June 22, 1948. A. H. DAVIS, JR 2,443,816

DISCHARGE VALVE

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FIG. 1

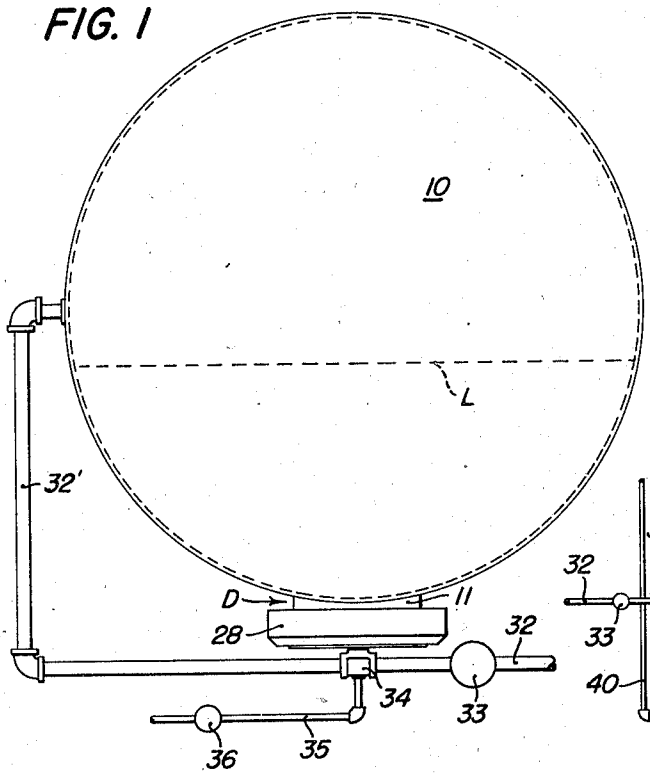



FIG. 3

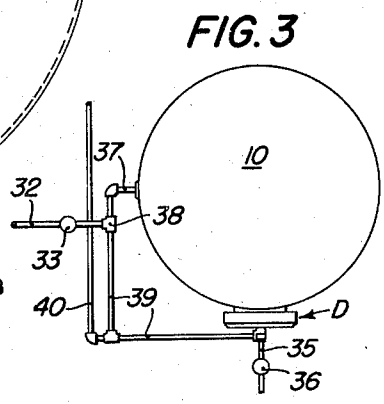
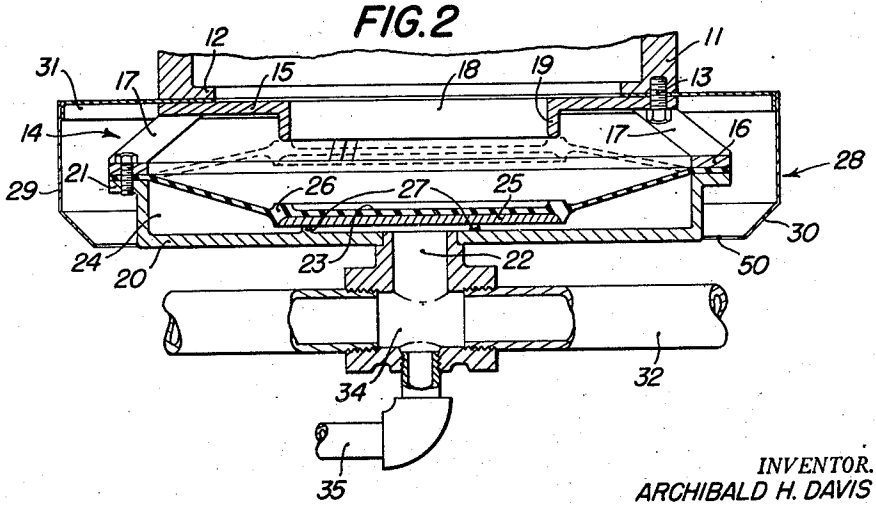



FIG. 2




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## DISCHARGE VALVE

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9 Claims. (Cl. 137—21)

1

This invention relates to fluid control mechanisms, and more particularly to such mechanisms for washing machines and the like.

Among the objects of the present invention is to provide a novel fluid control mechanism adapted for use, for example, as a discharge or dump valve operatively associated with the intake and outlet means for the shell or container of a washing machine or the like, which, as is well known, must be emptied and refilled repeatedly during the various stages of a washing cycle.

Another object of the present invention is to provide a fluid control mechanism for the discharge means of a container for a washing machine or the like which embodies an hydraulically operated discharge valve in its construction, which will close automatically when fluid is supplied to said container.

Another object of the present invention is to provide a discharge valve for the container of a washing machine or the like which is responsive to fluid pressure in the fluid control system for said container.

