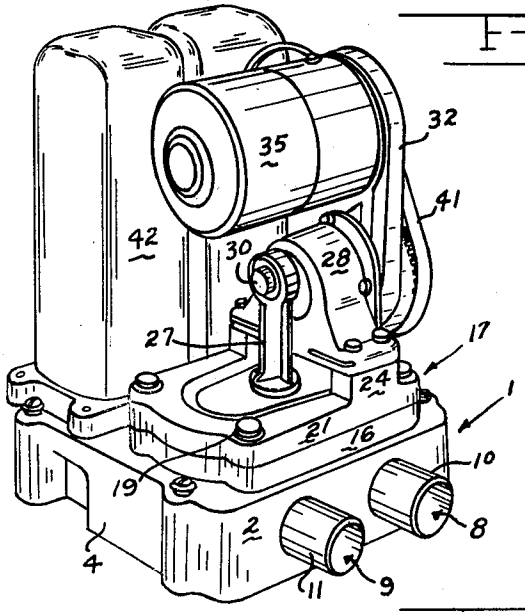
Sept. 22, 1964 L. E. RUSSELL 3,149,576

PUMP

Filed July 27, 1960 2 Sheets-Sheet 1

Fig-1



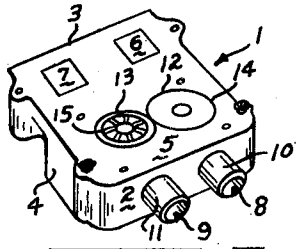
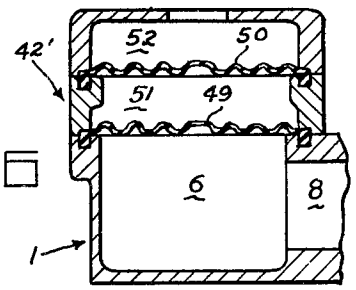


Fig-2

Fig-6



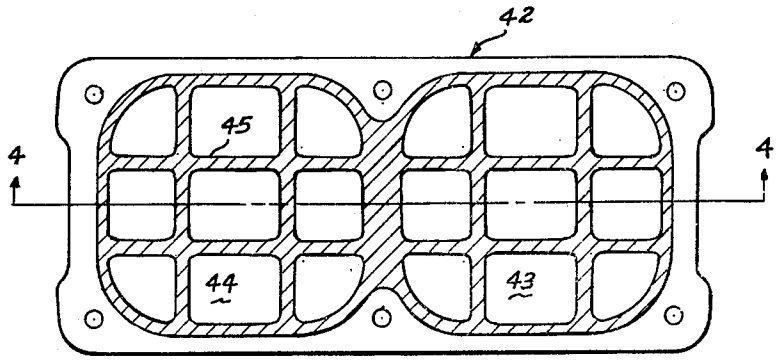


Fig-5

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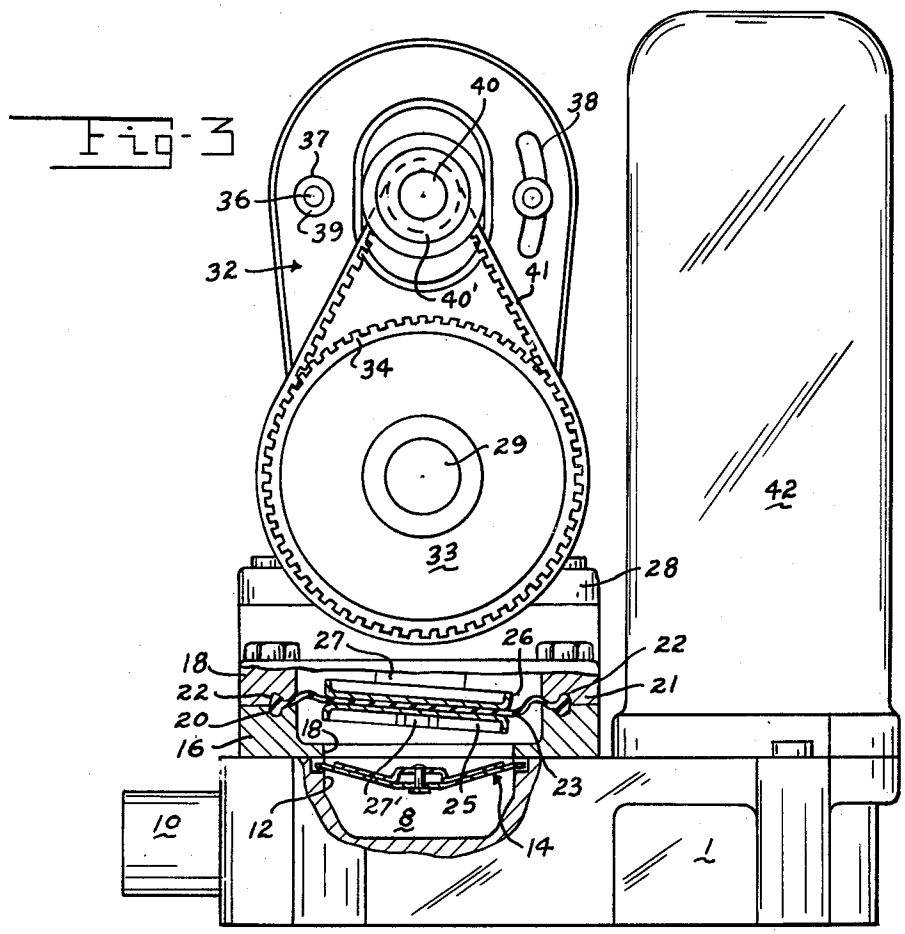
Fig-3



