Nov. 20, 1951 J. SCHROEDER 2,575,398

DIAPHRAGM PUMP

Filed Sept. 26, 1949 2 SHEETS—SHEET 1

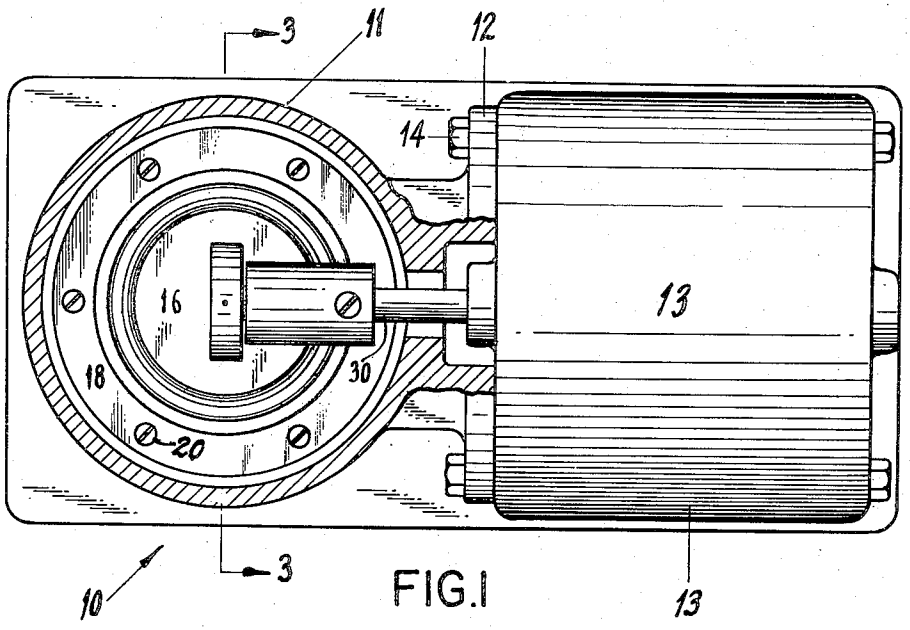

FIG.1

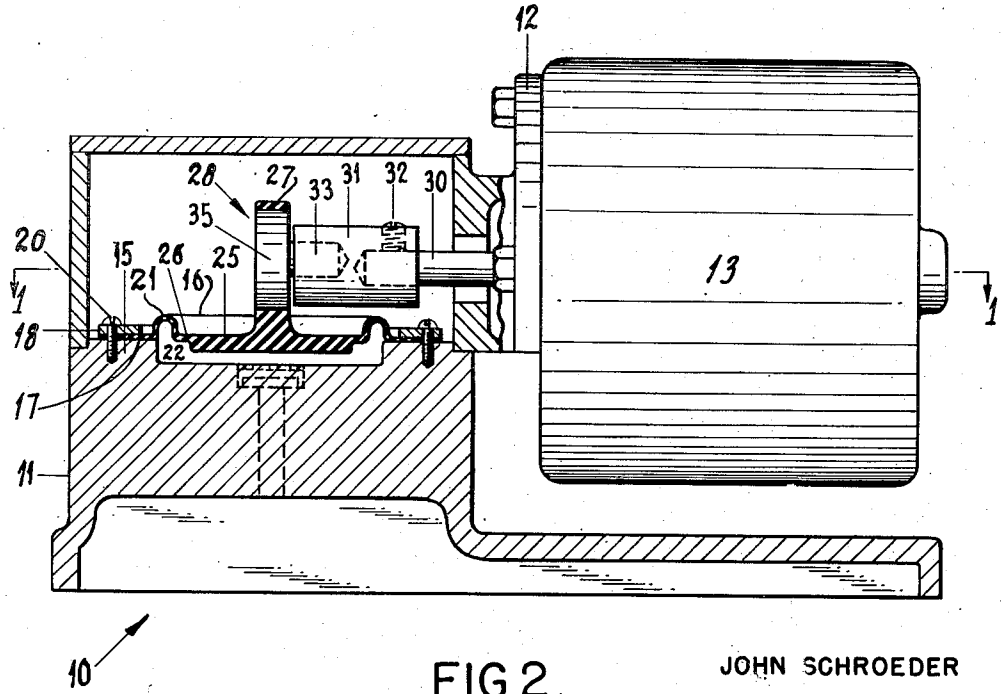

FIG.2

JOHN SCHROEDER
INVENTOR

BY Joseph Blacker

ATTORNEY

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DIAPHRAGM PUMP

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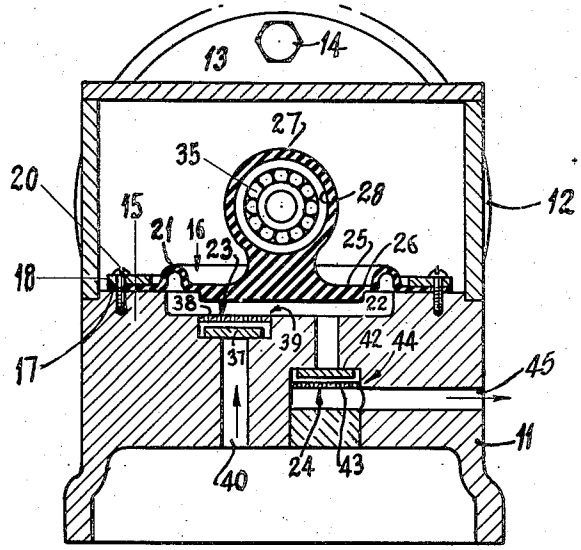

FIG. 3

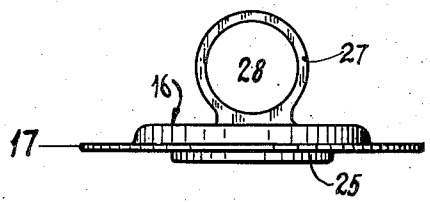

FIG. 4

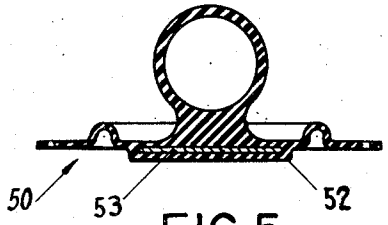

FIG. 5

JOHN SCHROEDER
INVENTOR

BY Joseph Blacker

ATTORNEY

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DIAPHRAGM PUMP

John Schroeder, New York, N. Y.

Application September 26, 1949, Serial No. 117,755

1 Claim. (Cl. 103—152)

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This invention relates to new and useful improvements in two-way drive-member-actuated diaphragm pumps, and an object of this invention is to provide a positively driven pump of simple and inexpensive construction.

Another object of this invention is to provide an air pump comprising a valve head having an elastic diaphragm secured thereto and covering a cavity in communication with inlet and outlet valves, and to provide a rotatable eccentric to move the diaphragm for both the suction and compression strokes.

In prior practice, in the construction of diaphragm pumps an attempt to eliminate parts and the resulting friction and expense has resulted in a diaphragm pump construction wherein the diaphragm was stretched during the downward stroke and the stretched and tensioned diaphragm returned to its normally flat form and caused the inlet valve to refill the valve cavity with air. This stretch in the rubber, which was pure gum, did not last long because pure gum rubber is sensitive to heat, oil, etc., and deteriorates and makes the pump inoperative after short use.

