

June 14, 1966

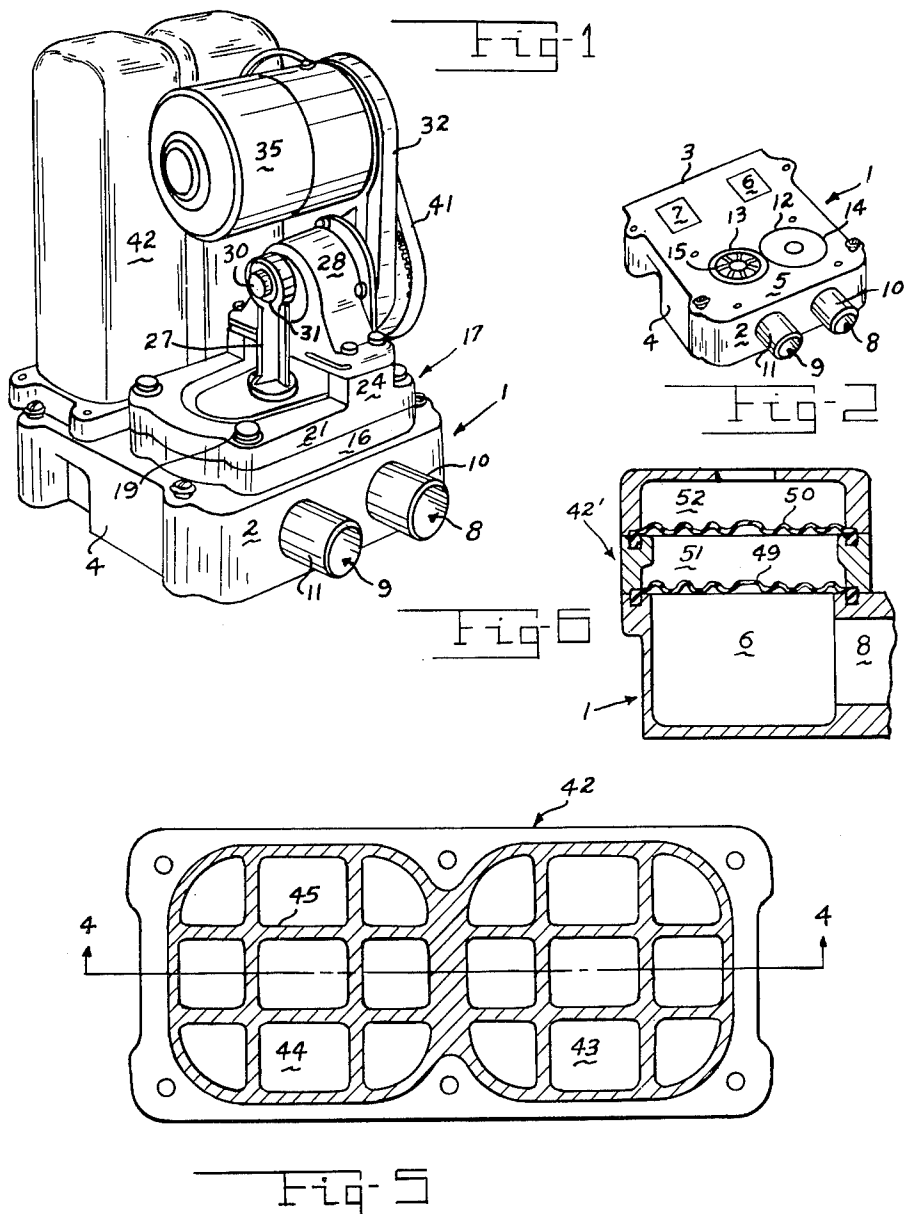
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SURGE CHAMBER

