Nov. 11, 1947. W. F. WESLEY 2,430,545

DIAPHRAGM PUMP

Filed June 18, 1945

Fig. 1

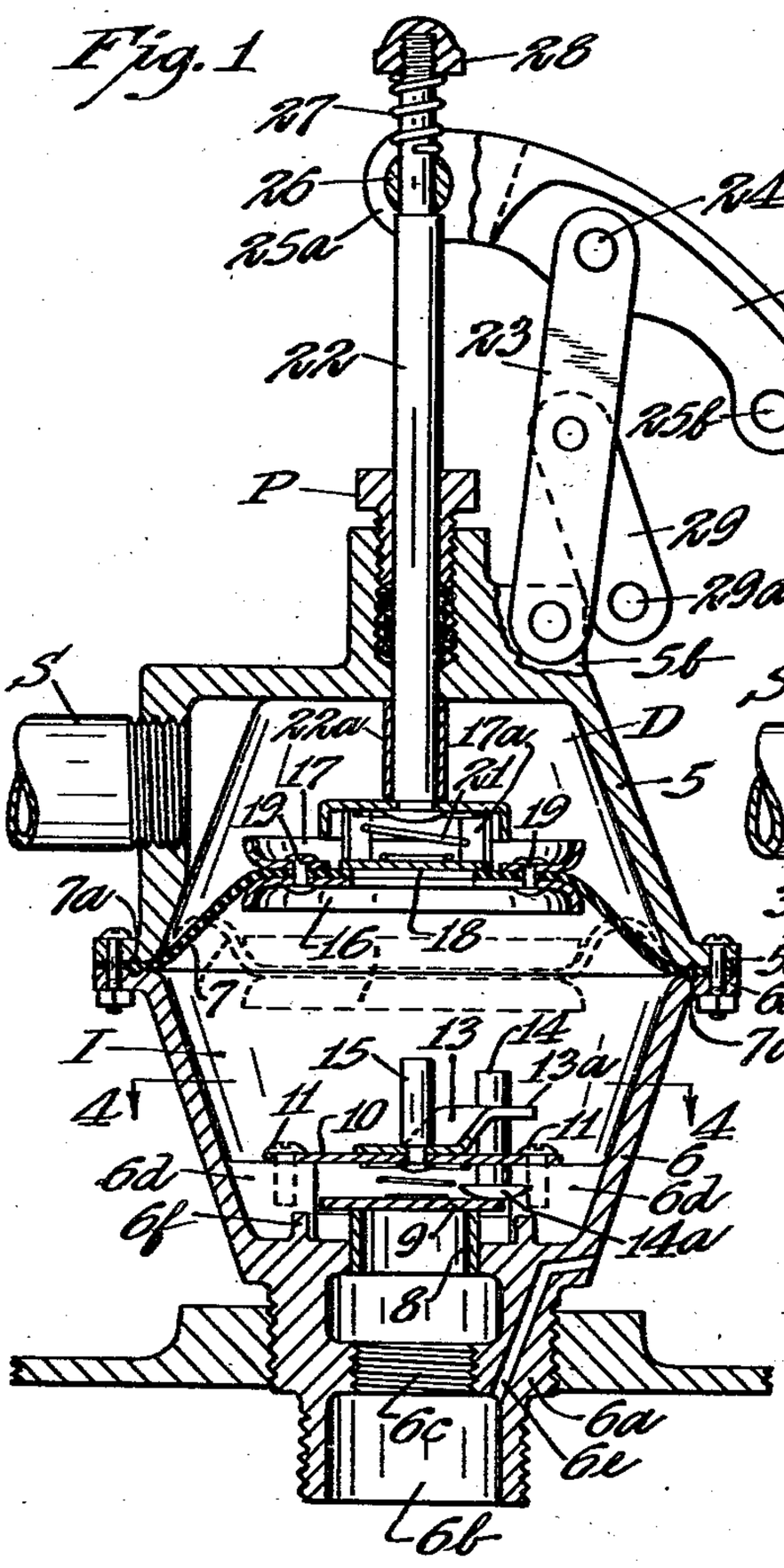


Fig. 2

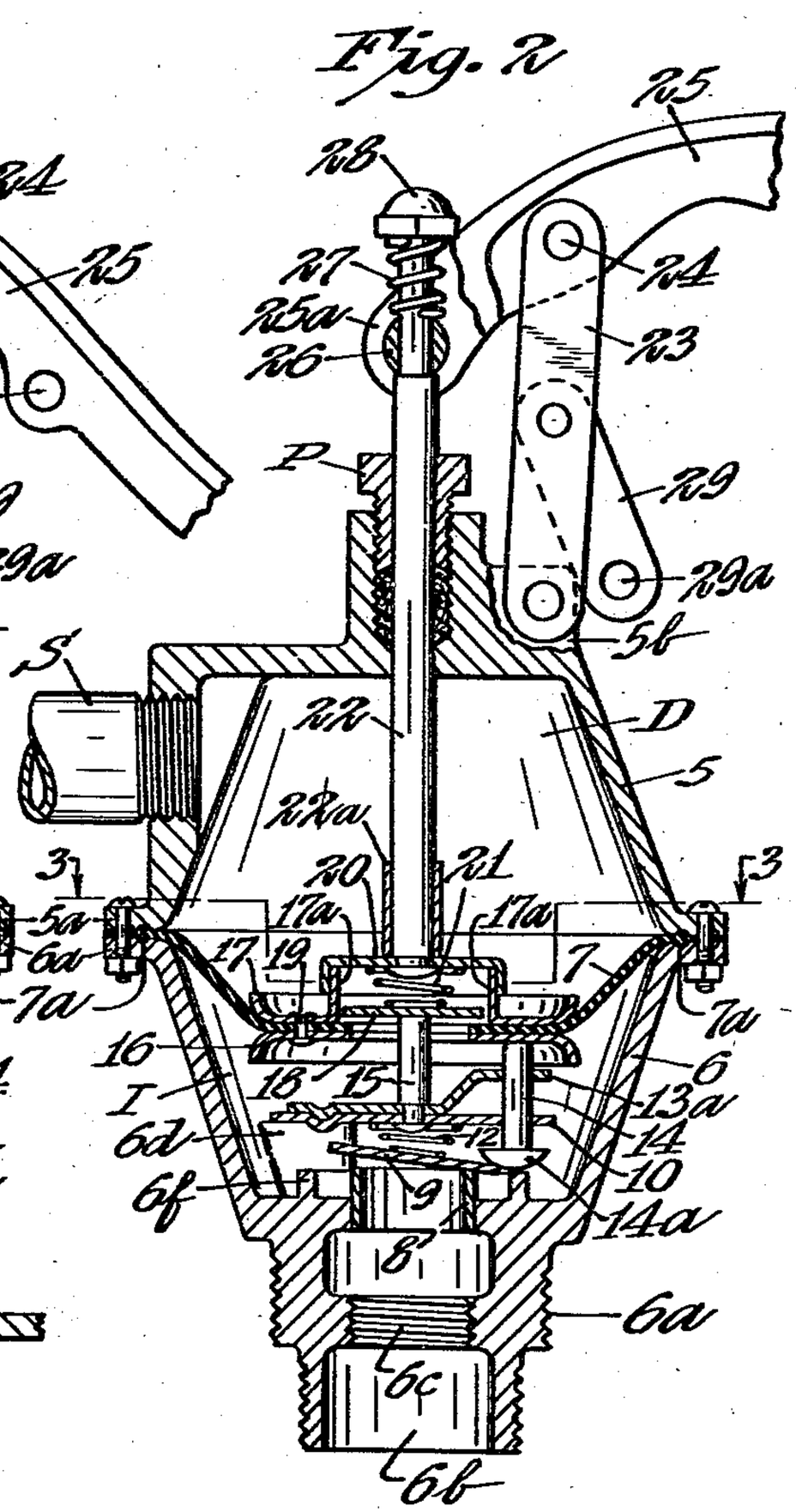