I have found that by using neoprene or synthetic rubber and by molding the diaphragm with an integral upstanding hollow extension in which the ball bearing drive member is housed, that there is no necessity for relying on the stretch and resiliency of the rubber because the ball bearing drive member becomes a two-way drive and results in a two-way drive-member-actuated diaphragm pump. This rubber mounting for the ball bearing eliminates all friction and lubrication troubles and the pump is free of maintenance troubles.

With the above and other objects in view, the invention will be hereinafter more particularly described, and the combination and arrangement of parts will be shown in the accompanying drawings and pointed out in the claim which forms part of this specification.

Reference will now be had to the drawings, wherein like numerals of reference designate corresponding parts throughout the several views, in which:

Figure 1 is a plan view of the pump, with the pump cover shown in cross-section, the section being taken as on line 1—1 in Figure 2.

Figure 2 is a central cross-sectional view of the pump, the cover being partly broken away.

Figure 3 is a cross-sectional view taken on line 3—3 in Figure 1.

Figure 4 is an elevational view of the diaphragm.

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Figure 5 is a central cross-sectional view of a modified diaphragm having a reinforcing rigid insert in the central portion of the diaphragm.

In the illustrated embodiment of the invention, the numeral 10 indicates a two-way drive-member-actuated diaphragm pump comprising a pump casing 11, having a flange 12 and an electric motor 13 secured thereto by bolts 14.