Original Filed July 27, 1960

2 Sheets-Sheet 1



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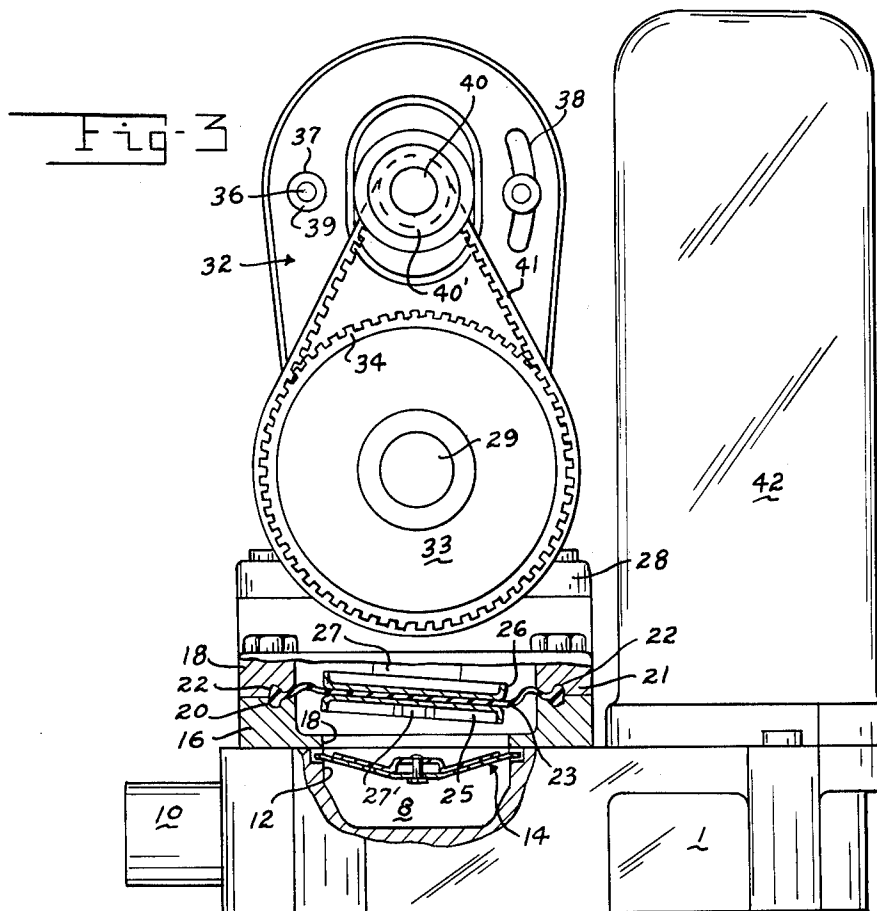
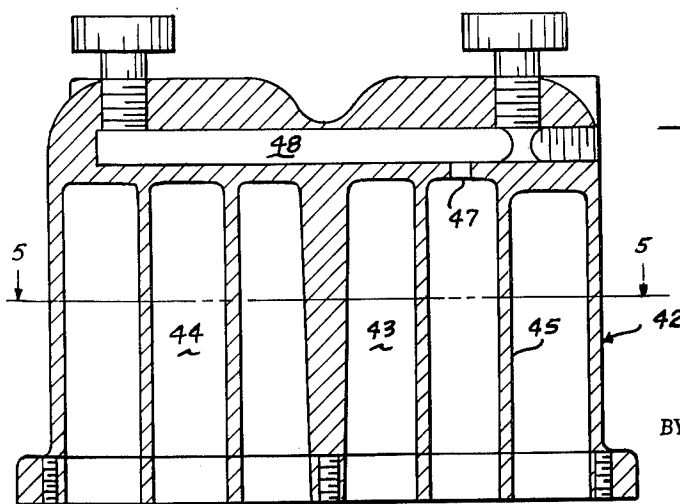
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1

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## SURGE CHAMBER

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Original application July 27, 1960, Ser. No. 45,641, now Patent No. 3,149,576, dated Sept. 22, 1964. Divided and this application July 8, 1964, Ser. No. 381,141  
5 Claims. (Cl. 138—26)

This is a division of application Serial No. 45,641, filed July 27, 1960 for Pump, now Patent No. 3,149,576, dated September 22, 1964.