A further object of the present invention is to provide a novel valve mechanism for the container of a washing machine or the like which is in communication with a valve-controlled intake means and is operable in accordance with the fluid pressure therein.

A further object of the invention is to provide a discharge valve wherein a diaphragm subject to the pressure created in the intake means directly closes or opens the outlet opening of the container for a washing machine or the like.

A further object of the invention is to provide a discharge valve wherein the release of the diaphragm from pressure tending to hold the diaphragm in the closing position may be achieved by opening a drain valve of the fluid control system for the container.

A further object within the purview of the present invention is to provide a novel fluid control system for the container of a washing machine or the like, involving a valve controlled intake means including a filling pipe for said container and a valve mechanism in operative association with the discharge means for said container, and wherein the said filling pipe for the container and the said valve mechanism are arranged in parallel relation to the valve of said intake means.

Another object of the invention is to provide a discharge valve for the container of a washing machine or the like which discharges the liquid

2

contents of the container practically without splashing.

A further object of the invention is to equip a discharge valve for a container of a washing machine or the like with means for guiding the discharge stream of liquid therefrom in such a manner that said discharged stream will take substantially the form of a converging cone.

Another object of the invention is to provide in a washing machine or the like whose container is to be partly filled only, a diaphragm operated discharge valve which will close automatically under the action of the hydrostatic head created in an intake pipe connected to the container at a point situated above the highest liquid level in the container.

Still another object of the invention is to simplify the actuating mechanism for the liquid discharge of automatically controlled washing machines or the like.

With these and other objects in view which will appear as the description proceeds, the invention consists in the construction and arrangement of parts which will be described in connection with the accompanying drawings, the novel features being pointed out in the claims at the end of the specification.

In the drawings:

Fig. 1 is a view in end elevation of certain parts of a washing machine, embodying in its construction a fluid control mechanism made in accordance with the present invention;

Fig. 2 is an enlarged fragmentary view in section of the valve mechanism shown in Figure 1 of the drawings; and

Fig. 3 is a view in end elevation of a modified form of the invention.

Referring first to Figs. 1 and 2, 10 denotes the container or shell of a washing machine or the like. Integral with or secured to the bottom of the container 10, and in open communication with the interior of the container is a short tubular part 11 having an inwardly extending flange 12. Secured to the flange 12 is a discharge or dump valve, marked generally as D. An annular cage 14, comprising a top plate 15, a ring 16 and interconnecting ribs 17 which form open ports therebetween through which liquid may flow, is connected to the flange 12 by means of screw bolts 13 or the like. The plate 15 is provided with a central opening 18 defined by a downwardly extending cylindrical valve seat 19. 20 is a cup-like casing provided with a flange 21 at its upper end and a central opening 22 at its bottom. Clamped between the ring 16 and the

flange 21 is a diaphragm 23 which has a substantially larger area than the outlet opening 18. The diaphragm 23 together with the casing 20 forms a pressure chamber 24. A disc shaped weight 25 is secured to the middle portion of the diaphragm 23 so as to hold flat this part of the diaphragm. While Fig. 2 shows the weight 25 at the lower side of the diaphragm 23, it will be understood that such a weight could be attached instead to the upper side of the diaphragm or, if desired, weights could be secured on both sides of the diaphragm. The diaphragm 23 has an annular projection 26 which bears against the seat 19 when the diaphragm 23 is in closed position, as shown in dotted lines in Fig. 2. In its open position the diaphragm 23 rests, by the intermediary of the weight 24, upon upstanding lugs 27 provided on the bottom of the casing 20.

The cage 14 is surrounded by a guard 28 adapted to guide the liquid passing through the ports of the cage 14 in a manner to be presently described. According to Fig. 2 the guard 28 consists of a cylindrical part 29 and a conical part 30 which terminates in spaced relation to the outer wall of the casing 20 to form an annular discharge opening 50. At the top, the guard 28 is closed by a disc 31 which may be secured to the part 11 of the container 10 or to the cage 14 in any suitable manner. In the specific embodiment disclosed, the disc 31 is clamped between the flange 12 and the plate 15.

The pressure chamber 24 is in communication with the pipe line 32 supplying the container 10 with water or other washing liquid. The normal maximum liquid level in the container 10 is indicated in Fig. 1 by the line L and it is preferably above this maximum level L that the filling pipe 32' of the pipe line is connected to the container 10. A valve 33 in the pipe line 32, which may be a solenoid operated valve, opens and shuts off the liquid supply to the container 10.

According to Fig. 1 the pressure chamber 24 is connected to a fitting 34 in the pipe line 32, situated at a point between the valve 33 and the filling pipe 32'. Connected to the fitting 34 is a drain pipe 35 having a valve 36, which may be a solenoid operated valve, if desired.

