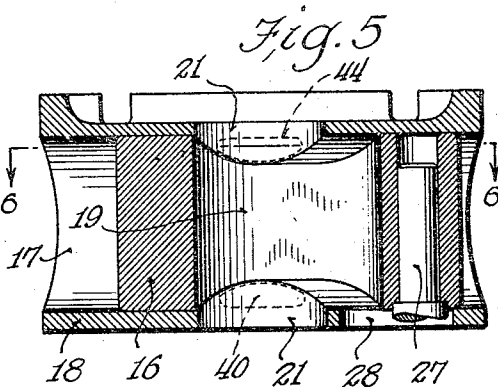
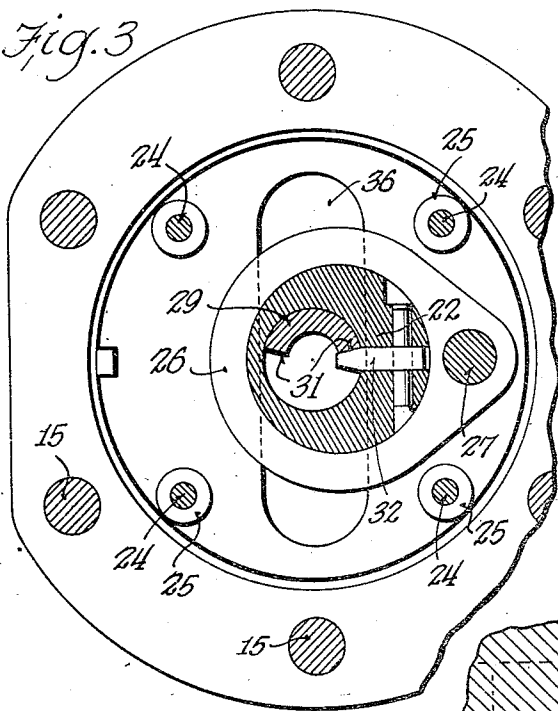
R. WIKEN

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2 Sheets-Sheet 2



INVENTOR.
RALPH WIKEN
BY *Ralph Wiken*
ATTORNEY.

UNITED STATES PATENT OFFICE

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PUMP

Ralph Wiken, Milwaukee, Wis., assignor to The Falk Corporation, Milwaukee, Wis., a corporation of Wisconsin

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6 Claims. (Cl. 103—158)

This invention relates to pumps and particularly to further improvements in pumps of the type disclosed in my copending application, Serial No. 229,438, filed September 12, 1938.

The pump disclosed in said application comprises a reciprocating chamber-forming member and a rotating liquid conducting member traversing the same and provided with ports for controlling the admission and discharge of liquid to and from the pump chamber. In pumps of that type, it is difficult to prevent by-passing of liquid through the ports from one end of the chamber to the other.

One object of the present invention is to overcome this difficulty. This I have accomplished by a novel arrangement which prevents communication of either port with either end of the chamber until communication thereof with the other end of the chamber has been blocked.

Another object is to further improve the construction and operations of pumps of this type.

Other more specific objects and advantages will appear from the following description of an illustrative embodiment of the present invention.

In the accompanying drawings:

Figure 1 is a vertical sectional view through a pump constructed in accordance with the present invention.

Figs. 2 and 3 are horizontal sectional views taken substantially along the lines 2—2 and 3—3, respectively of Fig. 1.

Fig. 4 is a vertical sectional view taken substantially at right angles to that of Fig. 1.

Fig. 5 is a longitudinal sectional view of the pump impeller with the pintle and bearing sleeve removed.

Fig. 6 is an enlarged sectional view taken along the line 6—6 of Fig. 5.

The pump selected for illustration is shown mounted in a hollow hub 10 formed in the bottom 11 of a gear casing where it is in position to receive lubricant from a surrounding reservoir in the bottom of the casing and to force the same up through a vertical hollow shaft 12 by which the pump is driven. The pump is confined between an appropriate shaft bearing 13 seated in the upper end of the hub 10 and a dished closure plate 14 removably attached to bottom of the hub, preferably by bolts 15.

The pump shown comprises a cylindrical impeller 16 closely fitted for lengthwise reciprocation in a horizontal bore 17 formed in a stationary block 18 fitted in the hub 10. A vertical opening 19 extending through the impeller 16 is closed at its top and bottom by the surrounding wall of the

bore 17 to form a pump chamber. This chamber is traversed by a vertical sleeve 20 closely fitted for rotation in appropriate openings 21 formed in the top and bottom of the block 18. The opening 19 in the impeller 16 is extended lengthwise of the latter, and the sleeve 20 makes contact with the side walls of the opening 19 so as to divide the pump chamber into separate end compartments which expand and contract as the impeller 16 reciprocates with respect to the sleeve 20.

