May 23, 1961 W. M. HENDERSON 2,985,111

DIAPHRAGM PUMPS

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FIG. 2.

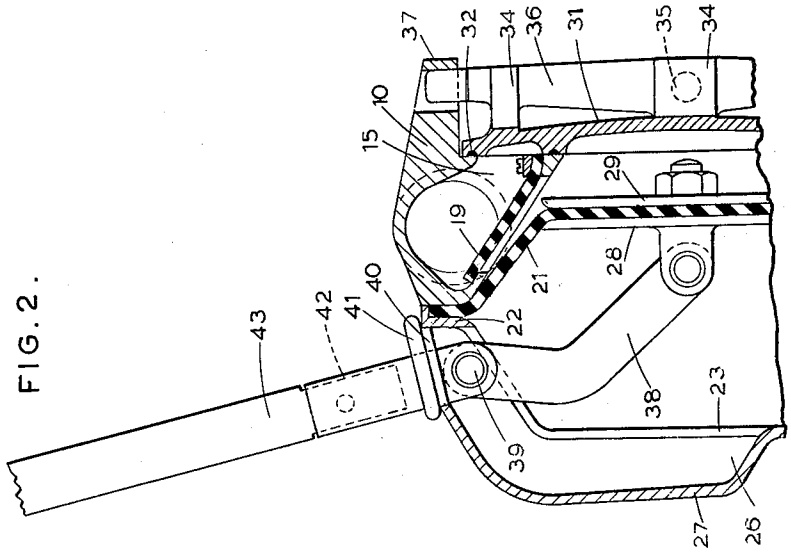
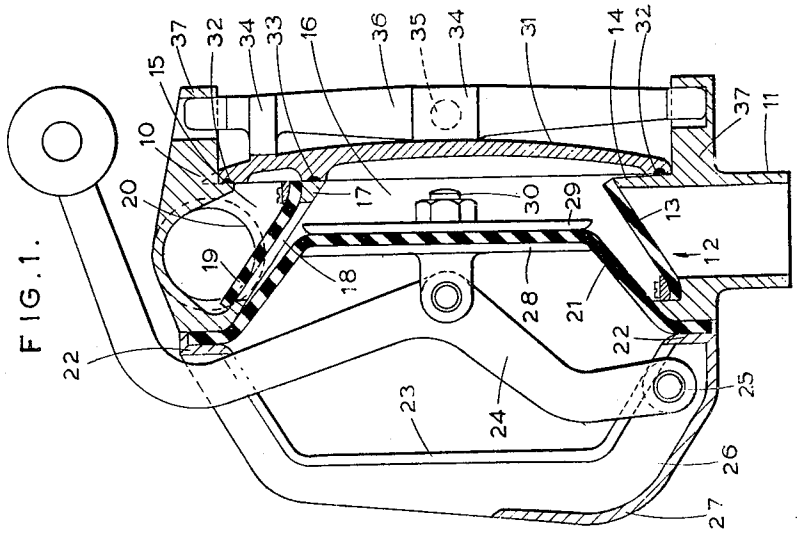


FIG. 1.



