

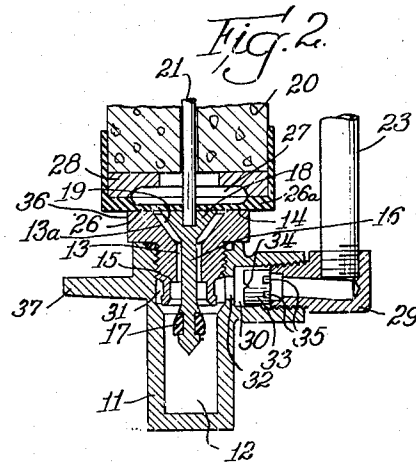
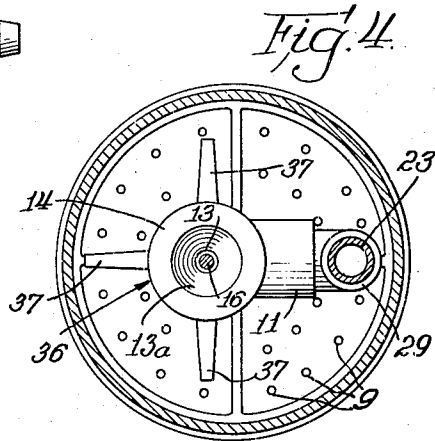
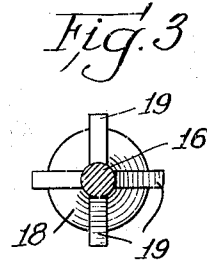
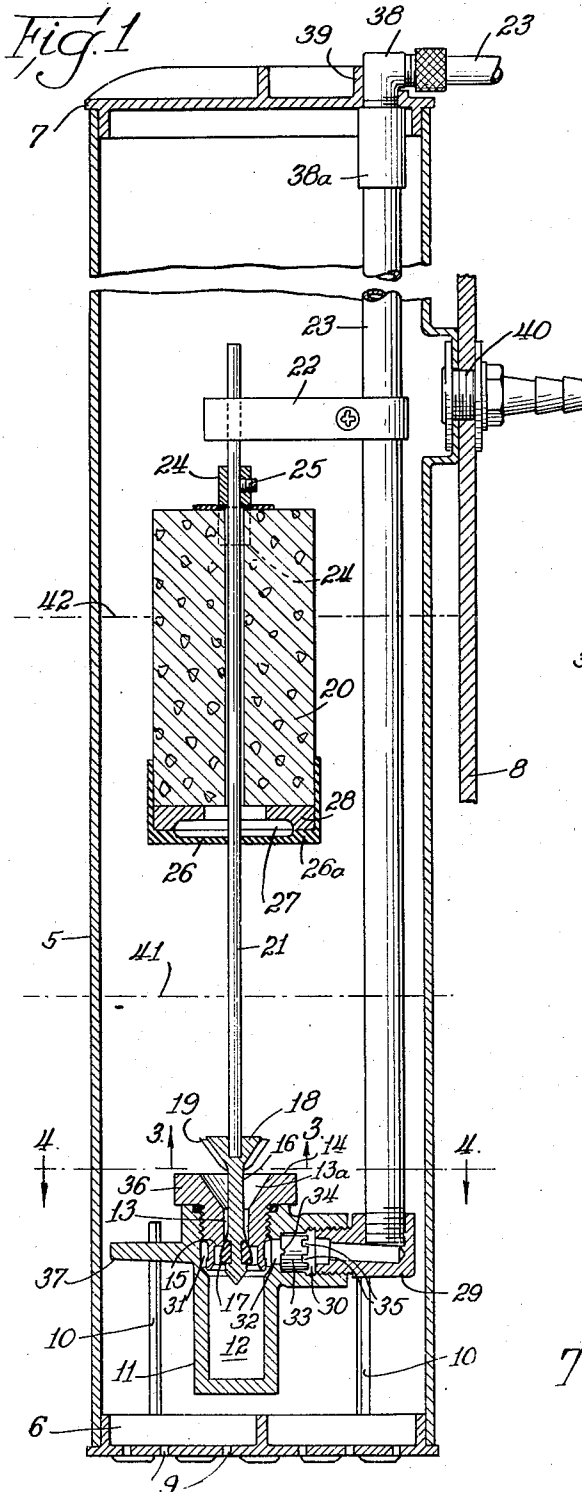
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FLOAT VALVE