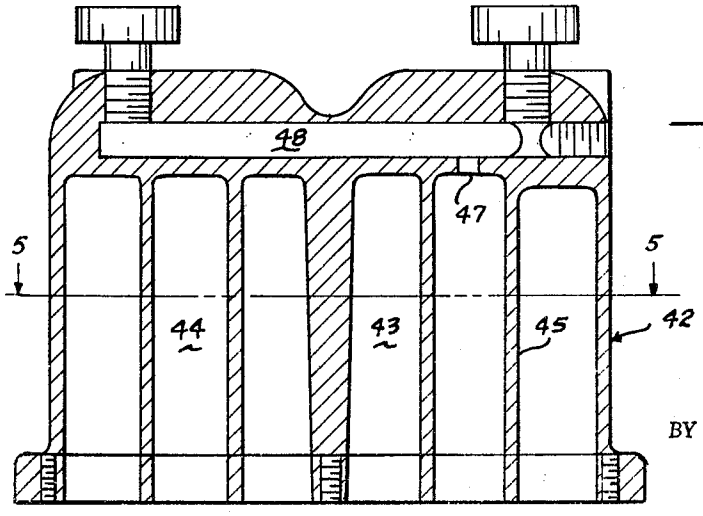


Fig-4

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United States Patent Office 3,149,576 Patented Sept. 22, 1964

3,149,576

PUMP

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Filed July 27, 1960, Ser. No. 45,641
12 Claims. (Cl. 103—152)

This invention relates to diaphragm type pumps and will be particularly described herein with reference to its embodiment in a bilge pump.

Bilge pumps of the prior art are many times beset with operational malfunction. Also, in a great many cases they are prone to be noisy and erratic in their pumping action. Corrosion and electrical difficulties are prime factors in problems prevalent in the use of bilge pumps. These problems are magnified due to the fact that many bilge pumps are structurally complex in a sense that important elements are relatively inaccessible and they are difficult to disassemble. The latter creates maintenance problems.

The present invention overcomes many of the difficulties incident to use of prior bilge pumps. It provides a pump which runs dry, has high lift and positive displacement. Embodiments are simply constructed and quiet and steady in operation. They embody positive drive systems and novel surge chambers which produce maximum efficiency at minimum cost. Moreover, the invention pump reduces maintenance problems to a minimum due to the accessibility of its various components.

A primary object of the invention is to provide improvements in bilge pumps and the like whereby they may be more economically manufactured, more efficient and satisfactory in use, more versatile in application and unlikely to malfunction.

A further object of the invention is to simplify the construction of pumps in a manner to reduce their maintenance cost to a minimum.

Another object of the invention is to provide a pump having novelly improved surge chambers.

An additional object of the invention is to provide a bilge pump or the like having surge chambers so oriented as to insure a smooth, quiet non-pulsating pumping operation.

A further object of the invention is to provide a pump which is so constructed as to be essentially friction free in operation.