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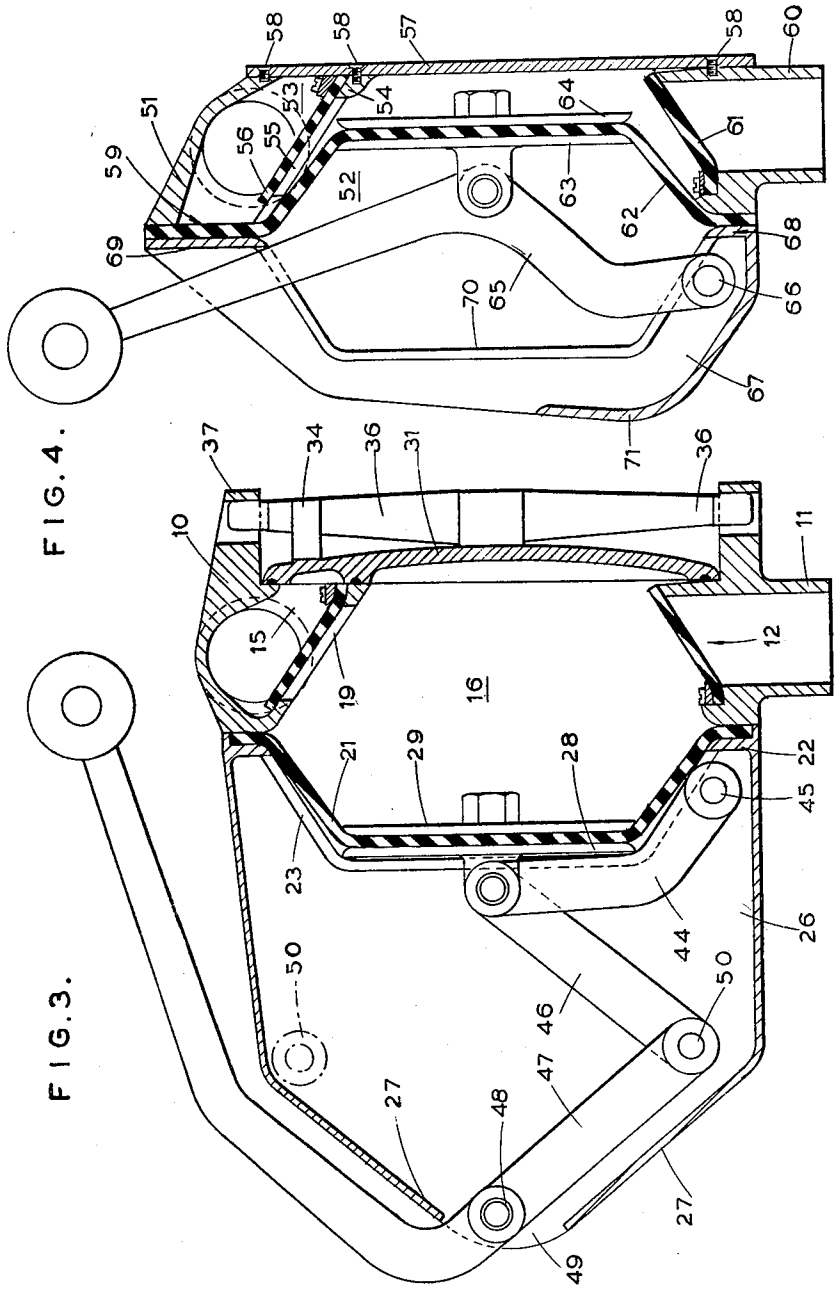


FIG. 4.

FIG. 3.

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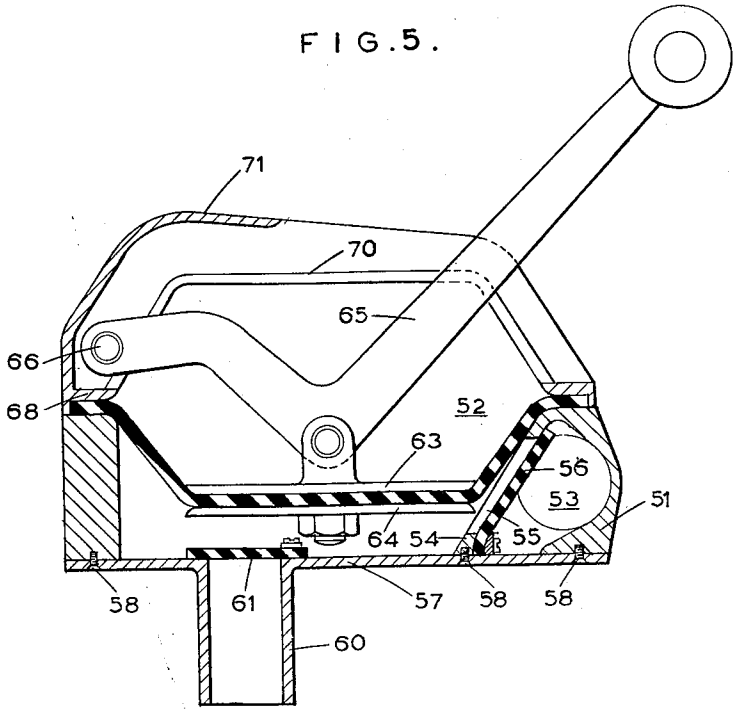
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FIG. 5.



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United States Patent Office 2,985,111 Patented May 23, 1961

2,985,111

DIAPHRAGM PUMPS

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Filed Feb. 7, 1958, Ser. No. 713,992

10 Claims. (Cl. 103—150)

This invention relates to improvements in diaphragm pumps. It is especially, but not exclusively, concerned with manually operated pumps for use in ships' lifeboats, where it is necessary that the pump should be robust, simple in construction, reliable in operation, and capable of being left untouched for long periods and yet operable whenever it may be required. It is a further requirement that such pumps should be capable of dealing with water containing small pieces of foreign matter without being stopped from operating.