The sleeve 20 extends upwardly from an eccentric disk 22, rotatable therewith and confined between the bottom of the block 18 and a non-rotating plate 23 seated upon the lower closure plate 14. The plate 23 is releasably attached to the block 18 by appropriate means, such as bolts 24, which extend upwardly therethrough and through spacer sleeves 25 and into the block 18. The disk 22 is freely rotatable within an encircling ring 26 which carries a vertical pin 27 that extends through a slot 28 in the block 18 into driving engagement with the impeller 16. The arrangement is such that lengthwise reciprocation of the impeller is effected by rotation of the sleeve 20 and eccentric disk 22.

The sleeve 20 and disk 22 are rotated from the shaft 12 through a pintle 29 constituting an extension thereof. The pintle 29 has a close rotating fit within the sleeve 20 and is fixed to the shaft 12 by a pin 30 or the like. The pintle 29 is partially cut away or otherwise fashioned to provide two shoulders 31 alternatively engageable with the end of an inwardly projecting pin 32 in the disk 22 to drive the latter. One of the shoulders 31 coacts with the pin 32 to drive the disk in one direction and the other in the other direction, the shoulders 31 being so spaced relatively to each other as to permit the pintle to turn through an angle of one hundred eighty degrees relative to the sleeve 20 and disk 22 whenever the direction of rotation of the shaft 12 is reversed. This idle motion between pintle and disk is provided for a purpose which will hereinafter appear.

Oil enters the pump from the surrounding reservoir in the casing 10 through ports 33 in the wall of the hub 10, and thence through arcuate recesses 34 in the sides of the block 18, through vertical ports 35 in the same block, through the space surrounding the disk 22 and ring 26, and through the open ends of a slot 36 in the plate 23 to a duct 37 in the lower end of the pintle 29. The duct 37 communicates with a lower port 39 in the sleeve 20 when the shaft is driven clockwise (Figs. 3 and 6) or with a second lower port 40 in the sleeve 20 when the shaft is driven

in the opposite direction. The pump discharges through a duct 41 in the drive shaft 12, this duct communicating with a duct 42 in the upper end of the pintle 29. Duct 42 communicates with an upper port 44 in the sleeve when the shaft is driven clockwise and with a second upper port 45 in the sleeve when the shaft is driven reversely. The arrangement is such that when the shaft 12, pintle 29, and sleeve 20 are rotating clockwise, as a unit, the lower pintle duct 37 communicates through the port 39 with the left end of the pump chamber during movement of the impeller 16 toward the left and with the right end of the chamber during movement of the impeller toward the right, and the upper pintle duct 41 communicates through the port 44 with the right end of the chamber during movement of the impeller toward the left and with the left end of the chamber during movement of the impeller toward the right.

The pump, fashioned and assembled as above described, operates in the following manner: With rotation of shaft 12 in a particular direction, for example clockwise in Figs. 2 and 3, shoulder 31 bears against pin 32 to thereby induce rotation of eccentric 22 and sleeve 20 with shaft 12. Ring 26 surrounding eccentric 22 swings about pin 27 so as to move freely in a direction transverse to channel 17, but is constrained to move bodily longitudinally of channel 17 together with pin 27. Rotary motion of cam 22 is thereby translated into reciprocatory motion of pin 27 and thus of impeller 16, which is moved back and forth lengthwise within channel 17. Since rotary shaft 29 and sleeve 20 completely span opening 19 in impeller 16, they divide opening 19 into segregated end chambers, which increase and decrease in size with reciprocation of impeller 16, so as to secure a pumping action against the rotary members. At the same time, rotation of the latter presents inlet and outlet ports 39 and 40 alternately to the opposite ends of the pump chamber, so that with contraction of the segregated space at one end of the chamber, oil will be forced through the outlet port 40 and duct 42, while at the same time the expanding opposite end of the chamber will be drawing oil through inlet port 39 and duct 37.