Prior to the filling of the container 10 with washing liquid or the like, the two valves 33 and 36 are closed, at which time the diaphragm 23 is in open position, as shown in full lines in Fig. 2. When the valve 33 is turned on to fill the container 10, liquid entering the fitting 34 passes partly through the filling pipe 32' into the container 10 and partly into the pressure chamber 24. The hydrostatic head developed in the vertical portion of the filling pipe 32' creates almost instantly sufficient hydraulic pressure in the pressure chamber 24 to force the diaphragm 23 upwardly and against the seat 19 to automatically close the outlet opening 18 of the container 10.

Closing of the supply valve 33 will not reverse the pressure conditions in the pressure chamber, the hydrostatic head due to the liquid level in the vertical portion of the pipe 32 remaining high enough to keep the diaphragm 23 in the closed position. To move the diaphragm into the open position the drain valve 36 has to be opened. In automatically controlled washing machines or the like, the opening of the drain valve will usually be subject to the electrically controlled mechanism of the machine, but such opening may also be brought about manually. Opening of the drain valve 36 will relieve the pressure underneath the diaphragm 23 and the latter will move downwardly into the position shown in full lines in Fig. 2 under the combined action of the weight of the diaphragm, of the weight 25, as well as of the hydraulic pressure exerted upon the upper face of the diaphragm 23 by the liquid in the container 10. By virtue of those forces, the outlet opening 18 of the container 10 is opened completely and the fluid contained in the container passes through the outlet opening 18 and through the ports formed between the ribs 17 of the cage 14. The stream of liquid leaving the cage 14 in substantially radial direction enters the guard 28 where it is forced to change its direction. The change in direction of flow takes place gradually, the liquid first flowing in a substantially axial direction in the cylindrical zone 29 of the guard 28, after which the conical wall 30 forces the liquid to leave the annular discharge opening 50 in the form of a converging cone directed towards a drain opening (not shown). This construction avoids the heretofore encountered splashing around of the discharging liquid which in certain phases of a washing process, for example, has a temperature high enough to cause severe burns to a person hit by the splashing liquid. Such construction for the guard 28 also permits the usual drain sink underneath the discharge opening of the container 10 to be made much smaller than has been necessary heretofore.



The discharge of the liquid in the form of a converging cone can also be achieved with a somewhat different shape of the guard 28. For instance, the side wall of the guard could be shaped as a zone of a sphere, or it may follow a curve, other than a part of a circle, defining a concave inner surface of the guard 28.

Fig. 3 shows a modified pipe line arrangement as compared with Fig. 1. 10 again denotes the shell or container of the washing machine or the like, D the discharge or dump valve, 33 the supply valve, 35 the drain pipe, and 36 the drain valve. The discharge valve D is of the construction shown in Fig. 2. Extending from the supply valve 33 is a filling pipe 37 which is connected to the container 10. Connected to the filling pipe 37, as at 38, is a pipe line 39 for diverting into the pressure chamber 24 a part of the liquid supplied by the filling pipe. Thus the container 10 and the pressure chamber 24 are arranged in parallel with respect to the supply valve 33, whereas in Fig. 1 the pressure chamber 24 and the container 10 are connected in series. The parallel connection of Fig. 3 permits the use of differently dimensioned pipes in the parallel branches, such as a diverting pipe 39 of smaller cross section than the filling pipe 37. A vent tube 40 is connected to the pipe 39, as at 41, to provide for the quick escape of air which may be present in the pipe 39, in order that the hydrostatic head in the pipe 39, instrumental for moving the diaphragm 23 into its closing position, may be established very rapidly. The vent tube 40 extends beyond the point of discharge of the filling pipe 37 into the container 10, so that no liquid may flow out at the open end of the vent tube 40.

As will be seen from the foregoing description, the outlet opening 18 of the shell or container 10 of the washing machine is automatically and directly closed by the diaphragm 23 whenever the liquid supply for said container is turned on, and is kept safely closed by virtue of the resultant fluid pressure on its underside due to the difference existing between the areas of the outlet opening 18 and the diaphragm 23, provided the drain valve 34 is closed at that time. While this applies to

manually as well as to automatically controlled washing machines or the like, the described connection between the filling pipe and the pressure chamber of the valve D is of particular value in the case of automatically controlled washing machines because one of the solenoid operated valves used in machines of this type, together with its electrical circuit, is eliminated without impairing the automatic character of the control. Thus in the examples shown only two solenoid operated valves, the supply valve **33** and the drain valve **36**, are used whereas no solenoid operated valve is necessary in connection with the hydraulically operated discharge or dump valve D.

While I have shown and described certain embodiments of the invention, it is to be understood that these embodiments have been given by way of example only and that various changes, rearrangements, and modifications may be made without departing from the spirit of the invention.

