March 31, 1964 E. J. TISCHLER ET AL 3,126,907

FLOAT VALVE MECHANISM

Filed June 8, 1961

FIG. 1

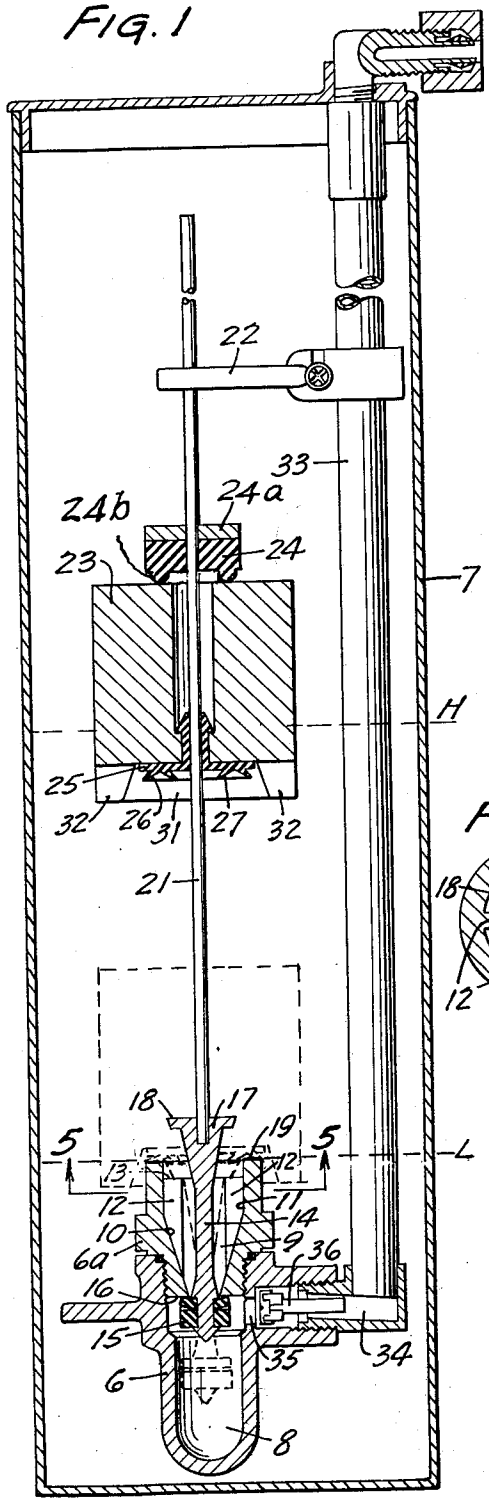


FIG. 2

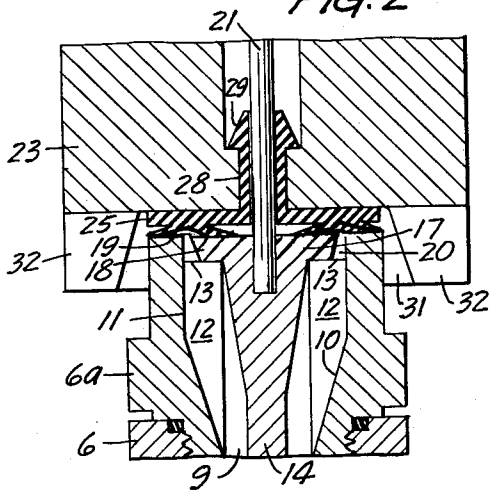


FIG. 3

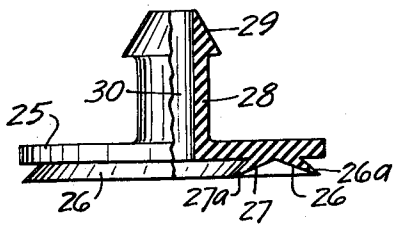


FIG. 5

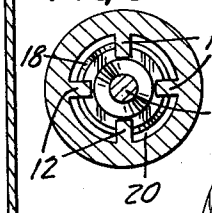
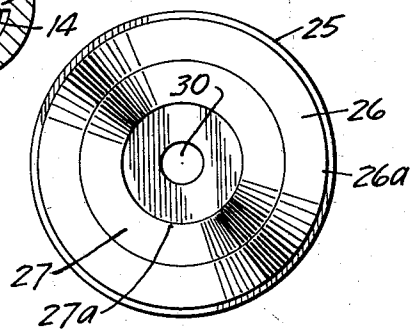


FIG. 4



INVENTORS
EDWARD J. TISCHLER
THOMAS J. SCHOENECKER
BY John E. Thompson
ATTORNEY

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FLOAT VALVE MECHANISM

Edward Joseph Tischler, St. Paul, and Thomas J. Schoenecker, North St. Paul, Minn., assignors to Union Tank Car Company, Chicago, Ill., a corporation of New Jersey

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This invention relates to a float valve of the type adapted to be submerged in liquid in a container or tank and including a valve body having an internal chamber and a port communicating with the interior of the container, and particularly to improved means for closing and sealing such a port when the liquid in the container descends to a predetermined low level therein.