Fig. 3

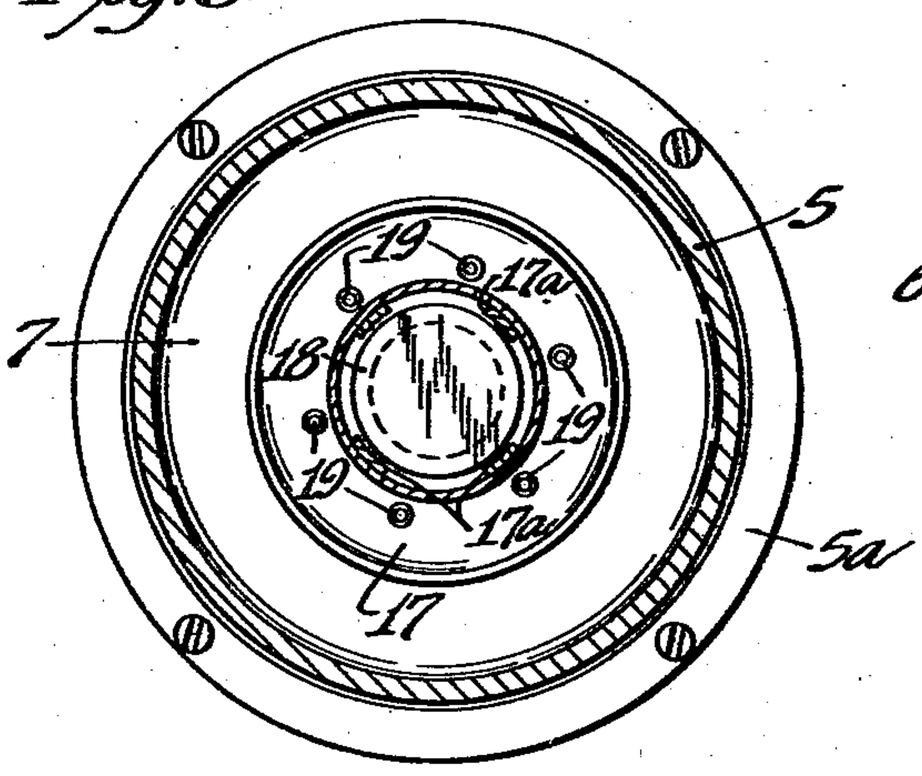
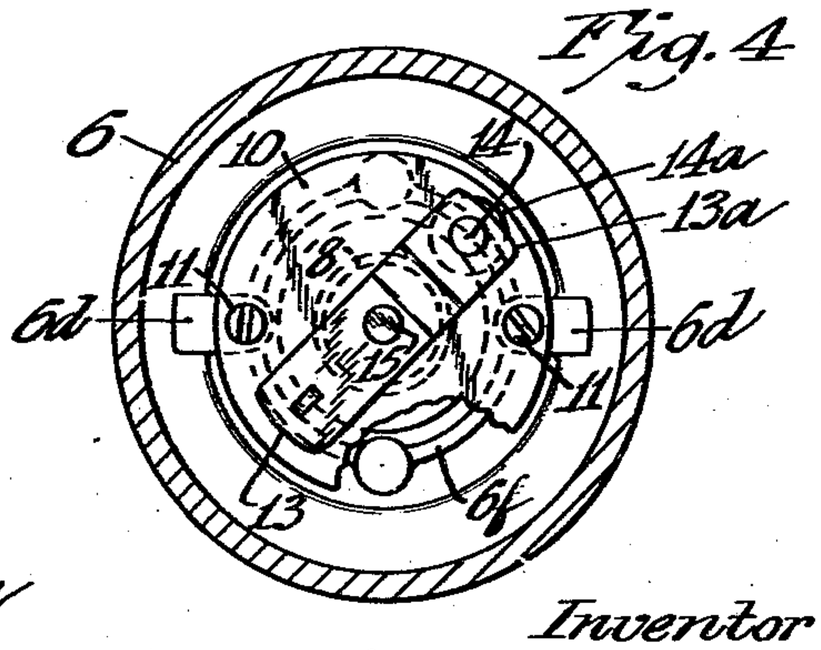