Provision is made for preventing communication of either duct with either end of the pump chamber until after communication thereof with the other end of the chamber has been broken. This is accomplished by blocking all of the ports at the instant the impeller reaches either end of its stroke. In the pump shown, the interior surfaces of the openings 21 in which the sleeve 20 is journaled are utilized for this purpose. In this connection it will be noted, particularly from Fig. 5, that by reason of the intersection of these vertical cylindrical openings 21 with the horizontal cylindrical bore 17 in which the impeller 16 reciprocates, the internal surfaces of those openings 21 at the opposite sides of the bore 17 extend inwardly beyond the upper and lower extremities of the bore; and as indicated particularly in Figs. 4, 5 and 6, the upper ports 44 and 45 in the sleeve 20 are so disposed and shaped as to be completely covered by the extended surfaces of the upper opening 21 and the lower ports 39 and 40 are similarly disposed and shaped so as to be completely covered by the extended surfaces of the lower opening 21, at each instant that the impeller 16 reaches an end of its stroke.

The inwardly extended surfaces of the upper and lower openings 21 thus form arcuate lands

which, during rotation of the pintle 29 and sleeve 20, momentarily but completely block communication between each pintle duct 41 and 37 and the ends of the pump chamber, and thus effectively prevent communication of either duct with either end of the pump chamber until communication with the other end of the chamber has been blocked.

As in the pump described in the application above identified, both ends of the bore 17 are preferably maintained flooded with oil received from the surrounding reservoir through ducts 46 extending through the wall of the hub 10.

It will be noted that the pump herein shown, including the block 18 and plate 23 may be removed, as a unit, with the shaft 12, upwardly from the hollow hub 10 for ready inspection and repair, and that after removing the lower closure plate 14 the pump may with equal facility be withdrawn, as a unit, downwardly from the hollow hub 10.

Various changes may be made in the embodiment of the invention hereinabove specifically described without departing from or sacrificing the advantages of the invention as defined in the appended claims.

I claim:

1. In a pump the combination of means forming a reciprocating pump chamber, a rotor separating the ends of said chamber and rotatable about a fixed axis disposed transversely of said chamber, said rotor having inlet and outlet ports each disposed to communicate with the opposite ends of said chamber alternately during rotation of said rotor, and means coacting with said ports for preventing simultaneous communication of either of said ports with both ends of said chamber.
2. In a pump the combination of means forming a reciprocating pump chamber, means spanning said chamber and restrained against reciprocation therewith to thereby effect a pumping action, said last named means including a rotor penetrating said chamber and rotatable about an axis disposed transversely of said chamber, said rotor having inlet and outlet ports in the periphery thereof each disposed to communicate with the opposite ends of said chamber alternately during successive strokes of said chamber, and means providing arcuate surfaces for sealing said ports at the end of each stroke of said chamber.
3. In a pump the combination of means forming a reciprocating pump chamber, means spanning said chamber and restrained against reciprocation therewith to thereby effect a pumping action, said last named means including a rotor separating the ends of said chamber and rotatable about an axis disposed transversely of said chamber, said rotor having inlet and outlet ports each disposed to communicate with the opposite ends of said chamber alternately during successive strokes of said chamber, and centering means for said rotor, said centering means having surfaces disposed to seal said ports at the end of each stroke of said chamber.
4. In a pump the combination of means forming a pump chamber, a member separating the ends of said chamber, and operating connections for effecting relative rotation and reciprocation between said member and means, said rotation being about an axis transverse to the direction of reciprocation, said member having inlet and outlet ports each disposed to communicate with the opposite ends of said chamber alternately during successive reciprocations, and means for closing

said ports at the end of each reciprocating stroke.

5. In a pump the combination of a block, an element reciprocable in said block and having an opening therein closed by said block to form a pump chamber, a rotor traversing said opening to thereby separate the ends of said chamber, said rotor being restrained against reciprocation with said element to thereby effect a pumping action, said rotor having inlet and outlet ports each disposed to communicate with the opposite ends of said chamber alternately in timed relation with reciprocation thereof, said block having an opening in which said rotor is journaled, and said last named opening being bounded by surfaces positioned to seal said ports as said element reaches the end of each reciprocating stroke.

6. In a pump the combination of a body portion having a cylindrical channel therein, a cy-

lindrical element fitted to reciprocate lengthwise of said channel and having an axially extended opening therein cooperating with said channel to form a chamber, said body portion having a second cylindrical channel intersecting said first named channel, and a rotor journaled in said second channel and disposed to separate the ends of said chamber, said rotor being connected to operate in timed relation with said element and having inlet and outlet ports each adapted to communicate with the separated ends of said chamber alternately during reciprocation of said element, and said ports being disposed to cross and recross the line of intersection between said channels during rotation of said rotor whereby said ports are momentarily closed by the walls of said second channel at each end of the strokes of said member.

RALPH WIKEN.