The casing 11 comprises a valve head 15. A molded diaphragm 16 having an annular flange 17 is clamped to lie flat on the upper face of the valve head 15 by an annular member 18 lying on the flange 17 and secured by screws 20. The diaphragm 16 is made of elastic synthetic rubber, such as "neoprene."

The diaphragm 16 has a hollow circular rib 21 adjoining the circular flange 17 and positioned over a cavity 22 in the valve head 15. The cavity 22 is in communication with inlet and outlet valves 23 and 24.

The diaphragm 16 has a thick and substantially rigid central disk-shaped portion 25 which is connected to the rib 21 by a thin portion 26. At the center of the diaphragm 16 and at the center of the central portion 25 is an integral upstanding extension 27 having an opening 28.

The motor 13 has a shaft 30 extending across and centrally of the diaphragm 16. A collar 31 is secured to the shaft 30 by a screw 32 and has a pin 33 fixed therein in offset relation from the shaft 30. A ball bearing 35 is mounted on the pin 33 and is rotated in eccentric relation with the motor shaft.

The inlet valve 23 has a disk 37 spaced from a perforated metal disk or screen 38 which is held in fixed position in a circular opening 39 in the valve head 15. Air is fed from an upright inlet passage 40 of smaller diameter than the valve 23.

The outlet valve 24 has a disk 42 spaced from a perforated metal disk or screen 43 which is held in fixed position in a circular opening 44 in the valve head 15. Air is discharged from a horizontal outlet passage 45 of smaller diameter than the valve 24.

The diaphragm 16 is secured by the screws 20 passing through the diaphragm. When the motor 13 is operated, movement is imparted by the eccentrically mounted ball bearing to the diaphragm.

Upward movement of the ball bearing 35 causes the diaphragm to return to its normally flat form, thereby refilling the valve cavity 22. The motor shaft 30 is positioned diametrically of the diaphragm 16 so that it is moved up and down freely and these movements are facilitated by

the hollow circular rib 21 without putting any excessive stress on the diaphragm and this results in maximum life for the diaphragm 16 and for the pump 10. Figure 4 is an elevational view of the diaphragm shown in Figures 1 to 3 inclusive.

Figure 5 is a central cross-sectional view of a modified diaphragm 50 wherein the central disk-shaped portion 52 has a rigid disk 53 molded therein. This rigid disk insert makes the central portion 52 of the diaphragm 50 to assume the rigidity of a piston or plunger without any attendant noise resulting from designs of diaphragms where a rigid disk member is placed externally of the diaphragm. The remainder of the modified diaphragm 50 is like the diaphragm 16 in all other respects and needs no further description.

It will thus be seen that I have provided a two-way drive-member-actuated diaphragm pump which can pump air, water or any other fluid with equal facility and without any modification of the structure disclosed.

The importance of the hollow flexible circular or annular rib 21 arises from the fact that when the ball bearing moves from side to side, a thrust is developed tending to position the bottom surface of the diaphragm in angular relation with the horizontal surface of the cavity 22. The hollow rib serves to absorb the strain due to the thrust caused by the eccentric motion of the ball bearing or eccentric member.

In accordance with the patent statutes I have described and illustrated the preferred embodiment of my invention, but it will be understood that various changes and modifications can be made therein without departing from the spirit of the invention as defined by the appended claim.

I claim:

In a diaphragm pump, a valve head having a cavity, a one-piece molded diaphragm made of synthetic rubber and having an outer flange mounted on said valve head, said diaphragm being in spaced-apart relation from the bottom surface of said cavity, a rigid annular member clamping said flange to said valve head, said diaphragm comprising a rigid inner disk-like member having an apertured upright portion, said diaphragm having a hollow flexible annular rib connecting said outer flange and said rigid inner disk-like member, a rotatable shaft, an eccentric member carried by said shaft, said upright portion having a hollow rubber housing in which said eccentric member is mounted, thereby forming a two-way drive-member-actuated diaphragm pump, inlet and outlet valves mounted in said valve head, rotation of said eccentric member, causing said rigid inner disk-like member to move in one direction to expel the air from said cavity and to move in the opposite direction to return said diaphragm and cause said inlet valve to refill said cavity with air, said flexible annular connecting rib serving to absorb the thrust caused by the motion of said inner rigid member by said eccentric member.

JOHN SCHROEDER.

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