Fig. 4



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UNITED STATES PATENT OFFICE

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DIAPHRAGM PUMP

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6 Claims. (Cl. 103—151)

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My present invention relates to high capacity, diaphragm pumps and is an improvement upon the structure disclosed in my U. S. Letters Patent No. 2,314,745, as well as the pump structure disclosed in my co-pending application, S. N. 479,667, entitled "Diaphragm force pump."

In general, it is an object of my present invention, to provide an improved diaphragm pump, adapted for quite universal use, and which simplifies the structure and increases the efficiency and durability of my earlier construction.

More specifically, it is an object to provide a diaphragm assembly of improved efficiency and adapted for manufacture at lower cost, including a pre-formed, centrally apertured, cup-shaped diaphragm, constructed of reinforced, flexible and elastic material, preferably synthetic rubber, which is so related with its means for attachment to the pump housing and to the pumping head, as to have a rolling action when the diaphragm is reversed from uppermost to lowermost position and vice-versa, thereby materially extending the durability of my device.

A further object is the provision in a pump of the class described, of a diaphragm assembly so related with valve-releasing elements as to provide an automatic drain feature for the entire pump when the diaphragm is positioned in an unusual and fully lowered relation.

A still further object is the provision of an improved means in diaphragm pump construction, for reinforcing and securing the central portion of the flexible diaphragm to the connecting rod as well as to provide a housing and guide for the valve disposed between the intake and discharge members of the pump.

These and other objects and advantages of my invention will be more apparent from the following description made in connection with the accompanying drawings, wherein like reference characters refer to the same parts throughout the several views and in which—

Fig. 1 is a vertical section taken axially of the connecting rod of the pump, showing an embodiment of my invention with the diaphragm shown in full lines in extreme uppermost position and shown in dotted lines in an intermediate position near the lower end of its pumping stroke;

Fig. 2 is a similar view with the diaphragm assembly shown in extreme lowered position below the normal end of the working stroke and in such position, to operate valve release members for draining the pump;

Fig. 3 is a cross section taken approximately on the line 3—3 of Fig. 2; and

Fig. 4 is a cross section taken approximately on the line 4—4 of Fig. 1.

As shown in the drawings, my improved diaphragm pump comprises a main casing having an upper shell section 5 and a lower shell section 6

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provided with circular out-turned attachment flanges 5*a* and 6*a* respectively, which are secured together with sealed effect, in between which is anchored and sealed the outer, peripheral edge of a pre-formed, flexible diaphragm 7. Casing sections 5 and 6 may conveniently be in the form of metal castings and the lower section 6 is preferably provided with an axially aligned boss 6*a* at its lower end having a fluid-intake passage 6*b* formed therein and as shown, being externally threaded in two zones of different diameter, in adaptor fashion for threaded connection with a socket or top of a container such as a tank or barrel. Internally, the medial and somewhat restricted portion of the passage 6*b* may be threaded at 6*c* for an attachment to an extension intake pipe, not shown. The body of casing section 6, internally forms an intake chamber I at the lower end of which and as shown, inserted in the upper end of intake passage 6*b*, is mounted an annular valve seat 8, preferably constructed of brass or some other non-corrosive metal and having a smooth, circular upper edge, defining the seat proper. A flat, disc valve 9 of somewhat larger diameter than the seat member 8, cooperates with the annular seat and is guided in its vertical movement by a plurality of lugs 6*d*, which may be integrally cast in the lower portion of the interior of casing section 6. A valve retaining plate 10 in the form of a metal disc, is attached by suitable means as screws 11, across the tops of the several lugs 6*d* and a light, spiral spring 12 is interposed between retaining disc and the upper surface of the disc valve 9, urging the valve to lower and closed position. A mounting strap 13 is fixed to the upper side of valve retainer plate 10 and has a horizontally off-set outer end 13*a* spaced above plate 10, which is apertured in alignment with an aperture of plate 10 to guide and accommodate a valve-releasing stem 14 which carries at its lower end, a mushroom head 14*a*, adapted to engage against the cap of valve disc 9. A second valve-releasing stem 15 is fixed at its lower end, by swedging or otherwise, to strap 13 and also retainer plate 10 and is disposed axially of the pump housing in upstanding position, for contacting an upper disc valve, as will later be made apparent.

