

July 13, 1943.

A. RAPPL ET AL

2,324,023

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2 Sheets-Sheet 1

FIG. 2.

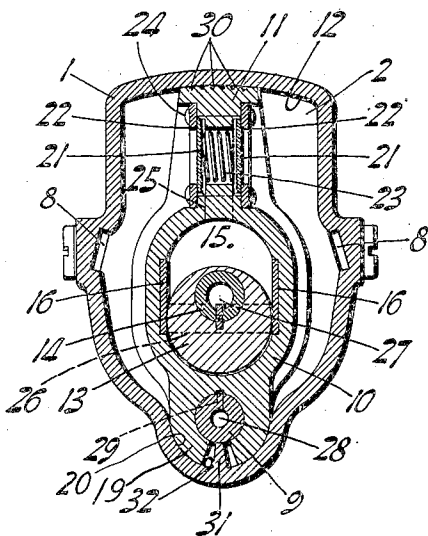


FIG. 1.

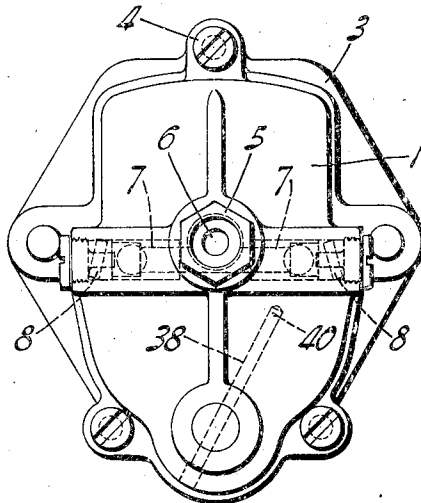
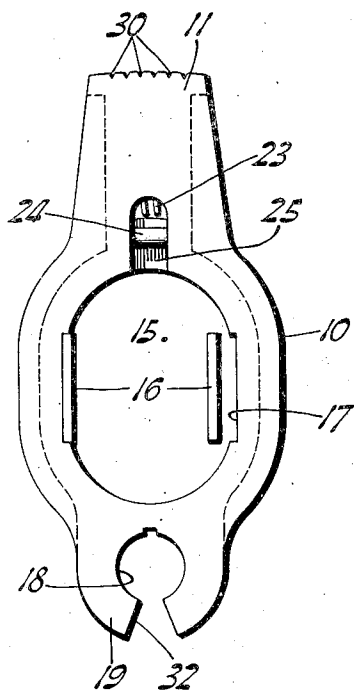


FIG. 3.

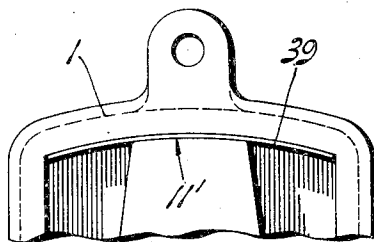
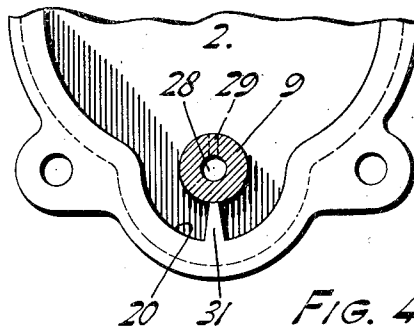


FIG. 4.