Another object of the invention is to provide a bilge pump or the like which provides high lift and positive displacement, enabling its installation considerably above water level.

A further object of the invention is to provide an improved diaphragm type pump that has natural ventilation and can run dry.

A further object of the invention is to provide pump apparatus possessing the advantageous structural features, the inherent meritorious characteristics and the mode of operation herein mentioned.

With the above and other incidental objects in view as will more fully appear in the specification, the invention intended to be protected by Letters Patent consists of the features of construction, the parts and combinations thereof, and the mode of operation as hereinafter described or illustrated in the accompanying drawings, or their equivalents.

Referring to the accompanying drawing wherein is shown one but obviously not necessarily the only form of embodiment of the invention.

FIG. 1 is a perspective view of a bilge pump constituting an embodiment of the invention;

FIG. 2 is a perspective of the base of the pump of FIG. 1;

FIG. 3 is a side elevation of the pump of FIG. 1 with parts broken away for clarity of disclosure;

FIG. 4 is a cross sectional view of the surge chambers in accordance with the invention taken on line 4—4 of FIG. 5;

FIG. 5 is a cross sectional view taken on line 5—5 of FIG. 4; and

FIG. 6 is a fragmentary view illustrating a modification of the pump of FIG. 1.

Like parts are indicated by similar characters of reference throughout the several views.

The pump shown includes a generally rectangular base 1 having a front face 2, a back face 3, sides 4 and a top surface 5. A pair of generally rectangular cavities 6 and 7 are formed in the upper surface of the base 1 adjacent the back side 3. The cavities 6 and 7 are laterally aligned and extend substantially the depth of the base.

Parallel inlet and discharge passages 8 and 9 are formed in and adjacent the bottom of base 1 to respectively open at one end into the bottoms of the respective cavities 6 and 7 and at their other ends from the front face 2. Tubular adapters 10 and 11 are fixed in the front face 2 to respectively define the openings to the passages 8 and 9.

A pair of laterally aligned cylindrical recesses 12 and 13 are formed in the upper surface of base 1 adjacent its front face 2. The recess 12 is open at its bottom to the passage 8 while the recess 13 is open at its bottom to the passage 9. Each of the recesses 12 and 13 is counter-bored to provide shoulders inwardly thereof respectively seating an intake valve unit 14 and a discharge valve unit 15 in bridging relation thereto. The units 14 and 15 provide conventional one way valving action as will be further described.

Bolted over the base 1 adjacent its front face 2, is the base plate 16 of a diaphragm holder 17. The plate 16 has an elliptical recess centrally of its upper surface. A pair of apertures 18 and 19 provided in the recessed portion of plate 16 are arranged to align with the respective recesses 12 and 13. The plate 16 also has an elliptical groove 20 in its uppermost surface bounding the apertures 18 and 19.

The top plate 21 of the holder 17 is superposed on the plate 16 and has a peripheral configuration identical therewith. The plate 21 has an elliptical aperture centrally thereof and a groove 22 in its bottom which mates with the groove 20. The grooves 20 and 22 mutually accommodate the beaded periphery of a flexible diaphragm 23 having an elliptical configuration. The diaphragm 23 is thereby fixed to bridge the elliptical aperture in plate 21 over and in spaced relation to the valve units 14 and 15 and form a chamber therebetween. The plate 21 also has opposite vertical projections 24 to front and rear edges thereof adjacent one end.

Elliptical plates 25 and 26 are fixed to opposite sides of diaphragm 23 by a bolt 27' which extends centrally therethrough to project vertically and engage them to the dependent extremity of an arm 27. The plates 25 and 26 are centered on the diaphragm and extend substantlaily the length and width thereof. It is provided that these plates, which are dishshaped outwardly from the diaphragm in opposite directions, are rimmed by a flexible fold of the diaphragm, as may be seen in FIG. 3 of the drawings.

The projections 24 on top plate 21 support a bearing block 28 adjacent the arm 27. The block 28 rotatably mounts a shaft 29 having an eccentrically projected extremity 30. The eccentric projection 30 extends through a bearing 31 fixed in the annularly formed upper extremity of the arm 27. As may be readily seen, drive of shaft 29 produces an eccentric movement of the arm 27 as and for purposes to be further described.