The diaphragm 7 is pre-formed into cup-shape, as shown in Fig. 2 and is preferably constructed of cord fabric embedded or vulcanized in synthetic rubber. Synthetic rubber is preferred as it will retain its flexibility without wear, even if exposed to volatile hydrocarbon, such as naphtha gasoline, as well as alcohol, anti-free solutions and water. The marginal edge of diaphragm 7 adjacent its outer periphery is clamped between the outturned, cooperating attachment flanges 5*a* and 6*a* of the pump casing and is preferably provided with an annular anchoring and sealing

bead 7*a* which is received by cooperating annular channels of somewhat smaller diameter, in the opposed faces of the flanges 5*a* and 6*a*. The central portion of the preformed, cup-shaped diaphragm 7, is circularly apertured to form a communication passage between lower or intake chamber I and the upper or discharge chamber D, of the housing. A valve-contained reinforcing head is attached to the marginal portion of diaphragm 7, defining the said communicating passage and preferably, consists in a pair of concentric, reinforcing rings 16 and 17 respectively, the lower of which, 16, is of somewhat smaller internal diameter than the upper ring 17, to expose a flat, marginal portion of the central apertured part of diaphragm 7, which constitutes an annular valve seat for the upper disc valve 18, when the two reinforcing rings 16 and 17 are secured and clamped together, upon the central portion of the diaphragm, as shown in Figs. 1 and 2. The said reinforcing rings 16 and 17 may be clamped against the diaphragm and secured together by suitable means such as rivets, 19. It will be noted that both of the reinforcing rings 16 and 17 are of shallow dish-shape to provide outturned and opposed, rounded or partial-spherical surfaces, which permits rolling and flexing of the diaphragm in its pumping stroke without bending the material on any predetermined circular line. The upper reinforcing ring 17, at its central portion, has extending upwardly therefrom, and preferably integrally formed therewith, a plurality of symmetrically arranged, guide arms 17*a*, disposed in the corners of an imaginary polygon and spaced apart with suitable clearance for guiding the disc valve 18 in its vertical movement. A cap member 20 fits over the upper ends of the rigid arms 17*a* and is spot-welded or otherwise rigidly secured thereto, to confine the disc valve 18 and to complete the head of the diaphragm, as well as to furnish a base of resistance for a spiral spring 21, the lower end of which reacts against the top of disc valve 18. A vertical pump or connecting rod 22, has its lower end connected to the reinforced head of the diaphragm by suitable means such as swedging its diminished extremity against the underside of cap member 20. The pump rod 22 extends upwardly through an aperture in the upper portion of casing section 5 and it is provided with a packing gland, designated as an entirety, by the letter P. An upstanding clevis pin 23 is pivoted at its lower end to a suitable attachment lug 5*b*, provided at the upper portion of casing section 5 and is fulcrumed, by a pin 24, at its upper end, the handle lever 25, the short working end of which is secured to the upper and somewhat reduced end of connection rod 22 for limited lost motion or cushioning play. To this end, as shown, handle 25 in the form of a casting, is bifurcated at its connected end 25*a* and provided with a transverse, heavy pin 26 which is vertically apertured to receive the reduced upper extremity of pump rod 22. A short coil spring 27 is interposed between the pin 26 and a nut 28, having threaded engagement with the extremity of the reduced upper end of connecting rod 22.

To lock the handle against operation when it is desired, a short link 29 is provided, pivotally connected with the intermediate portion of the clevis 23 and the outer end of which is apertured at 29*a* for registration with a locking aperture 25*b* formed in the intermediate portion of handle lever 25. When said apertured portions are in registration a padlock hasp may be secured therethrough.