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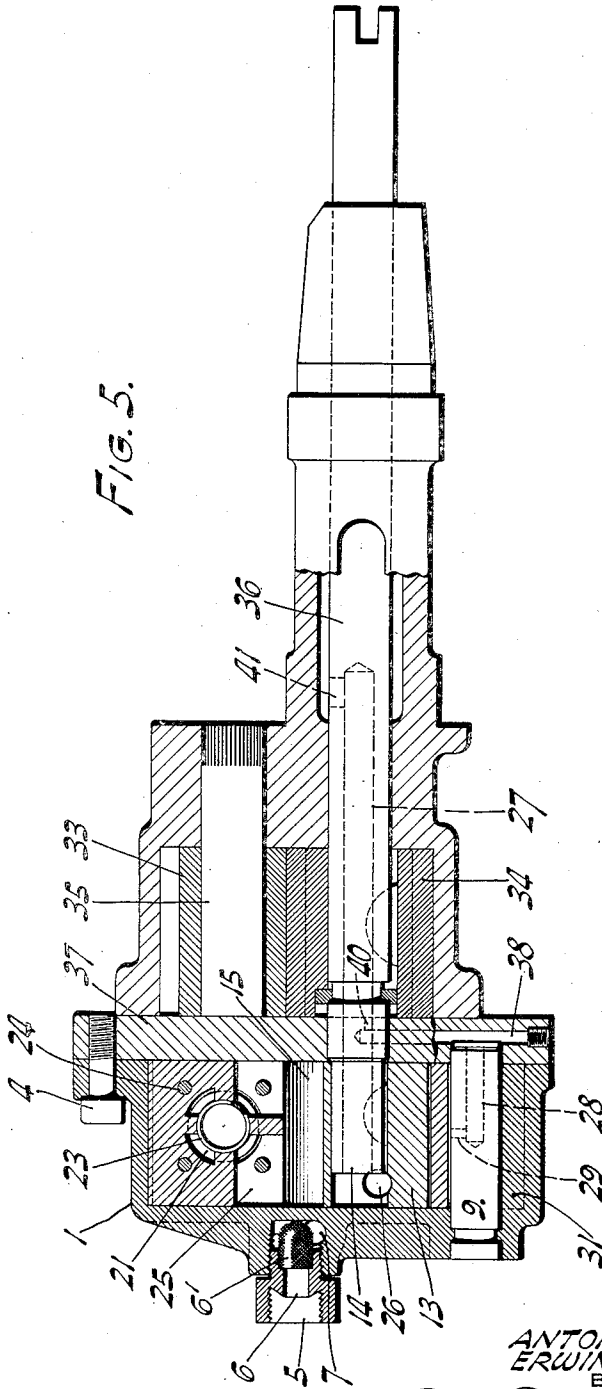
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UNITED STATES PATENT OFFICE

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PUMP

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Application August 2, 1939, Serial No. 287,979

9 Claims. (Cl. 230-159)

This invention relates to pumps and has particular application in the automotive field as a source of suction for the operation of motor vehicle accessories, such as windshield cleaners.

It has heretofore been proposed to provide a vane type fluid pump, utilizing the oscillating vane for the displacement of air or gas wherein the sliding contact of the vane-like piston on the chamber walls has been sealed by a lubricant.

Practical experience has demonstrated that in certain positions of the pump the sealing liquid is more efficacious than in other positions.

The primary aim of the present invention is to provide a pump of this character which is equally efficient under all circumstances, an object of the invention being to provide improved means whereby the fluid displacing member may be effectively sealed by the sealing liquid. The invention further resides in certain salient features of construction by which the efficiency of the pump is greatly improved.

In the drawings:

Fig. 1 is an elevation of the improved pump;

Fig. 2 is a transverse vertical section thereof;

Fig. 3 is a detailed elevation of the vane or fluid displacing member with one of the wear pads removed;

Fig. 4 is a fragmentary view of the pump with the cover plate removed and showing the modified embodiment of the invention; and

Fig. 5 is a longitudinal vertical section through the pump mechanism as combined with the oil pump of a motor vehicle power plant.