This invention relates to surge chambers having particular utility in application to diaphragm type pumps. It will therefore be described, by way of example, in reference to embodiment thereof in a bilge pump.

Bilge pumps are often plagued with operational problems. Moreover, they are, many times, prone to be noisy and erratic in use.

The present invention provides means constituting a surge chamber which, when suitably applied, can produce a bilge pump which is not only simply constructed but quiet and steady in operation. While the surge chambers of the invention are achieved by structure of comparative simplicity, they are nevertheless capable of enabling maximum pump efficiency at minimal cost.

A primary object of the invention is to provide improvements in bilge type pumps rendering them more economical to manufacture, more efficient and satisfactory in use, more versatile in application and unlikely to malfunction.

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

A further object of the invention is to provide pump surge chambers which are simply constructed and capable of enabling maximum pump efficiency at a minimal cost.

An additional object of the invention is to provide surge chambers, the application of which to a bilge pump or the like produces a smooth, quiet, non-pulsating pumping action.

Another object of the invention is to provide a simple compact device affording an improved surge chamber the function of which is enhanced by a novel incorporation of diaphragm type control elements.

An additional object of the invention is to provide surge chambers for application to bilge type pumps and the like 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 are illustrated in the accompanying drawings, or their equivalents.

Referring to the accompanying drawings, 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 incorporating surge chambers in accordance with the present invention;

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

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

FIG. 4 is a cross-sectional view of the surge chamber 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

2

FIG. 6 is a fragmentary view illustrating another form of the improved surge chamber as contemplated by the present invention.

Like parts are indicated by similar characters of reference through 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 adjacent its 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 the 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 the base 1 adjacent its front face 2. The recess 12 opens at its bottom to the passage 8 while the recess 13 opens at its bottom to the passage 9. Each of the recesses 12 and 13 is counterbored at the upper surface of the base 1 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 in a manner to be further described.

Bolted over the top surface of the base 1, adjacent its front face 2, is a base plate 16 of a diaphragm holder 17. The plate 16 has an elliptical recess centrally of its upper surface. The recessed portion of the plate 16 includes a pair of apertures 18 and 19 which respectively align with the 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 are arranged to mutually accommodate the beaded periphery of a flexible diaphragm 23 which also has 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. Plate 21 also has opposite vertical projections 24 to the 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 in the dependent extremity of an arm 27. The plates and the diaphragm are thereby positioned in fixed relation to the arm 27.

Plates 25 and 26 are centered on the diaphragm and extend substantially its length and width. It is provided that these plates are dished outwardly from the diaphragm in opposite directions and rimmed by a flexible fold of the diaphragm, as may be seen in FIG. 3 of the drawings.

The projections 24 on the top plate 21 support a bearing block 28 adjacent the arm 27. Block 28 rotatably mounts a shaft 29 having an eccentrically projected extremity 30. The 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 the 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 the bearing

3

block 28 adjacent one end of the plate 21 to project vertically, in a plane perpendicular thereto. Plate 32 has an aperture for the extension of shaft 29 there-through. Shaft 29 has a large pulley 33 fixed to its projected extremity remote from the eccentric 30. Pulley 33 has teeth 34 peripherally thereof in the manner of a gear.

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

An opening in plate 32 intermediate aperture 37 and slit 38 accommodates the projection of the motor shaft 40 therethrough above and parallel to the shaft 29. 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. This is produced 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 pulley belt 41 can be readily achieved by merely loosening the nut 39 on the bolt 36 extending through the 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 structure 42 providing surge chambers 43 and 44 which respectively position over the cavities 6 and 7. The shell 42 is formed with a central vertical partition to respectively define the chambers 43 and 44 to either side. Each chamber opens from its bottom, the chamber 43 being open to the cavity 6 and the chamber 44 being open to the cavity 7. Integrated to the shell wall structure and partition forming each of the surge chambers, substantially the length thereof, are vertically oriented, rectangularly intersected plates 45.