A plate 32 is fixed to the outer face of bearing block 28 adjacent one end of plate 21 to project vertically in a plane perpendicular thereto. Plate 32 has an aperture for extension of shaft 29 therethrough. Shaft 29 has a large pulley 33 fixed to its projected extremity remote from the eccentric 30. The pulley 33 has teeth 34 peripherally thereof in the manner of a gear.

A motor 35 is connected to project perpendicular to plate 32 over and in spaced relation to the shaft 29 and diaphragm holder 17. The motor bolts 36 project from one end abutting plate 32 respectively through an aperture 37 and an arcuate slot 38 therein, to have nuts 39 adjustable thereon to fix the motor to the plate.

An opening in plate 32 intermediate aperture 37 and slot 38 accommodates the projection of the motor shaft 40 therethrough above and parallel to shaft 29. The shaft 40 mounts a small pulley 40' similar to and coplanar with the gear pulley 33. A gear type continuous flexible belt 41 having teeth to its inner face operatively engages thereby about the pulleys to give the effect of a positive power transmission therebetween without the friction, noise, or lubrication problems incidental to the use of a conventional gear drive.

It will be obvious that the motor 35 can be quickly removed from plate 32 by merely disconnecting the two motor bolts. Also, release of the tension on the pulley belt 41 can be readily achieved by merely loosening the nut 39 on the bolt 36 extending through slot 38 and moving the bolt in the slot to the degree necessary.

Mounted over the base 1, to its rear, is an integral shell-like unit 42 providing surge chambers 43 and 44 respectively over cavities 6 and 7. Each surge chamber provides a hollow cavity open to its bottom to the respective cavities 6 and 7. Vertical plates 45 in spaced parallel relation are rectangularly intersected by other plates at right angles thereto to provide vertical baffles defining a plurality of vertical recesses in the surge chambers.

The one of the surge chambers over cavity 6 communicates by means of an aperture 47 with a horizontal pressure passage 48 in the unit 42. Pressure switches are schematically shown in communication with the passage 48 in the even they are needed.

A complete novelly fabricated pump is thus provided in accordance with the invention. Its construction is of the utmost simplicity. It is built in the manner of stacking blocks. The base 1 has the plates 16 and 21 of the diaphragm holder and the surge chamber unit 42 simply stacked and bolted thereto. The diaphragm 23 is fixed relative the base 1 and over valve units 14 and 15 in the very act of connecting plates 16 and 21. The bearing block 28 is bolted over projections 24 on top the diaphragm holder 17 to support the eccentric drive means for reciprocating the diaphragm and adjustably support motor 35 thereabove by means of plate 32. It is obvious each component is simply accessible producing economy in manufacture and simplicity in maintenance.

The invention pump can be employed as follows. Due to its high efficiency it need not be immersed to function as a bilge pump. This immediately reduces the possibility of corrosion or electrical difficulty to an absolute minimum. There is no power waste as the pump motor 35 is energized to provide an instant positive frictionless drive of the shaft 29 through the motor shaft 40, pulley 40', belt 41, pulley 33 and shaft 29 to provide an eccentric reciprocation of the diaphragm 23. The diaphragm 23 is rocked to pull water into the inlet passage 8 through valve 14 and simultaneously push water through the valve 15 to the outlet passage 9. There is a smooth double action provided thereby. As the water in passages 8 and 9 might surge back into the hollow surge chambers, the surge is broken by the vertical plates 45 therein to minimize absorption of air by the surging water. Also, the air in the separate recesses vertically

of the chambers provides a multiplicity of air cushions to smooth the water surge and flow. Shock is substantially eliminated in the process.

Thus the pump operates continuously dry and friction free. It does not depend on water to lubricate or cool its moving parts. The motor drive provides positive power transmission without noise, friction or lubrication problems.

A modified surge chamber in accordance with the invention is shown in FIG. 6 of the drawings. Employing the modified chamber keeps the water and air distinctly separated therein, insuring elimination of water logging and allowing the surge chamber to be considerably smaller. As may be seen in the drawings, in this instance flexible diaphragms 49 are provided at the top of base 1 to seal the upper extremities of the cavities 6 and 7. These diaphragms have a series of convolutions which allow them to flex up and down in an effective resilient fashion. Here the surge chambers 42' are relatively shallow and have diaphragms 50 similar to diaphragms 49 dividing the shallow chambers into separately seal chamber sections or air pockets 51 and 52. As may be seen from FIG. 6 of the drawings, the chambers 42' may be defined by superposed sections to relatively simply confine the peripheries of the generally corrugated resilient diaphragms 49 and 50 therebetween.