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2,904,062

FLOAT VALVE

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9 Claims. (Cl. 137—391)

This invention relates to a float valve of the general type described in Patent No. 2,716,422, granted August 30, 1955, to R. H. Whitlock, Jr., and has for its principal object to provide in a valve of this type simple means for insuring the positive closing of a flow passage both at the end of the period for withdrawal of liquid from a container and at the end of a refill period.

A further object is to provide such a valve with internal and external passage closure members which are guided accurately to and form seats at the upper and lower ends respectively of a flow passage.

A further and particular object is to provide a valve having an annular port arranged to direct the flow through the valve uniformly at all sides of an internal closure member whereby straight line, rapid and positive closing of the member at its seat is insured at the end of each refill period.

Other objects will appear and be more fully pointed out in the following specification and claims.

Referring to the accompanying drawing which illustrates, by way of example and not for the purpose of limitation, one form of my invention:

Figure 1 is a vertical sectional view showing my float valve in a container of a type used in brine tanks for water softening apparatus, the float being shown in its high level position;

Fig. 2 is a fragmentary vertical sectional view showing the lower portion of the valve and float with the latter in its low level position, and

Figs. 3 and 4 are horizontal sectional views taken on the lines 3—3 and 4—4 of Fig. 1.

In the drawing a container for liquid in which the valve may be submerged is indicated at 5. This container is vertically elongated and has a bottom 6 and a removable cover 7. In installations where the container 5 is to supply brine to a water softener it is placed in a brine tank or reservoir having a wall 8. Openings 9 in the bottom of the container 5 and vertically elongated slots 10 formed in the cylindrical wall of the container 5 provide for flow of liquid between the surrounding tank and container 5.

My improved float valve has a casing indicated generally at 11 forming a chamber 12 which is preferably cylindrical or circular in cross sectional shape. Extending upward from the chamber 12 is a flow passage 13 communicating with the interior of the container 5 and having a substantially conical upper end surface 13a forming an upwardly and outwardly flaring recess in the top of the valve casing. Surrounding the upper and lower ends respectively of the passage 13 are valve seats 14 and 15. A valve stem 16 is movable longitudinally and coaxially in the passage 13 and carries on its lower end a head 17 adapted to close the passage at seat 15.

Fixed on the upper end of the system 16 is a second head 18 adapted to fit in the recess formed by conical surface 13a when the head 17 is open in relation to its seat 15 as indicated in Fig. 2. As best shown in Figs. 1 and 3, the head 18 is formed with peripheral projections

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19 affording between them continuations of the passage 13 when the stem is in its lowered position. The head 18 and its projections 19, when seated on the surface 13a, also centers the stem 16 and 17 carried thereby by relative to the passage 13 and seats 14 and 15.

A float indicated generally by the numeral 20 is mounted above the valve casing on a guide rod 21. At its lower end this rod is connected to the stem 16 in axial alignment therewith. The upper end portion of the rod 21 is slidable vertically in a fixed guide bracket 22 suitably supported in the container 5. As shown, the support for bracket 22 comprises a conduit 23 adapted to alternately supply liquid to the valve casing 11 and withdraw liquid from this casing. To facilitate straight line sliding movement along the rod 21, the float 20 has an elongated axial bearing embracing the rod 21. Upward movement of the float relative to the rod 21 is limited by a stop collar 24 which is secured in a selected position along the rod 21 by suitable means, e.g., by a set screw 25.