A portion of the plates 45 are arranged in spaced parallel relation to extend from front to rear of the base 1. This portion is rectangularly intersected by other vertically oriented plates 45 at right angles thereto. The rectangularly intersected plates 45 thereby provide a plurality of vertically extending recesses forming elongated pockets in each surge chamber. They additionally provide a plurality of intersecting vertical baffles presenting their lower edges at the openings to the chambers 43 and 44.

Thus, as the shell structure 42 is applied over the base 1, the chambers 43 and 44 respectively communicate with and present the lower edges of their plates 45 to the cavities 6 and 7 to function in a manner to be further described.

Formed in the shell structure 42, adjacent its upper extremity, is a horizontal pressure passage 48 which communicates with the upper end of the surge chamber 43 by means of an aperture 47 in the shell structure. Pressure switches are schematically shown in the drawing to communicate with the passage 48, to either end, in the event they may be needed. Passage 48 is shown sealed at one end by a plug.

A complete and novelly fabricated pump is thus provided the performance of which is enhanced by the surge chambers in accordance with the present invention. The function of the pump including the improved surge chambers is as follows. As the pump motor 35 is energized, it provides an instant positive frictionless drive of the shaft 29 through the motor shaft 40, pulley 40', belt 41 and pulley 33. This produces an eccentric reciprocation of the diaphragm 23. The diaphragm 23 is rocked thereby to pull water into the inlet passage 8 and through the valve 14 and to simultaneously push water through the valve 15 to the outlet passage 9.

4

There is a smooth double action provided thereby. As the water in the passages 8 and 9 tends to surge back to the vicinity of the cavities 6 and 7 in the base 1, its natural action is to flow upwardly to the overlying surge chambers defined in the shell structure 42. It should be noted that the cross-sectional area of each of the surge chambers from bottom to top, including the portion defining the opening thereto, is generally uniform. The water surge to the chambers 43 and 44 is inherently broken on contact with the lowermost edges of the vertical plates 45 and the water is channelled, in the process, into the separate vertical recesses defined by such plates. The breaking of the water surge by the vertical plates 45 functions to minimize the absorption of air by the surging water. Moreover, the air in the separate recesses extending vertically of the respective surge chambers provides a multiplicity of air cushions vertically co-extensive with the chambers which jointly cushion and thereby smooth the character of the water surge and flow to and from the pump. The nature and the form of the shell structure and the orientation therein of the vertical plates 45 substantially coextensive therewith to form the separate vertical recesses, as shown in the accompanying drawings, is such to produce a substantial elimination of shock in the operation of the invention pump.

A modified form of surge chamber in accordance with the invention is shown in FIG. 6 of the drawings. The use of this form is preferred in many instances. Its nature is such as to keep the surging water and air in the surge chamber distinctly separated. This insures elimination of water logging and, more important, allows a surge chamber which is relatively compact and considerably smaller than normally anticipated.

As may be seen in the drawings, in this embodiment flexible diaphragms 49 are provided, in a pump as previously described, at the top of its base 1 to seal the upper extremities of, or, in other words, the openings from the cavities 6 and 7. In the preferred form illustrated, the diaphragms include therein a series of convolutions which allow them to flex up and down in an effective resilient fashion. Superposed on the base 1 to provide surge chambers, in this instance, is a relatively shallow shell-like structure 42'. The structure 42' is formed of an upper and a lower section. The lowermost section consists of a wall structure, the bottom of which seats to the base 1 to fix the first mentioned diaphragms 49 to bridge the openings to the cavities 6 and 7. The upper section consists of a relatively shallow cap. Confined between the lower edges of the cap and the upper edges of the lower wall section of the structure 42' are a pair of diaphragms 50. The diaphragms 50, which are similar in form to the diaphragms 49, define, in respect to each chamber in the shell structure 42', an air pocket 51 therebelow and an air pocket 52 thereabove. It will of course be obvious that the cap portion and lower wall section of the structure 42' include central partitions to establish a line of demarcation to respectively provide a surge chamber over the cavity 6 and a surge chamber over the cavity 7. It will therefore be seen that the lowermost extremity of each chamber is bridged by a diaphragm 49 and an intermediate section of the shallow extent of each chamber is bridged by diaphragm 50. As shown in FIG. 6 of the drawings, the cap portion of the shell structure 42' may have an opening which in use of the invention embodiment described may be either sealed with an ordinary plug or, in the alternative, where circumstances so require, a pressure switch for delivering a signal corresponding to the pressure exerted by the fluid moving into the cavity 6.