As shown, the lower bossed portion of the lower casing section 6 may be provided with an air-admission port 6*e* communicating from the exterior of the casing and connecting with the intermediate portion of the fluid-intake passage 6*b*. An upstanding collar 6*f* as shown, is integrally formed in the bottom portion of casing section 6, disposed axially of the valve seat member 8 and spaced therefrom. This collar 6*f* is substantially aligned with the mushroom head 14*a* to limit downward movement thereof in the unseating of disc valve 9.

I prefer to provide a stop-bushing 22*a*, rigidly connected with the lower portion of connection rod 22, to limit the upper movement of the diaphragm assembly in the upward stroke of the pump.

Operations

When the operating handle 25 is lifted from the position shown in Fig. 1, the diaphragm head and diaphragm are thrust downwardly, slightly below the position shown in dotted lines, at such time, the fluid pressure causing the lower valve to seat and close the intake passage and to open against the tension of spring 21, the upper valve 18 controlling the communication between the intake and discharge chambers of the casing. When handle 25 is next depressed, the diaphragm head and diaphragm is elevated to the position shown in Fig. 1, thereby producing a strong suction stroke which closes valve 18 in the head of the diaphragm and causes opening of the intake disc valve 9, drawing fluid into the intake chamber. The next successive downward stroke of the diaphragm forces fluid from the intake chamber I upwardly into the discharge chamber and the next lifting stroke of the diaphragm discharges fluid through the discharge spout S, while simultaneously drawing in additional fluid through intake passage 6*b* into the intake chamber I. Thus, in operation, the discharge of fluid from my pump, is positively effected; no priming is necessary and the device is positive-acting and has a high capacity for delivery. In the movement of the diaphragm assembly, the pre-formed, cup-shaped diaphragm rolls throughout a major portion of its area, about the curved surfaces of the clamping or reinforcing rings 16 and 17 and near its outer marginal edge, about the opposed curved clamping surfaces of the connected sections 5 and 6 of the casing. This major rolling action is further facilitated by the circular-cross sectional head 7*a* of the diaphragm and there is no folding or flexing of the material along any one or set of defined circular lines, in the reversing of the diaphragm, from the position shown in Fig. 1 to the position shown in Fig. 2. The rolling action of the diaphragm takes place when viewed in cross section, along reverse curves and the wear is thus greatly reduced and not imposed upon a narrow zone or zones of the diaphragm, but is distributed in this compound rolling action, throughout substantially the entire area.

When pumping operation is completed and it is desired to drain the casing, the handle at its free end, is swung upwardly to extreme position beyond that normally assumed in operation which in turn, lowers the diaphragm head to the extreme position shown in Fig. 2, whereby the lower, reinforcing ring 16, strikes against the top of valve-releasing pin 14, causing the mushroom

head 14*a* to engage and open the valve disc 9, by fulcruming the disc at one side of its annular valve seat. Simultaneously, in said extreme lowering of the diaphragm, the upper valve disc 18 is engaged and raised by the stationary valve-releasing pin 15. Thus, with both the lower and upper valves, 9 and 18, opened and with air port 6*e* provided, substantially all fluid contained in both intake and discharge chambers of the pump, return by gravity, to the source of supply or tank.

With the structure of my reinforcing head, including the reinforcing rings 16 and 17, the upstanding rigid arms 17*a* and welded cap member 22, a very simple, efficient means is provided for not only reinforcing the central portion of the diaphragm, but also confining the upper disc valve 18 and guiding it in its vertical movement as well as connecting the diaphragm in an efficient manner with the pump rod 22.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the parts without departing from the scope of my invention.