Heretofore valves of this type have been used in regenerant supply tanks for water treatment apparatus. In such tanks the float valves are connected by one or more conduits to the treatment apparatus and make-up water or other fluid is alternately supplied to the regenerant tank and the regenerant solution withdrawn from the tank through the valve. The withdrawal of regenerant is usually at sub-atmospheric pressure and under control of a float actuated valve. For best results it is important that the flow of liquid out of the tank or container be cut off instantaneously when the level of liquid in the container reaches a low level at the elevation of the valve inlet port. This prevents the entry of air into the flow system and minimizes variations in the quantity of regenerant supplied for each regenerating operation. Since the regenerant liquid usually contains solid particles of impurities and salt which are deposited on the contact surfaces of the valve seat and closure member, the instantaneous closing and sealing of the inlet port at the precise moment when a predetermined low level is reached presents a real problem.

It is, therefore, the principal object of the present invention to provide novel and improved means carried by the float of a valve of the class described for closing and effectively sealing the container port instantaneously when the level in the liquid container reaches a predetermined low level.

It is a particular object of our invention to provide a closure member of the class described which is adapted to coact with radially spaced annular seat surfaces surrounding an annular port, and including inner and outer flexible resilient flanges disposed to close against the annular seat surfaces when the liquid descends to a predetermined low level.

Our invention also includes certain other novel features of construction which will be more fully pointed out in the following specification and claims.

Referring to the accompanying drawing:

FIGURE 1 is a central vertical sectional view showing our improved valve mechanism;

FIG. 2 is a fragmentary sectional view on a larger scale showing the valve in closed relation to the upper valve port;

FIG. 3 is a part side elevational and part vertical sectional view showing the closure member;

FIG. 4 is a bottom plan view of the same, and

FIG. 5 is a horizontal sectional view taken on the line 5—5 of FIG. 1.

Referring to FIG. 1 of the drawing, our improved valve is of the type having a casing 6 adapted to be submerged in liquid in a container 7, the casing 6 defining a chamber 8. From the chamber 8 a first passage 9 extends upwardly and communicates at its upper end with the interior of the container 7. The passage 9 is defined by an upwardly and outwardly flaring wall portion 10 and a cylindrical upper wall portion 11 of a separable

casing member 6*a*. Vertically elongated stop members 12 are formed in the casing member 6*a* and have horizontally disposed upper ends 13 which are spaced downwardly from the upper end of the cylindrical wall portion 11 to afford a stop for downward movement of a valve stem 14.

Fixed on the lower end of the stem 14 within the chamber 8 is a valve closure member 15 adapted to close the passage 9 at a seat 16 surrounding the lower end of the passage. The upper end portion of the stem 14 has an integral head 17 and an annular flange 18 adapted to be supported on the upper ends of the members 12 when the stem is at the lower extremity of its movement, as indicated in detail in FIG. 2. The cylindrical wall 11 and annular flange 18 form an annular port 20 between them (FIGS. 2 and 5) for flow of liquid from the valve casing into the container 7 and from the container into the valve casing. A valve seat surrounding the upper end of the passage 9 has surfaces spaced radially inward and radially outward of the annular port 20. These surfaces comprise a plane upper surface of the flange 18 and a similar upper surface 19 of the valve casing member 6*a*. The surface 19 and top surface of the flange 18 are plane horizontally disposed surfaces and are disposed at substantially the same elevation when the stem 14 is in its lowermost position.

A float guide rod 21 is secured at its lower end to the stem 14 in coaxial relation thereto and is guided for limited vertical movement in a bearing opening formed in a guide bracket 22. Mounted coaxially on the rod 21 is a float body 23 having a loosely fitting axial bore through which the guide rod 21 passes. Adjustably secured to the guide rod 21 above the float 23 is an upper limit stop 24 which may be constructed in whole or in part from resilient rubber-like material having an axial bore which fits snugly about the rod 21. Gravity bias of the valve stem 14 toward its lowermost position may be increased by the addition of a weight 24*a* to the upper side of the stop 24. The surface area of the stop 24 for contact with the upper surface of the float body 23 is minimized by providing a plurality of circumferentially spaced knobs 24*b* on the bottom surface of the stop 24. This prevents the sticking of the float to the stop when the float is in its high level position.