The object of the invention is to produce such a pump having improved means for obtaining access to the interior in the event of the pump requiring to be cleared and at the same time of very simple and robust construction. It will be appreciated that although a pump for a ship's lifeboat will be described, the invention may be applied to other diaphragm pumps, e.g. low pressure air pumps.

According to one aspect of the invention, a diaphragm pump has a hollow body open at one end, a transverse partition in the interior of the body to divide it into a diaphragm chamber and an outlet chamber, said diaphragm chamber being open at said one end, an outlet port in the partition, an outlet valve co-operating with said port, and a removable cover plate having means to seal said one end of the diaphragm chamber and so arranged that when the cover plate is removed, access can be had to the outlet valve.

According to another aspect of the invention, a diaphragm pump has a hollow body open at one end, a transverse partition in the interior of the body to divide it into a diaphragm chamber and an outlet chamber, both said diaphragm chamber and said outlet chamber being open to said one end, an outlet port in the partition, an outlet valve cooperating with said port, and a removable cover plate having means to seal said open end and arranged to be in sealing engagement with said partition, the arrangement being such that when the cover plate is removed, access may be had to both sides of the outlet valve.

The pump body may be open at both ends, said one end being sealed by said removable cover plate and the other end being provided with a housing carrying the diaphragm and diaphragm actuating means, and arranged to clamp the periphery of the diaphragm against the body to seal said other end thereof.

Alternatively the removable cover plate may carry the diaphragm and diaphragm actuating means and is arranged to clamp the periphery of the diaphragm against the body to seal said open end thereof.

The outlet valve may be constituted by a flap extending across an aperture in the partition.

The invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a vertical longitudinal section through a diaphragm pump according to a first embodiment of the invention,

Figure 2 is a detail section similar to Figure 1 of a second embodiment,

Figure 3 is a section similar to Figure 1 of a third embodiment,

Figure 4 is a section similar to Figure 1 of a fourth embodiment, and

Figure 5 is a section similar to Figure 1 of a fifth embodiment of the invention.

Referring now to Figure 1, the pump has a body **10** of generally cylindrical shape, its bore being several times its length. An inlet pipe **11** is arranged radially, and is served by a non-return inlet valve **12** consisting of a rubber flap **13** arranged to seat against the inclined mouth **14** of the inlet pipe so that liquid may be drawn in but is prevented from returning out through the inlet pipe by the seating of the flap.

Diametrically opposite the inlet pipe there is an outlet chamber **15** which is separated from a diaphragm chamber **16** by a partition **17** which extends from one part of the periphery of the body to another part and divides the body into the chambers **15** and **16**. The outlet chamber **15** thus formed may be of any desired configuration, such as a segment. There is formed in the partition **17** an outlet port **18** spanned by another rubber flap valve **19** secured on the outer side of the partition, and arranged to act as a non-return outlet valve. An outlet pipe **20** is in communication with the outlet chamber **15**.

One end of the body **10** is closed by a rubber diaphragm **21** which spans the whole end of the body and is clamped around its periphery to the body by a housing **22**. The housing is slotted at **23** to allow passage to an actuating lever **24** which is pivoted at **25** between a pair of flanges **26** formed on the housing on the side remote from the body. A web **27** is formed between the lower portions of the upstanding edges of the flanges **26**. Intermediate its length, the actuating lever **24** has pivotally secured thereto an assembly comprising two clamping plates **28**, **29** which grip the diaphragm **21**, one on each side, so that it is sandwiched between them, the two plates being secured by a bolt **30** which is passed through the diaphragm.

At the other end of the body there is a removable cover plate **31** arranged to be clamped so as to seal the end of the body and be in sealing engagement with the partition **17**. For this purpose the cover plate has two resilient gaskets **32**, **33** secured thereto, while at its outer side it is caused to be forced against the pump body by a cam **34** operated by a handle **35** on a shaft **36** journalled loosely in bearings in lugs **37** projecting from the pump body. The partition **17** lies in a plane at an angle of approximately 45° to the axis of the cylindrical pump body, and one edge of the partition (that which is sealed by the cover plate **31**) is a free edge, whereas the other edge is joined to the pump body and conveniently the partition is formed integrally with said body.

The result of this formation is that the chambers **15** and **16** are both opened and both sides of the outlet valve **19** are exposed when the cover plate **31** is removed. The outlet valve **19** is therefore readily accessible for inspection and can be cleared if it has become obstructed, as also can the inlet valve **12**.