Mounted on the lower end of the float 20 is a closure member 26. This member is preferably a flexible elastic diaphragm having a peripheral portion 26a secured to the float in suitable manner and a central portion which is free to flex upwardly or downwardly, being extended across the lower side of a recess 27 provided at the lower side of the float. Stability in the vertical movement of the elongated float is insured by providing an annular weight 28 at the upper side of the closure member 26. At its center the member 26 is perforated to receive the guide rod 21 and the adjacent annular portion is free for limited movement along the rod. When the float is in its low level position indicated in Fig. 2, the member 26 is firmly closed and supported on the annular seat 14 and on the upper surface of the head 18 so that the passages at the periphery of this head are effectively sealed.

At its lower end the liquid conduit 23 is connected to the valve casing 11 by a suitable elbow fitting 29. Communication through this fitting is established with the chamber 12 through a passage 30, the inner end portion of which comprises an annular recess 31 concentric with the cylindrical chamber 12 and having an annular port 32 communicating with the chamber. Since the port 32 is concentric with the head 17 and stem 16, flow to and from the chamber 12 is distributed at all sides of the valve head so that the hydraulic forces created by the flow do not bias the head 17 laterally out of alignment with its seat 15.

A flow check member 33 of generally cylindrical shape fits loosely in the passage 30 and is formed with a cross slot 34 at one end to restrict the flow into the chamber 12 during the period for refill or pressure flow to the container 5. The opposite end surface of check member 33 has a pair of larger cross slots 35 which allow more rapid flow out from the chamber 12 to the conduit 23. During refill operation the check member 33 is in the position indicated in Fig. 1 and during withdrawal of liquid through conduit 23 this check member is in the position indicated in Fig. 2.

The upper end wall of chamber 12 is formed by a casing member 36 having a threaded connection with the body of the casing. Flow passage 13, conical surface 13a and the annular recess 31 of the passage 30 are formed in the casing member 36, as are the seats 14 and 15 at the upper and lower ends respectively of the flow passage. Access to the chamber 12 and valve head 17 is obtained by removing the threaded casing member 36.

To insure suitable spacing of the float valve from the walls of the container 5, the casing 11 is provided with horizontally projecting fingers 37. These fingers project outwardly beyond the periphery of the float 20 from three sides of the valve casing and at the fourth side the con-

duit 23 and fitting 29 project to maintain a suitable space at this side between the float and container 5.

Interposed in the conduit 23 at the elevation of the container cover 7 is an elbow 38. This elbow is held in a predetermined angular position relative to the container 5 by a flange formation 39 on the cover 7. This flange formation surrounds an opening in the cover for the lower end portion of the elbow 38 and is so shaped as to prevent any turning of the elbow and vertical portion of conduit 23 which might force the float against a side of the container 5. A coupling 38a abuts against the lower side of the cover 7 to confine the float valve in the container 5. The cover 7 is removable with the complete float valve as a unit from the upper end of the container 5. At one side a safety overflow fitting 40 communicates with the interior of the container 5 at an elevation somewhat above the upper level position of the float 20.

In operation liquid may alternately be fed to the container 5 at a pressure above atmospheric pressure and then withdrawn under sub-atmospheric pressure through the conduit 23. Assuming that the float is in the low level position indicated in Fig. 2, liquid enters the chamber 12 through the passage 30 and annular port 32. Flow control member 33 is thereby moved to its left position indicated in Fig. 1 so that the rate of flow is limited by the size of the cross slot 34. Fluid pressure in the passage 13 then raises the float 20 from the closed position indicated and allows water to pass into the container 5 through the passages between the projecting members 19, head 18 and surface 13a.

Such refill flow continues until the float 20 reaches its top level position shown in Fig. 1, the approximate level being indicated by the broken line 42. During the greater part of this flow the head 18 remains seated on the conical surface 13a and the stop 24 is in its lower position indicated in broken lines in Fig. 1. Finally the upper surface of the float engages the stop 24 and the float moves the stop, rod 21 and stem 16 carrying the heads 17 and 18 upward to the closed position indicated in Fig. 1. This, of course, stops flow into the container 5 through the passage 13 and the head 17 remains in its closed position on seat 15.