An important feature of our invention comprises an annular valve closure member indicated generally by the numeral 25 which is mounted at the lower side of the float body 23 to close the port 20 when the float descends to its low level position. The lower face of the member 25 is formed with an outer flexible, elastic annular flange 26, extending obliquely outwardly and downwardly, and an inner annular flange 27 of similar character projects obliquely inwardly and downwardly toward the port 20. These flanges are disposed to close respectively on the seat surface 19 of the casing and on the upper surface of the flange 18. Each flange is formed with a thin annular feathered edge indicated at 26*a* and 27*a* to make the initial contact with the seat surfaces. As indicated in FIG. 2, the flanges 26 and 27 bridge the annular port 20 when in closed position in relation thereto.

The closure member 25 and flanges 26 and 27 are preferably molded from a suitable flexible elastic material such as rubber or rubber-like material, in the nature of suction cup material, for forming the tight seals against their respective annular seat surfaces. Suitable means for securing the closure member 25 to the float body 23 may comprise an elastic hub portion 28 of the member 25 which extends vertically in a bore formed in the float body and a head member 29 formed on the hub member 28 to engage the float body on an annular shoulder formed therein. A tubular opening 30 extends axially through the member 25 and its hub portion 28. Thus

this member fits loosely about the guide rod 21 to allow free movement of the float body 23 from the upper level position shown in FIG. 1 to the low level position shown in FIG. 2.

The lower side of the float body 23 is preferably formed with an annular recess 31 to receive the closure member 25 and the peripheral wall defining the recess 31 is formed with one or more notches 32 extending to the elevation of the member 25 to allow water to enter the recess 31 and prevent the trapping of air therein.

In order to insure uniformity in the limitation of liquid withdrawal to a predetermined low level in the container 7, we have found that the specific gravity of the float body 23 should be so related to the specific gravity of the liquid in the container 7 as to cut off flow out of the container when the level reaches a low level, such as that indicated at L in FIG. 1, which corresponds to the elevation of the annular seat portion 19. It is important that the flow of liquid out of the tank be stopped at the level L instantaneously by the sealing member 25 when the flanges 26 and 27 complete the seal under the atmospheric pressure above the closure member and sub-atmospheric pressure in the chamber 8 and passage 9.

A conduit 33 may be provided to alternately supply liquid to the valve casing 6 and withdraw liquid therefrom. The conduit is shown connected at one end to the chamber 8 by a passage 34 terminating at a port 35 at the chamber 8. A suitable check member 36 may be provided in the passage 34 to regulate the rate of flow to and from the chamber 8. This check member, when used in connection with water treatment apparatus, is designed to permit flow out of the liquid container 7 through port 35 at a higher rate than the return flow into the chamber 8 through port 35. As shown, the conduit 33 provides a support for the guide 22 of the rod 21.

In operation, make-up water or other liquid may be fed to the chamber 8 through port 35 at pressures above atmospheric pressure and, subsequently, brine or other liquid may be withdrawn under sub-atmospheric pressure through the conduit 33. When the float body 23 is in its low level position shown in FIG. 2, the closure member 25 and its flanges 26 and 27 seal the annular port 20 by contact with the horizontal seat surfaces 19 and at the top of flange 18 of the stem 14. Atmospheric pressure above the member 25 causes the flanges 26 and 27 to be compressed with the flange 26 expanded radially outward and the flange 27 expanded radially inward in contact with the seat surfaces.

Refill liquid may be supplied to the container 7 through the conduit 33 or otherwise. As the refill flow starts the fluid pressure in the passage 9 raises the closure member 25 from its seat and allows water to pass freely into the container 7 while the float body 23 rises. This refill flow continues while the float body 23 engages the upper stop 24 and then actuates the rod 21 connected to the stem 14 and stem to move the lower closure member 15 to its closed position on its seat 16, as indicated in FIG. 1. Complete closure of the valve at the seat 16 occurs when a quantity of liquid sufficient to raise the level in the container 7 to a predetermined high level such as that indicated at H in FIG. 1 has been reached.

With the valve and float in the position shown in full lines in FIG. 1, withdrawal of liquid from the container 7 starts when suitable sub-atmospheric pressure is created in the conduit 33 and chamber 8. Liquid is then withdrawn from the chamber 8 and causes the closure member 15 to be drawn down from its seat 16, opening passage 9 for flow at a controlled rate from the valve casing through the passage 34 and conduit 33. Shortly after the withdrawal starts, the annular flange 18 on the valve stem 14 seats on the stop surfaces 13 of the members 12, thereby stopping downward movement of the rod 21. Closure member 25 now remains in open position in the container 7 while the withdrawal continues and causes the float body 23 to slide down the guide rod 21 until the closure member 25 reaches a low level position in which its flanges 26 and 27 close and seal the port 20 at the annular seat surfaces surrounding this port. Thus the predetermined low level L located at the elevation of the valve seat 19 of the valve casing is established and maintained at the end of each liquid withdrawal from the container 7. This prevents the entry of air into the passage 9 through the port 20 and insures a liquid seal at the level of the seat surfaces 19 and upper surface of the flange 18.