On operation of the described pump, utilizing surge chambers as just described, during the pumping action, as water surges back into the inner extremities of the passages 8 and 9 and tends to move upwardly out of the cavities 6 and 7, the surge will be broken by contact,

5

in each instance, with a corrugated diaphragm 49. The respective diaphragms 49 will flex under the influence of the surge, cushioned by the air pocket 51 thereabove. The shock occasioned thereby will be further absorbed through the upper diaphragms 50 and the air pockets defined thereabove in the shell-like structure 42'.

As may be readily seen, the convolutions provided in the diaphragms enable them to readily adapt to the nature and direction of the surge pressures in a manner to effect a uniform suppression of shock occasioned thereby. Moreover, a most effective cushioning of water pulsation is achieved in each instance by the use of the plurality of vertically spaced air pockets 51 and 52 as separated by the resilient corrugated diaphragms 50. The reaction forces produced by the included diaphragms, as interposed in reference to surge from the respective cavities 6 and 7, effect a condition insuring that pulsations in the flow of water to and from the pump are substantially eliminated.

Note that in use of this form of embodiment of the invention, the surging water cannot absorb any portion of the air in the surge chambers.

It may thus be seen that the embodiments of the surge chambers as described have significant utility when properly applied to a pump such as herein illustrated.

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. For use in a pump, a device constituting a surge chamber consisting of means providing a hollow shell open to one end to accommodate a surge of fluid and means defining baffles coextensively bridging said one end of said shell and including at their one ends edge portions immediately presenting themselves to the surging fluid and so formed to interrupt and relatively deflect the surge in a manner to minimize absorption therein of air from the chamber defined by the shell and to dampen pulsation of the fluid, said baffles being provided by vertical plates providing partitions and defining recesses in said

6

shell individually closed at ends opposite said one ends of said baffles.

2. For use in a pump, a device constituting a surge chamber comprising a shell, a pocket formed by said shell opening from its bottom, the opening at said bottom generally providing the maximum cross-sectional area of said pocket and having, in bridging relation thereto, plate elements presenting edge portions at said opening which on surge of fluid to said pocket are operative to immediately break the surge and quiet fluid pulsations inherent in such surge, said plate elements forming air pockets coextensive with said housing and oriented in a sense longitudinally thereof, said pockets being individually closed at their tops by the top of said shell.

3. For use in a pump, a device constituting a surge chamber including a shell closed at its top and open at its bottom, and a plurality of intersecting baffle plates in the interior of said shell defining a plurality of longitudinally extending recesses opening at their lower ends through the bottom of said shell, said plates merging with the closed top of said shell individually to close said recesses at their upper ends.

4. A device according to claim 3, characterized by a pressure passage integrally formed in the top of said shell, a small diameter opening in said shell communicating said passage with one of said recesses.

5. For use in a pump, a device to overlie a surge chamber opening comprising a shell the bottom of which has an open configuration to coincide with said opening and the top of which is closed, said shell having an interior chamber formed as a uniform continuation of said open configuration, and a plurality of intersecting plates in said interior chamber longitudinally disposed therein to terminate at their one ends at the bottom of said shell in the plane of said open configuration and to terminate at their other ends in the said top of said shell, recesses formed by said intersecting plates having their inner ends closed by said shell from communication with other recesses.

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