What I claim is:

1. A diaphragm pump comprising a casing, a transversely disposed diaphragm dividing said casing into a fluid-tight intake compartment and a fluid-tight discharge compartment, an intake port and a discharge port in said casing, a central passage in said diaphragm for connecting said two compartments, a reinforcing head secured to the central portion of said diaphragm, a valve associated with said head for controlling flow of fluid through said passage, said intake port at its inner end, being opposed to the central portion of said diaphragm, a valve associated with said intake port for controlling the same and valve releasing mechanism comprising a pair of pins each having an end opposed to one of said valves and mounted for response to the movement of said diaphragm in one direction and beyond the normal operation stroke to release and open said valves for drainage of said casing.

2. A diaphrgm pump comprising a casing, a transversely disposed diaphragm dividing said casing into a fluid-tight intake compartment and a fluid-tight discharge compartment, an intake port and a discharge port in said casing, a central passage in said diaphragm for connecting said two compartments, a reinforcing head secured to the central portion of said diaphragm, a valve associated with said head for controlling flow of fluid through said passage, said intake port at its inner end, being opposed to the central portion of said diaphragm, a valve associated with said intake port for controlling the same and a valve releasing member mounted in said intake compartment to open said intake valve and having an element opposed to a portion of said reinforcing head whereby said intake will be opened for drainage when said diaphragm is moved in one direction beyond its normal operating limit.

3. A diaphragm pump comprising a casing, a transversely disposed diaphragm dividing said casing into a fluid-tight intake compartment and a fluid-tight discharge compartment, an intake port and a discharge port in said casing, a central passage in said diaphragm for connecting said two compartments, a reinforcing head secured to the central portion of said diaphragm, a valve associated with said head for controlling flow of fluid through said passage, said intake port at its inner end, being opposed to the central portion of said diaphragm, a valve associated with said intake port for controlling the same and a

valve releasing member fixedly mounted in said intake compartment independently of said head and valve associated therewith and having a portion opposed to the valve associated with said head for striking and unseating said valve for drainage purposes when said diaphragm is moved in one direction beyond its normal operating stroke.

4. A diaphragm pump comprising a casing, a transversely disposed diaphragm dividing said casing into a fluid-tight intake compartment and a fluid-tight discharge compartment, an intake port and a discharge port in said casing, a central passage in said diaphragm for connecting said two compartments, a reinforcing head secured to the central portion of said diaphragm, a valve associated with said head for controlling flow of fluid through said passage, said intake port at its inner end, being opposed to the central portion of said diaphragm, a valve associated with said intake port for controlling the same, a plunger member slidably mounted in said intake compartment and having an end disposed against said intake valve, said plunger member having an upper end opposed to a zone of said reinforcing head whereby said intake valve will be opened for drainage when said diaphragm is moved in one direction beyond its normal operating limit.

5. A diaphragm pump comprising a casing, a transversely disposed diaphragm dividing said casing into a fluid-tight intake compartment and a fluid-tight discharge compartment, an intake port and a discharge port in said casing, a central passage in said diaphragm for connecting said two compartments, a reinforcing head secured to the central portion of said diaphragm, a valve associated with said head for controlling flow of fluid through said passage, said intake port at its inner end, being opposed to the central portion of said diaphragm, said inlet port having a projecting annular seat, a valve disposed over said seat and having a marginal portion projecting beyond said seat, a plunger member slidably mounted in said intake compartment and extending longitudinally of said intake port and having an end disposed against the marginal edge of said intake valve, said plunger having an upper end opposed to a zone of said reinforcing head whereby said intake valve will be tilted for drainage when said diaphragm is moved in one direction beyond its normal operating limit.

6. The structure set forth in claim 5 and a transverse member in said intake chamber wherein said plunger is mounted and a valve-operating pin secured to said member and having an end opposed to said valve associated with said head to open the same when said diaphragm is moved in one direction beyond its normal operating limit.

WALTER F. WESLEY.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
39,259	Holly	July 14, 1863
768,984	George	Aug. 30, 1904
1,484,115	Eells	Feb. 19, 1924
1,562,069	Arringdale	Nov. 17, 1925
2,314,745	Wesley	Mar. 23, 1943

FOREIGN PATENTS

Number	Country	Date
505,510	Great Britain	1939