It will be evident that the flanged closure member 25 has a unidirectional closing movement and is self tightening. This allows for a unique amount of warping and misalignment of the seat surfaces and closure member without hindering good sealing performance. The flanges 26 and 27 with the annular space between them act like a suction cup in closing and sealing the annular port 20.

Our invention is not limited to its application to a regenerant flow control valve but has many other fields of use which will be evident to those skilled in the art.

We claim:

1. In a float valve of the type adapted to be submerged in liquid in a container, a valve body having an internal chamber and an upwardly opening annular port communicating with said container, concentric annular seat portions disposed at the inner and outer peripheries of said annular port, a vertically elongated float guide extending above said seat portions in said container and a float movable along said guide in response to changes in the level of liquid in said container, the improvements which comprise, an annular valve closure member carried by said float and having inner and outer concentric flexible resilient flanges disposed to close against said annular seat portions respectively for closing said annular port when the liquid descends to a predetermined low level in said container, said flanges moving in generally horizontal opposite directions in contact with their respective seat portions during closing.

2. In a float valve of the type adapted to be submerged in liquid in a container, a valve body having an internal chamber and an upwardly opening annular port communicating with said container, concentric annular seat portions disposed at the inner and outer peripheries of said annular port, a vertically elongated float guide extending above said seat portions in said container, and a float movable along said guide in response to changes in the level of liquid in said container, the improvements which comprise, an annular valve closure member carried by said float and having inner and outer concentric flexible resilient flanges disposed to close against said annular seat portions respectively, said outer flange projecting obliquely outwardly and downwardly and said inner flange projecting obliquely inwardly and downwardly and both of said flanges having thin feathered lower edge portions for closing said annular port when the liquid descends to a predetermined low level in said container.

3. A float valve and closure member in accordance with claim 2 in which said annular seat portions are defined by flat substantially horizontally disposed surfaces of sufficient radial extent to contact the feathered lower edge portion of said flanges in the several flexed positions thereof during the closing of said annular port.

4. In a float valve of the type adapted to be submerged in a liquid in a container and having an internal valve chamber, conduit means connected to said chamber for alternately withdrawing liquid therefrom and supplying liquid thereto, an 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, a valve stem movable substantially coaxially in said passage, a lower valve closure member fixed on the lower end of said stem in said chamber to close said passage at

said lower end seat, a rod connected to and extending upwardly from the upper end of said valve stem in axial alignment therewith, a float movable along said rod in response to changes in the level of liquid in said container, said upper valve seat including radially spaced inner and outer seat portions, the inner seat portion being formed on the upper end of said valve stem, said seat portions defining an annular port between them, and an annular upper valve closure member carried by said float and having means for wiping said seat portions comprising inner and outer concentric flexible resilient flanges disposed to close against said annular seat portions respectively by movement in opposite directions thereacross when the liquid in said container descends to a predetermined low level.

5. In a float valve of the type adapted to be submerged in liquid in a container, a valve body having an internal chamber and an upwardly opening annular port communicating with said container, concentric annular seat portions disposed at the inner and outer peripheries of said annular port, a vertically elongated float guide extending above said seat portions in said container, and a float movable along said guide in response to changes in the level of liquid in said container, the improvements which comprise, an annular valve closure member carried by said float and having inner and outer concentric flexible resilient flanges disposed to close against said annular seat portions respectively for closing said annular port when the liquid descends to a predetermined low level in said container, said outer flange projecting obliquely outwardly and downwardly, and said inner flange projecting obliquely inwardly and downwardly from the lower side of the float.

6. In a float valve of the type adapted to be submerged in liquid in a container, a valve body having an internal chamber and an upwardly opening annular port communicating with said container, concentric annular seat portions disposed at the inner and outer peripheries of said annular port, a vertically elongated float guide extending above said seat portions in said container, and a float movable along said guide in response to changes in the level of liquid in said container, the improvements which comprise, an annular valve closure member carried by said float and having inner and outer concentric flexible resilient flanges disposed to close against said annular seat portions respectively for closing said annular port when the liquid descends to a predetermined low level in said container, and the elevation of said float with respect to the closure member and the specific gravity of said float with respect to the specific gravity of the liquid contents of said container being so related as to maintain said annular valve closure member approximately at the elevation of the liquid in said container when said closure member contacts said annular seat portions.

References Cited in the file of this patent

UNITED STATES PATENTS

768,042	Ginaca et al.	Aug. 23, 1904
1,053,992	Hewitt	Feb. 25, 1913
1,775,090	Frank	Sept. 9, 1930
2,716,422	Whitlock	Aug. 30, 1955
2,904,062	Techler	Sept. 15, 1959
2,952,439	Koons	Sept. 13, 1960
3,075,547	Scaramucci	Jan. 29, 1963