The surge chambers 42' function as follows. During the pumping action, as the water flows back to the inner extremities of the passages 8 and 9, the corrugated diaphragms 49 will flex, cushioned by the air pocket in the chambers 51, the shock being further absorbed through the upper diaphragms 50 and the air pockets thereabove. As may be readily seen, the convolutions provided in the diaphragms readily adapt to the surge pressures in a manner to effect uniform suppressing of the water surge, very effectively cushioned by the plurality of air pockets 51 and 52, the reaction forces of which insure that pulsations in the water flow are substantially eliminated. In this form of the invention, the water cannot absorb any portion of the air in the surge chambers.

It may thus be seen that the invention provides many novel features directed to the pump art which may be incorporated in an exceedingly simple fashion.

From the above description it will be apparent that there is thus provided a device of the character described possessing the particular features of advantage before enumerated as desirable, but which obviously is susceptible of modification in its form, proportions, detail construction and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

While in order to comply with the statute the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific features shown, but that the means and construction herein disclosed comprise but one of several modes of putting the invention into effect, and the invention is therefore claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims.

Having thus described my invention, I claim:

1. A bilge pump or the like comprising a base member, said base member including, in the upper surface thereof, a plurality of openings, certain of said openings being disposed towards the front of said base member, certain others being disposed towards the rear of said base member, means defining an inlet passage and a discharge passage in said base member, each passage being arranged to intersect a different portion of said openings to the front of said base member and a different portion of said openings to the rear of said base member, inlet valve means in the portion of said openings to the front of said base member which is intersected by said inlet passage, discharge valve means in the portion of said openings to the front of said base member which is inter-

sected by said discharge passage, means mounting in superposed relation to the front portion of the upper surface of said base member which includes the openings intersected by said inlet and discharge passages including a diaphragm defining a chamber therewith which provides communication between said inlet and said discharge valve means, means defining surge chambers fixed on the rear portion of the upper surface of said base member which includes the openings therein which are intersected by said inlet and discharge passages, said surge chambers being displaced thereby to an area of said base member remote from the line of flow provided by said chamber which interconnects said passages through the medium of said inlet and discharge valve means, and means fixed to said superposed means having drive means thereon which are operatively interconnected for actuating said diaphragm to induce fluid to enter said inlet passage, move through said inlet valve means, said chamber and discharge valve means to exit through said discharge passage.

2. A bilge pump or the like including a base unit having formed therein an inlet passage and a discharge passage, a pair of openings in the top of said base unit in respective communication with said passages, means including a flexible wall element superposed over the portion of said base unit including said openings to define a flow chamber over said openings which affords communication between said passages, drive means supported on said chamber defining means, said drive means being operatively connected to reciprocate said flexible wall member in a manner to induce a continuous flow of fluid through said passages by way of said chamber and means defining surge chambers in communication with the respective passages, said surge chambers being mounted on said base unit at a position displaced from said superposed means and the normal line of flow between said passages.

3. The structure as set forth in claim 2 characterized by baffle plates in said surge chambers vertical to said passages, said baffle plates being in direct communication with said passages and operative to dampen surge of fluid into said chambers.

4. A bilge pump or the like including a base member having an inlet passage and a discharge passage, means defining a pair of openings in the top of said base member in respective communication with said inlet and said discharge passages, means on said base member defining a flow chamber over said openings to thereby provide communication between said passages, an inlet valve in one of said openings, an outlet valve in the other of said openings, means in operative connection with a portion of said means defining said flow chamber and operative thereon to produce a continuous flow of fluid between said passages by way of said chamber, means defining further openings in the top of said base member in positions external to and offset from said chamber, at least one of said further openings being in communication with said inlet passage and another of said further openings being in communication with said outlet passage at positions substantially displaced from the flow to and from said chamber and means defining surge chambers over said further openings comprising hollow shell means having fixed therein vertically spaced flexible membranes providing a series of spaced air pockets.