The cylindrical pump body **10** is arranged with a symmetrical pattern of threaded or clearance holes (not shown) equally spaced around its periphery to receive set screws or bolts (not shown) to secure the housing **22** to the body **10**. Due to the equal spacing of the holes it is possible for the housing to be located in any one of a variety of positions, thereby enabling the actuating lever to be placed in the most convenient position having regard to the eventual location of the pump.

Referring now to Figure 2, the pump there shown is similar to the pump described and shown in Figure 1 except for the arrangement of the housing and the ac-

tuating lever. The same reference numerals are used in Figure 2 to denote parts which are the same as those in Figure 1.

The diaphragm plate 28 is pivotally attached to a short, cranked actuating lever 38 which is pivoted at 39 between upstanding flanges 26 on the housing 22. The upstanding edges of the flanges 26 are integral with a web 27 which extends upwardly so as to leave only a comparatively small slot 40 through which the actuating lever 38 projects. The slot 40 is provided with a rubber grommet 41 which surrounds the lever 38 and excludes dirt from the interior of the housing 22. The upper end of the lever 38 is provided with a socket 42 arranged to receive the lower end of an extension lever 43.

It will be seen that the valve 19 is as accessible in the embodiment of Figure 2 as in the embodiment of Figure 1. The actuating mechanism shown in Figure 2 is useful when the pump is situate at the bottom of a boat locker and is operated by the extension lever 43 from outside the locker.

Referring now to Figure 3, the pump there shown is also similar to the pump shown in Figure 1 except for the arrangement of the housing 22 and the actuating means. The same reference numerals are used in Figure 3 to denote parts which are the same as those in Figure 1.

In Figure 3, the diaphragm plate 28 is pivotally attached to an arm 44 itself pivoted at 45 between the flanges 26 on the housing 22. The diaphragm plate 28 is also pivotally attached to a link 46 which in turn is pivotally connected to a cranked actuating lever 47. The actuating lever 47 is pivoted between the flanges 26 at 48. Webs 27 join the upstanding edges of the flanges 26 leaving a slot 49 which gives passage to the actuating lever.

It will be seen that as the lever 47 is moved through one stroke, the junction 50 will move upwardly to the position shown in dotted lines. During this movement the diaphragm will move to the right and then return to the position shown in the figure. It follows that for every stroke of the actuating lever 47 the diaphragm will complete two strokes. Both sides of the valve 19 are accessible as in the pumps shown in Figures 1 and 2.

Referring now to Figure 4 there is shown a somewhat different construction in which one end of the pump body is sealed by a plate which is not removed, except for major overhaul and access to both sides of the exhaust valve is obtained by removing the housing carrying the diaphragm and actuating means.

In Figure 4, 51 indicates the pump body divided into a diaphragm chamber 52 and an outlet chamber 53 by a partition 54. The partition has an outlet port 55 closed by a rubber outlet valve 56. One end of the body is closed by a plate 57 which is secured thereto by screws 58 and is not normally removed except for a major overhaul. The partition is also provided with a port 59 which is open to the other end of the body from that closed by the plate 57. The body is provided with an inlet pipe 60 and an inlet valve 61.

The other end of the body is closed by a diaphragm 62 which is mounted between two plates 63 and 64. The plate 63 is pivotally connected to an actuating lever 65 itself pivotally mounted at 66 between flanges 67 formed on a housing 68. The housing 68 clamps the periphery of the diaphragm against the body to seal the latter. The housing also has a portion 69 which bears against one side of the diaphragm, forcing it against the body to close the port 59 of the outlet chamber 53. The housing is slotted at 70 to give passage to the actuating handle and the lower portions of the upstanding flanges 67 are integral with a web 71.

The housing is secured to the body by studs and wing nuts, not shown, and it will be seen that when the housing is removed, together with the diaphragm, both sides of the outlet valve 56 are exposed, one side through the port 59 and the other side from the diaphragm chamber 52.

Referring now to Figure 5, the pump there shown is somewhat similar to that shown in Figure 4 and may conveniently be mounted horizontally as shown.

In Figure 5 the same reference numerals are used for parts which are the same as in Figure 4. Thus in Figure 5 the inlet pipe 60 is mounted in the plate 57 and the inlet valve 61 is also mounted on the plate 57. The partition 54 divides the body into a diaphragm chamber and an outlet chamber, but the outlet port 55 is the only port formed in the partition. There is no port 59 as in the pump of Figure 4.