What I claim is:

1. In a washing machine or the like, the combination of a container adapted to be partly filled with liquid and having a discharge opening, an intake conduit for supplying said container with liquid at a point above the highest liquid level in said container, a chamber, a diaphragm valve member forming a movable top for said chamber and adapted to close said opening under the action of fluid pressure created in said chamber, said opening and said chamber being arranged on opposite sides of said diaphragm, a supply line including a valve controlling fluid flow to said intake conduit, and connecting means between said chamber and said intake conduit, whereby fluid pressure for holding said diaphragm in its closed position with respect to said opening is created by the head of liquid in said intake conduit when fluid is supplied said container through said intake conduit.

2. In a washing machine or the like, the combination of a container adapted to be partly filled with liquid and having a discharge opening, an intake conduit for supplying said container with liquid at a point above the highest liquid level in said container, a chamber, a diaphragm valve member forming a movable top for said chamber and adapted to close said opening under the action of fluid pressure created in said chamber, said opening and said chamber being arranged on opposite sides of said diaphragm, said diaphragm being of substantially larger area than said opening, a supply line containing a valve feeding said filling pipe, and connecting means between said chamber and said intake conduit, whereby fluid pressure for holding said diaphragm in its closed position with respect to said opening is created by the head of liquid in said intake conduit when fluid is supplied said container through said intake conduit.

3. In a washing machine or the like, in combination, a tank open to the atmosphere, an outlet valve adapted to be closed by liquid under pressure, a tank inlet above the outlet valve, a liquid supply leading to the inlet, a branch of the liquid supply line leading to the outlet valve, the head of the liquid in the supply system above the outlet valve supplying the liquid pressure to keep said outlet valve closed.

4. In a washing machine or the like, in combination, a tank open to the atmosphere, an outlet valve adapted to be closed by liquid under pressure, a tank inlet above the outlet valve, a liquid supply leading to the inlet, a branch of the liquid supply line leading to the outlet valve, the head of the liquid in the supply system above the outlet valve supplying the liquid pressure to keep said outlet valve closed, means to drain said branch to allow the outlet valve to open.



5. In a washing machine or the like, in combination, a tank open to the atmosphere, an outlet opening for the tank, a pressure cell supported adjacent said outlet opening, a diaphragm forming one face of said pressure cell and adapted to be forced against said opening by pressure in the cell, a tank inlet above the outlet opening, a liquid supply line to the inlet, a branch of the liquid supply line leading to said pressure cell, the head of the liquid above the pressure cell supplying the liquid pressure to automatically keep said outlet opening closed.

6. In a washing machine or the like, in combination, a tank open to the atmosphere, an outlet opening for the tank, a pressure cell supported adjacent said outlet opening, a diaphragm forming one face of said pressure cell and adapted to be forced against said opening by pressure in the cell, a tank inlet above the outlet opening, a liquid supply line to the inlet, a branch of the liquid supply line leading to said pressure cell, the head of the liquid above the pressure cell supplying the liquid pressure to automatically keep said outlet opening closed, means to drain said branch to allow discharge of the tank contents through said outlet opening.

7. In a washing machine or the like, in combination, a tank open to the atmosphere, an outlet opening for the tank, a pressure cell supported adjacent said outlet openings, a diaphragm of substantially larger area than said outlet opening forming one face of said pressure cell and adapted to be forced against said opening by pressure in the cell, a tank inlet above the inlet opening, a liquid supply line to the inlet, a valve controlling admission of a liquid into the supply line, a branch of the liquid supply line leading to said pressure cell, the head of the liquid above the pressure cell supplying the pressure to automatically keep said outlet opening closed after the inlet valve is closed.

8. In a washing machine or the like, in combination, a tank open to the atmosphere, an outlet opening for the tank, a pressure cell supported adjacent said outlet openings, a diaphragm of substantially larger area than said outlet opening forming one face of said pressure cell and adapted to be forced against said opening by said pressure in the cell, a tank inlet above the inlet opening, a liquid supply line to the inlet, a valve controlling admission of a liquid into the supply line, a branch of the liquid supply line leading to said pressure cell, the head of the liquid above the pressure cell supplying the pressure to automatically keep said outlet opening closed after the inlet valve is closed, means to drain said branch to allow discharge of the tank contents through said outlet opening.

9. In a washing machine or the like, in combination, a tank open to the atmosphere, an outlet opening for the tank, a pressure cell supported adjacent said outlet opening, a diaphragm forming one face of said pressure cell and adapted to be forced against said opening by pressure in the cell, a tank inlet above the outlet opening, a liquid supply line to the inlet, a branch of the liquid supply line leading to said pressure cell, an air vent extending above the inlet connected with the branch line to eliminate air lock when the branch is being filled, the head of the liquid above

the pressure cell supplying the liquid pressure to automatically keep said outlet opening closed.

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