Referring more particularly to the drawings, the numeral 1 designates the casing having a chamber 2 and a cover plate 3 secured to the casing by suitable fasteners 4. The casing is provided with a nipple 5 for connection to a suction operated accessory. The passage 6 through the nipple may be provided with a filter element 6' and branch through valved inlet ports 7 leading to passageways 8 formed in the opposing side walls of the chamber 2. Pivotaly mounted within the chamber by a shaft 9 is a fluid displacing member in the form of a vane 10 which has its outer end 11 of arcuate form for wiping contact on the similarly shaped end wall 12 of the chamber. The vane is oscillated by a cam 13 fixed on a drive shaft 14 and operating within a second chamber 15, the latter being formed within the vane 10, so that as the cam is rotated the vane will be oscillated about its support 9. Hardened wear plates or pads 16 are provided at the opposite sides of chamber 15 for

being constantly wiped by the cam during its rotary movement. These wear plates are removably fitted within recesses 17 in the side walls of the chamber 15 and are held against displacement by their close fit with the periphery of the cam. The shaft 9 is received within a bearing 18 for relative pivotal action, and the adjacent end of the vane is shaped concentrically as at 19 for sliding contact upon the adjacent end wall surface 20 of the chamber 2.

For discharging the displaced air or fluid from the chamber 2, the piston is provided with a transversely arranged valve chamber which opens through the opposite faces thereof and in which are disposed a pair of valve discs 21 and an interposed spring 23, the latter serving to yieldably hold the valves outwardly in closed position against seat forming plates 22. These plates are conveniently secured in place by fastener elements 24 extending through the piston body. The valve chamber also opens into chamber 15 by channels 25 so that as the fluid is displaced from chamber 2 it will unseat alternately the valves 21 and pass into chamber 15 from whence it flows through a chordal passage 26, provided in the cam 13, and into the axial bore 27 formed in the shaft 14. Any air which passes entirely through the chordal passage 26 and into the lower end portion of the cam chamber 15 will merely surge back and forth, in a breathing manner, as the cam enlarges and ensmalls the chamber portion.

For sealing the clearance between the piston and the walls of chamber 2 a small quantity of sealing liquid, such as oil, is admitted through an axial passage 28 provided in shaft 9 and discharges through a radial port 29 into the bearing 18 from whence the lubricant will flow to the several sliding points of contact. For more effectively sealing the outer end of the piston a series of transverse grooves 30 are formed therein in opposition to the end wall surface 12 so as to collect and hold sufficient sealing liquid even though this portion of the pump may be mounted in an upright position with the shaft 9 disposed in a lower and horizontal plane.

To forestall the passage of air from one side of the vane to the opposite side thereof between the wall surfaces 19 and 20, there is provided a web 31 serving to close the space between the shaft 9 and such wall 20 so as to provide in effect an increased path about the shaft 9. By reason of the presence of the sealing liquid this distorted path will effectively prevent the passage of air about the adjacent end of the piston. To

accommodate the web 31 the adjacent end of the piston is formed with a segmental opening 32 of sufficient size to permit the oscillatory movement.

While the shaft 14, to which the cam is fixed, may be rotated in any desired manner, there has been shown in Fig. 5 an arrangement by which the suction pump derives its power from the oil pump of a motor vehicle power plant. In this illustration the intermeshing gears 33 and 34, which constitute the pumping elements of the oil pump, are mounted on shafts 35 and 36, the latter being extended for operative connection to the engine cam shaft. In this adaptation a special cover plate 37 will be provided between the two pumps with an oil duct 38 delivering oil from the pressure side of the oil pump to the shaft passage 28 for sealing the suction pump. The cam shaft 14 may be an integral continuation of the oil pump shaft 36.

In lieu of the oil grooves 30 a very thin flat steel plate 39 may be inserted between the end walls 11' and 12 so that the piston will substantially conform the plate to the curvature of the wall 12 while still maintaining good contact with the end wall 11' of the piston.