Access to the outlet valve 56 is obtained by removing the housing 68 and diaphragm 62 as in Figure 4. In the pump of Figure 5 however access is only obtained to one side of the exhaust valve, i.e. from the diaphragm chamber 52.

It will be seen that in all the embodiments of the invention which have been described access may easily be obtained to one or both sides of one or both of the valves by removing either an easily removable cover plate or a housing which carries the diaphragm and actuating means.

If desired, the actuating lever of any of the embodiments described may be provided with a weight of such a size and arranged in such a position that if the pump is mounted on an oscillating object, e.g. a rocking boat, the inertia of the weight will automatically operate the pump. Preferably the weight is arranged on the lever above its pivot point on the housing.

Either or both of the valves may be arranged to serve as a pressure release valve. Thus, if it is desired to use the pump in an installation where it must not exceed a given figure, the flap of the inlet or outlet valve may be arranged to be of such a size relatively to its port that when the predetermined pressure is exceeded the flap will deform and be blown into the port, thus preventing further delivery by the pump until the flap is pushed back again and so restored to its normal operation.

Instead of rubber diaphragms, or flap valves, there may be employed components of rubber-like materials sucn as synthetic rubber or elastomers. Disc or ball valves may be used instead of flap valves if desired.

Moreover, instead of the body and cover plates of the pump being formed of metal, they may be of moulded synthetic resin, the material being chosen not only for its strength but also for its ability to withstand deleterious effects from the liquid being pumped. In the event of the use of such a material, it may be desirable to have certain parts of metal, e.g. the pivot for the actuating lever.

The bolt passed through the diaphragm to secure the clamping plates may form an extension of one clamping plate and may have at its opposite end the pivotal attachment for the actuating lever.

I claim:

1. A diaphragm pump comprising a hollow annular body formed with an inlet and an outlet, a first valve associated with said inlet, a partition formed in said body, said partition having a port therein and defining outlet and pumping chambers, a second valve cooperating with said partition at said port, a removable cover plate adapted to cooperate in sealing engagement with said annular body and an edge of said partition, a retaining means to hold the cover in position, a diaphragm, a diaphragm housing, said diaphragm housing cooperating with said hollow body for retaining said diaphragm in position therein, and a diaphragm actuating lever, said actuating lever pivotally secured at its end on said housing and also at a point intermediate its length on said housing, said outlet chamber and pumping chamber having the interiors thereof simultaneously accessible from the exterior of said hollow body with removal of said cover member and exposure of both sides of said second valve.

2. A diaphragm pump as described in claim 1, wherein said diaphragm actuating lever is provided with a weight member whereby oscillation of the body on which the pump is mounted produced automatic operation of said pump.

3. A diaphragm pump comprising in combination a substantially annular body formed with an inlet and an outlet therein, an inlet valve, a segmental partition formed in said body so as to define a pumping chamber and an outlet chamber, said partition having an aperture formed therein, a resilient flap valve operably associated with said aperture in said partition, a removable cover plate cooperating with one end of said annular body and with one edge of said partition, in sealing engagement with said annular body and the edge of said partition, retaining means for holding said cover plate in position, a diaphragm, a pair of rigid plates, said diaphragm disposed between said rigid plates, a lug fixed to one of said plates, a diaphragm housing for holding said diaphragm peripherally against said annular body, a link member pivotally attached to said lug, and a diaphragm actuating member pivotally arranged between said housing and said link member, said lever attached to said housing at a point intermediate its ends and attached to said link at one of its ends.

4. A fluid pressure transmitting device comprising, a body having a compression chamber and a discharge chamber formed therein, a partition separating the chambers, outlet means for discharging fluid from the discharge chamber, a normally closed unidirectional valve in the partition between said chambers adapted to be opened to pass fluid from said compression chamber to said discharge chamber, said body having means for varying the pressure in said compression chamber and inlet means for admitting fluid thereinto, and said body having a portion of the exterior wall thereof adjacent both chambers readily removable to give simultaneous access to the interior of both said chambers and boths sides of said partition when removed, said partition having an edge thereof in abutting sealing relationship with said removable portion of the body and there are releasable locking means operably associated with said removable portion for maintaining same in sealing relationship with the body and said edge of the partition, said locking means comprising a retainer bar secured on the exterior of the body biased against said removable portion.