Withdrawal of liquid from the container 5 through the valve chamber 12 starts when suitable sub-atmospheric pressure is created in the conduit 23. Such sub-atmospheric pressure draws the head 17 downwardly from its seat and allows flow at a controlled rate to be established through the passage 13 into the chamber 12 and then through the passage 30 into the conduit 23. As the flow starts the check member 33 moves to the right allowing increased rate of flow through the slots 35. Shortly after the withdrawal starts, the head 18 is seated on the conical surface 13a thus stopping downward movement of the head 17 and stem 16. Thereafter as the withdrawal continues the float slides down the guide rod 21 until it reaches a low level position approximately at the elevation indicated by the broken lines 41. At this time the closure member 26 makes contact with the seat 14 and upper surface of the head 18 and the flexible diaphragm is drawn downwardly by the suction to securely seal the passage 13 against further outward flow of fluid through the valve casing and conduit 23.

By the present invention I overcome the difficulties attendant upon the use of float valves having closure members which are free to move laterally to off center positions on the valve seats. It will be evident that the upper end of the stem 16 is accurately centered in the passage 13 when the closure member 26 is in its passage closing position. Also the float cannot move to an off center position since it is guided by the rod 21. Movement of the valve head 17 to and from its seat 15 is also accurately guided and the flow to and from the annular port 32 does not bias the head 17 toward any off center position.

I claim:

1. A float valve comprising, a casing normally submerged in liquid in a container and having an internal chamber, a first elongated passage extending upwardly from said chamber and having an upper end communicating with said container, valve seats surrounding the upper and lower ends of said passage respectively, said casing being formed with a recess surrounding the upper end of said passage, a rigid valve stem movable substantially coaxially in said passage, a valve head fixed on the lower end of said stem within said chamber to close said passage at said lower end seat, a second head fixed on said stem and fitting in said recess for centering the upper end of the stem with said passage when said valve head is in open position relative to said lower end seat, said second head being formed to define an extension of said passage when positioned in said recess, said seat surrounding the upper end of said first passage comprising an annular surface of the casing at the outer periphery of said recess a conduit connected to said casing for alternately withdrawing liquid from said chamber and supplying liquid thereto, a second passage connecting said conduit to said chamber, a guide rod for a float connected to said stem in axial alignment therewith and extending upwardly therefrom, a float movable along said rod, a closure member comprising a flexible diaphragm carried by said float to close said passage at its upper end seat when the liquid in said container is at a predetermined low level, and a stop fixed on said guide rod for engagement with the float when the liquid is at a predetermined high level whereby said stem and valve head may be actuated to close said passage at its lower end seat.

2. A float valve in accordance with claim 1 in which said chamber has a circular portion surrounding and in coaxial relation to said valve head, and said second passage has an annular end portion communicating with the circular portion of said chamber at all sides and in radially spaced relation to said valve head.

3. A float valve in accordance with claim 1 in which said second head fixed on said stem above said casing is disposed to contact said casing to limit downward movement of said stem.

4. A float valve in accordance with claim 3 in which said second head has a peripheral recess defining an extension of said first passage when said second head is in contact with the valve casing, the upper end of said extension passage being disposed to be closed by the closure member carried by the float.

5. A float valve in accordance with claim 1 in which said float has a recess in its lower side and said flexible, elastic diaphragm extends across the lower side of said recess.

6. A float valve in accordance with claim 4 in which said flexible elastic diaphragm is confined at its periphery on the float, having a central opening to receive said rod and an annular, normally horizontal portion of said diaphragm being adapted to close against said upper end seat to close said first passage.

7. A float valve in accordance with claim 1 in which said enlarged upper end portion of said passage is substantially conical, having upwardly and outwardly flaring sides and said second head has peripheral projections providing flow through said first passage when said second head is seated in the enlarged upper end portion of said passage.

8. A float valve in accordance with claim 1 in which said second head has an upper surface disposed to extend in continuation of said seat surrounding the upper end of said passage when said head is seated therein to support the central portion of the valve closure member carried by the float.

9. A float valve in accordance with claim 8 in which said flexible, elastic diaphragm is confined at its periphery on the float and annular portions of said diaphragm are

disposed to close against said upper end seat and against
the upper surface of said second head.

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