In operation the cam 13 will be rotated from the oil pump shaft to oscillate the piston within the chamber 2. The sealing oil will be supplied to the duct 38 through a small orifice 40 and will find its way into the bearing 18 and other sliding contacts within the chamber 2. Air will be withdrawn through inlet opening 6 first through one valve to passage 7 and then the other, while the air in front of the piston will be discharged through valve 21 and passage 25 into chamber 15, and thence through the shaft passage 27 which will be extended through the oil pump shaft 36 for radial discharge through port 41 into the engine crank case. With the discharge of the air the spent sealing oil will also be expelled. As the sealing fluid enters the bearing 18 it will not only seal the clearance about the shaft 9 but also the clearance between wall surfaces 19 and 20 so as to make it practically impossible for the fluid being pumped to traverse the distorted path by reason of the web 31, the latter having preferably a mechanically tight fit with the shaft 9. While the oil grooves may be extended around the sides of the piston if desired, this has been found unnecessary in practical use.

While the invention has been described for use as a suction pump, it is obvious that the same may be used as an air compressor or for the pumping of liquids. The detailed description has been given for the sake of clearness since the inventive principles herein involved are obviously capable of assuming other physical embodiments without departing from the spirit or scope of the invention claimed.

What is claimed is:

1. A pump comprising a casing having a chamber with inlet and outlet means, a shaft arranged in the chamber adjacent one wall thereof, a web extending between the wall and shaft and closing the space therebetween, a fluid displacing member dividing the chamber into pumping compartments and having a bearing receiving the shaft, said bearing being formed with a segmental cut-out to straddle the shaft and extend on opposite sides of the web with sufficient clearance to permit oscillation of the displacing member, and means for oscillating the fluid displacing member.

2. A pump comprising a casing having a

chamber with inlet and outlet means, a shaft arranged in the chamber adjacent one wall thereof, a web extending between the wall and shaft and closing the space therebetween, a fluid displacing member dividing the chamber into pumping compartments and having a bearing receiving the shaft, said bearing being formed with a segmental cut-out to straddle the shaft and extend on opposite sides of the web with sufficient clearance to permit oscillation of the displacing member, means for oscillating the fluid displacing member, and means for supplying the chamber with a sealing quantity of liquid, the end of the fluid displacing member which is remote from said bearing being formed with a liquid holding recess for entrapping some of the sealing liquid.

3. A pump comprising a casing having a chamber with inlet and outlet means, a shaft arranged in the chamber adjacent one wall thereof, a web extending between the wall and shaft and closing the space therebetween, a fluid displacing member dividing the chamber into pumping compartments and having a bearing receiving the shaft for oscillation of said fluid displacing member, said bearing being formed with a segmental cut-out to straddle the shaft and extend on opposite sides of the web with sufficient clearance to permit oscillation of the displacing member, means for supplying the bearing with a sealing quantity of liquid, a thin packing plate interposed between the end of the fluid displacing member which is remote from said bearing and the adjacent end wall of the chamber opposite to the shaft and made to conform to said chamber wall by the member, said plate being retained in position by other wall portions of the chamber, and means for oscillating the fluid displacing member.

4. A pump comprising a casing having a chamber with a shaft arranged therein adjacent one wall thereof, a relatively thin web extending radially from the shaft to the wall with the shaft extending on opposite sides of the web, a fluid displacing member dividing the chamber into pumping compartments and having a bearing receiving the shaft for oscillation of the fluid displacing member, said bearing extending about the shaft an extent greater than one-half the circumference of the shaft for suspension support therefrom and being formed with a segmental cut-out to straddle the shaft and extend on opposite sides of the web with sufficient clearance to permit oscillation of the displacing member, said fluid displacing member being provided with an opening, a cam journaled in the casing and operating in the opening to oscillate said member, said cam being provided with an exhaust opening, and valved inlet and outlet means for the casing chamber, the valved outlet means being carried by the fluid displacing member and discharging into the cam opening thereof for exhausting through the exhaust opening.