5. A fluid pressure transmitting device, comprising a body having a compression chamber and a discharge chamber formed therein, a partition separating the chambers, outlet means for discharging fluid from the discharge chamber, a normally closed unidirectional valve in the partition between said chambers adapted to be opened to pass fluid from said compression chamber to said discharge chamber upon increase of fluid pressure in said compression chamber, said body having means for varying the pressure in said compression chamber and inlet means for admitting fluid thereinto, and said body having a portion of the exterior wall thereof adjacent both chambers readily removable to give simultaneous access to the interior of said chambers and both sides of said partition when removed, said pressure varying means comprising a diaphragm assembly, actuating lever means pivotally attached to said assembly and to the body and having a portion thereof exterior of the body for manipulating same, and said lever means is weighted to automatically render the device operable upon oscillation of the body.

6. A pump comprising, a hollow body open at one end thereof, a transverse partition in the interior of the body having an edge opposite said open end, said partition dividing said body into a pumping chamber and outlet chamber each adjacent said open end, an outlet valve in said partition accessible from both sides of the partition through said open end, a removable cover member secured in sealing engagement over said open end and with the edge of the partition, and means for removably holding the cover member in such sealing position, said pumping and outlet chambers having ingress and egress means respectively, and said pumping chamber having means on the interior thereof for affecting transfer of fluid between said ingress and egress means through said chambers and outlet valve, both said chambers being simultaneously accessible upon removal of said cover member and said cover member has resilient sealing gasket means and said means for holding the cover members comprises a retainer bar on the exterior of the body.

7. A pump comprising, a hollow body open at one end thereof, a transverse partition in the interior of the body having an edge opposite said open end, said partition dividing said body into a pumping chamber and outlet chamber each adjacent said open end, an outlet valve in said partition accessible from both sides of the partition through said open end, a removable cover member secured in sealing engagement over said open end and with the edge of the partition, and means for removably holding the cover member in such sealing position, said pumping and outlet chambers having ingress and egress means respectively, and said pumping chamber having means on the interior thereof for affecting transfer of fluid between said ingress and egress means through said chambers and outlet valve, both said chambers being simultaneously accessible upon removal of said cover member and said last mentioned means includes a diaphragm, a housing for holding said diaphragm in said pumping chamber and a diaphragm actuating lever pivoted at one end thereof on said housing and at an intermediate point thereof on said diaphragm, a pair of rigid plates fixed to the diaphragm one on either side thereof, one of said plates having a lug to which said actuating lever is pivotally connected, and said actuating lever is provided with a weight whereby oscillation of the body on which said pump is mounted produces automatic operation of said pump.

8. A diaphragm pump comprising a hollow annular body, an inlet and outlet formed in said body, a valve cooperating with said inlet, a partition formed in said annular body, said partition disposed so as to follow a cord subtending an arc of said outlet-containing body, said partition having a port formed therein, an outlet valve cooperating with said port, a removable cover plate secured to one side of said hollow body having a portion thereof disposed on opposite sides of said partition whereby removal of said cover plate gives access to both sides of said partition, a diaphragm, a diaphragm housing for retaining said diaphragm in sealing engagement with the periphery of said annular body and with one edge of said partition, and a diaphragm actuating lever pivoted at one end thereof to said housing and at a medium point to said diaphragm.

9. A diaphragm pump comprising a hollow annular body, an inlet conduit, an outlet conduit, an inlet flap valve, a partition formed in said annular body, said partition disposed so as to follow a cord subtending an arc of said body wherein said outlet conduit is contained, an outlet valve connected to said partition at an aperture formed therein, a removable cover plate having sealing means thereon and connected to one side of said annular body having portions thereof disposed on both sides of said partition to permit simultaneous access to both sides of the partition on removal of said cover plate, a diaphragm, a pair of rigid plates on either side of said diaphragm and attached thereto, a lug member fixedly attached to one of said plates, a diaphragm housing for retaining said diaphragm in sealing engagement with the periphery of said annular body and with one edge of said partition, and a diaphragm actuating lever pivotally attached at one end to said housing and an intermediate point to said lug member.

10. A diaphragm pump comprising a hollow annular body formed with an outlet, a partition formed in said

body, a port formed in said partition communicating with said outlet, an outlet valve secured to said partition over said port, a cover plate removably secured to one side of said hollow body with portions thereof on both sides of said partition whereby removal of said cover plate gives access to both sides of said partition, said plate having an inlet conduit therein, an inlet valve secured to said plate covering said inlet conduit, a diaphragm, a diaphragm housing cooperating with said annular body to secure said diaphragm along its periphery to said annular body, and a diaphragm actuating lever pivotally attached at one end to said housing at a point intermediate its ends to said diaphragm.

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