5. The structure as set forth in claim 4 characterized by said membranes having a series of parallel convolutions therein enabling operation thereof with maximum efficiency.

6. A bilge pump or the like including a base block having an inlet passage and a discharge passage, means defining openings from each of said passages to the top of said block, means releasably superposed on said block to form a chamber over one of said openings from said inlet passage and another of said openings from said discharge passage, said chamber forming means including a flexible wall portion, an intake valve in said one opening from said inlet passage, a discharge valve in said one opening from said discharge passage, an arm fixed at one end to said flexible wall portion to project substantially vertically therefrom, a drive shaft having an eccentric connection with asid arm, said drive shaft being bearingly supported on said chamber forming means and plate means mounting vertically of said chamber forming means having a motor thereon which operatively connects to drive said shaft and reciprocate said arm whereby to effect a continuous flow of fluid from said inlet to said discharge passage by way of said chamber.

7. A bilge pump or the like including a base block having an inlet passage and a discharge passage, means defining at least one opening from each of said passages to the top of said block, means superposed on said block to form a chamber providing communication between said openings from each of said passages, said chamber forming means including a flexible wall portion, an intake valve in said one opening from said inlet passage, a discharge valve in said one opening from said discharge passage, an arm fixed at one end to said flexible wall portion to project vertically therefrom, a drive shaft bearingly supported on said chamber forming means having means in connection therewith for eccentric reciprocation of said arm, plate means mounting vertically of said chamber forming means, said plate means having an arcuate aperture, a motor pivoted to said plate means at one point and having a bolt thereon projecting through said arcuate aperture to enable adjustment of said motor about its pivot, means connected to said bolt to fix the position of said motor in reference to said plate and a belt drive between said motor and said drive shaft, the tension thereon being adjustable by means of a pivotal adjustment of said motor on said plate.

8. In a pump, a base block having an inlet passage and an outlet passage, each of longitudinal extent and opening at one end from one face of said block, means defining openings in another face of said block, said openings being in respective communication with said passages, means superposed on said block to cover said openings and thereby bridge said passages, said bridging means being formed to provide a flow path between said openings which interconnects said passages, and further openings in said another face of said block in respective communication with said passages at positions remote from said first mentioned openings and means defining surge chambers positioned over said further openings, said surge chambers being fixed thereby at positions remote from the plane of said flow path.

9. A pump, including a base having longitudinally elongated inlet and outlet fluid flow passages opening at their one ends through said base and closed at their other ends to terminate within the base, said base further having longitudinally spaced apart pairs of openings in a surface thereof, the openings of each pair communicating with respective flow passages, means for effecting an enforced flow of fluid between said passages through one of said pair of openings, and closure means for the other pair of said openings formed to provide surge chambers in communication therewith said surge chambers being longitudinally offset thereby from the line of flow between said one pair of openings.

10. A bilge pump or the like including, a base block having longitudinally elongated inlet and discharge passages formed therein, means defining at least one pair of openings in said block in respective communication with said passages, stacked plate means with aligned apertures having a diaphragm therebetween in bridging relation to said apertures, said plate means being superposed on said block to position said diaphragm over and in spaced relation to said openings and form a chamber thereby in communication with said passages, an outlet valve in one of said openings, an inlet valve in the other of said openings, a flow path being defined thereby be-

tween said passages, additional openings in said block in communication with said passages at positions longitudinally offset from said pair of openings and means defining surge chambers capping said additional openings to provide for smooth, relatively noiseless flow through said flow path on reciprocation of said diaphragm.

11. A bilge pump or the like including, a base block, inlet and outlet passages directed inwardly thereof, said block having openings to the respective passages at terminal portions thereof and additional openings to said passages at intermediate portions thereof, means stacked on said block forming a chamber including a flexible wall, said chamber providing communication between said additional openings, an intake valve in one of said additional openings communicating with said inlet passage, a discharge valve in another said additional openings communicating with said outlet passage, means mounted on said chamber forming means connected to eccentrically flex said flexible wall to provide a flow of fluid through said chamber and between said passages, and closure means for the openings at said terminal portions of said passages formed to provide surge chambers in communication therewith.

12. The structure as set forth in claim 11 characterized by a series of parallel generally corrugated membranes in superposed spaced relation in said chambers to effect resilient cushions opposing surge of fluid from said passages into said chambers.

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