5. A pump comprising a casing having a chamber, a fluid displacing member dividing the chamber into pump compartments and movable back and forth therein for displacing fluid first from one side and then the opposite side thereof, said member having an opening therein extending transverse to the direction of movement of the fluid displacing member, and a cam journaled in the casing and rotatable in the opening of the fluid displacing member with the periphery of the cam being in driving contact with the opposite side walls of the opening, the cam having a passage opening through its periphery at points

spaced with respect to each other and communicating with a second passage therein coaxial with the axis of rotation of the cam, a valve chamber in the fluid displacing member communicating with the pump compartments and also with the cam receiving opening, valve means in said valve chamber, the pump having inlet and outlet means, one of which inlet and outlet means includes the line of fluid communication as provided by the valve chamber and the cam passages.

6. A pump comprising a casing having a chamber with inlet and outlet means, a shaft arranged in the chamber adjacent one wall thereof, a fluid displacing member pivotally hung on the shaft and dividing the chamber into two pumping compartments, the end of the member remote from the pivot having liquid sealed contact with the opposite chamber wall, said member having an opening therein extending transversely to the direction of movement of the fluid displacing member, and a cam journaled in the casing and rotatable in the opening of the fluid displacing member with the periphery of the cam being in driving contact with the opposite side walls of the opening, the cam having a passage opening through its periphery at points spaced with respect to each other and communicating with a second passage extending axially therethrough, said displacing member having a valve chamber opening through the opposite sides thereof and formed with opposed seats, the passages in said cam and the valve chamber in said displacing member comprising said outlet means, a pair of valves within the valve chamber, and a spring interposed between the valves to yieldably hold them to their seats, either valve being unseated by a preponderance of fluid pressure in its adjacent pumping compartment, said valve chamber communicating with the cam receiving opening, said casing chamber being provided with an inlet passage communicating with the inlet means.

7. A pump comprising a casing having a chamber, a fluid displacing member dividing said chamber into pump compartments and oscillatable therein for displacing fluid first from one side and then the opposite side thereof, said member having an opening therein extending transversely to the direction of movement of the fluid displacing member, and a cam journaled in the casing and rotatable in the opening of the fluid displacing member with the periphery of the cam being in driving contact with opposite side walls of the opening, the cam having a passage opening through its periphery at spaced

points and communicating with a second passage extending axially thereof, a valve chamber in the fluid displacing member communicating with the pumping compartments at opposite sides thereof and also with the cam receiving opening, uni-directional valve means in said valve chamber permitting fluid flow in one direction only in the line of fluid communication provided by the valve chamber and the cam passages, the pump having inlet and outlet means, one of which includes the line of fluid communication provided by the valve chamber and the cam passages.

8. A pump comprising a casing having a chamber with inlet and outlet means, said chamber having opposed walls, a shaft arranged in the chamber adjacent one wall thereof, a fluid displacing member pivotally hung on the shaft and dividing the chamber into two pumping compartments, the end of the member remote from the shaft having liquid sealed contact with the chamber wall which is in abutting relation therewith, means independent of said shaft and engaging the fluid displacing member to oscillate the same, said member having a valve chamber opening through the opposite sides thereof and formed with opposed seats, a pair of valves within the valve chamber, and a spring interposed between the valves to yieldably hold them to their seats, and a fluid passage in said fluid displacing member oscillating means, said valve chamber being in communication with said fluid passage and forming with the latter a part of one of said inlet and outlet means.

9. A pump comprising a casing having a chamber with inlet and outlet means, a shaft arranged in the chamber adjacent one wall thereof, a web extending between the wall and shaft and closing the space therebetween, a fluid displacing member dividing the chamber into pumping compartments and having a bearing receiving the shaft, said bearing being formed with a segmental cut-out to straddle the shaft with a fluid tight seal and extend on opposite sides of the web with sufficient clearance to permit oscillation of the displacing member, an end of the fluid displacing member contacting the wall portion of the chamber which is opposite to and remote from said shaft and being provided with a series of shallow transverse grooves facing said opposite wall for affording fluid tight seal with such wall of the chamber which is remote from said shaft, and means for oscillating the fluid displacing member.

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