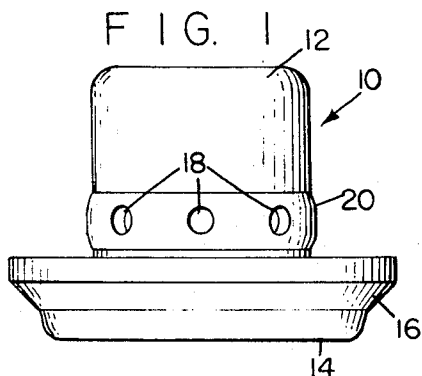
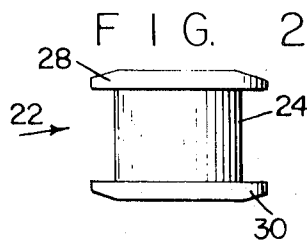
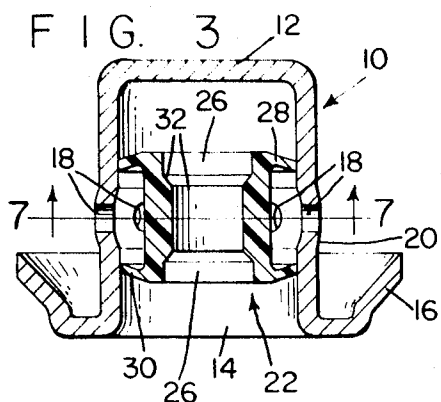
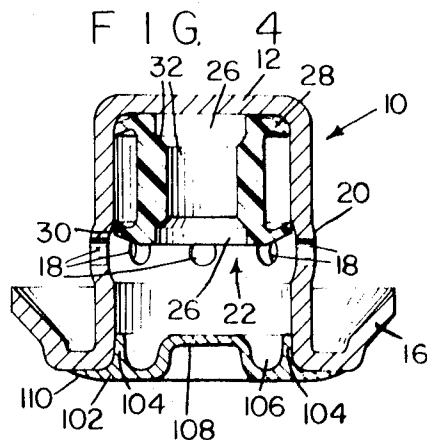
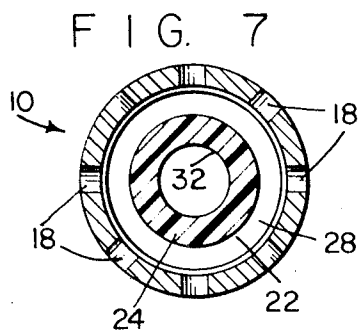
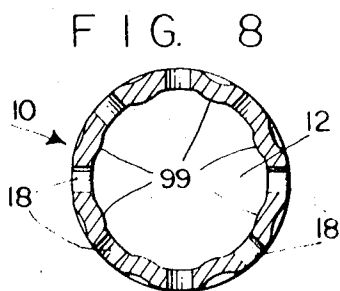
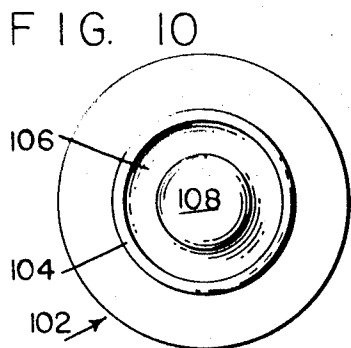
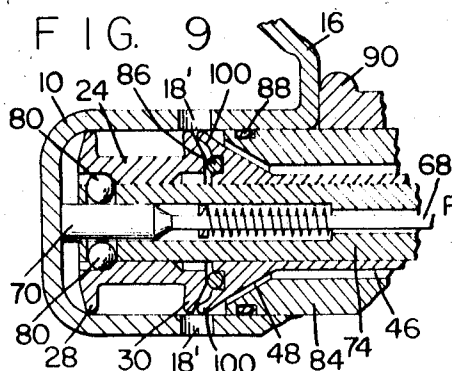




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[56]

References Cited

UNITED STATES PATENTS

488,473	12/1892	Fruen.....	141/311 X
1,081,149	12/1913	Quick.....	141/348
3,299,648	1/1967	White et al.	62/292 X

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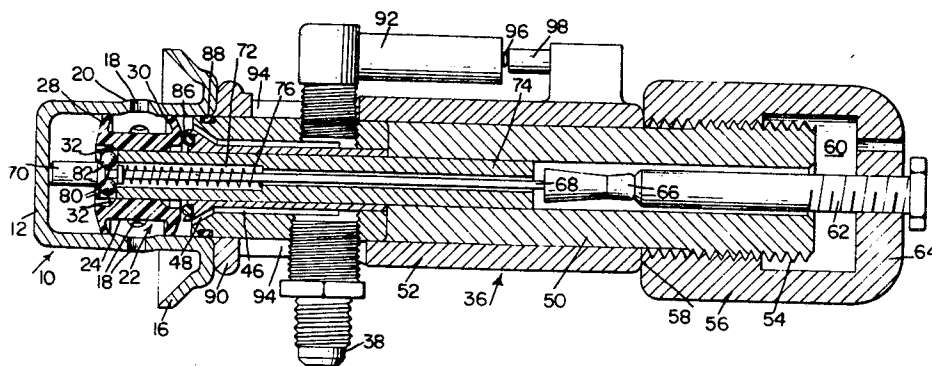
[54] RECIPROCAL VALVE AND ACTUATOR
6 Claims, 10 Drawing Figs.

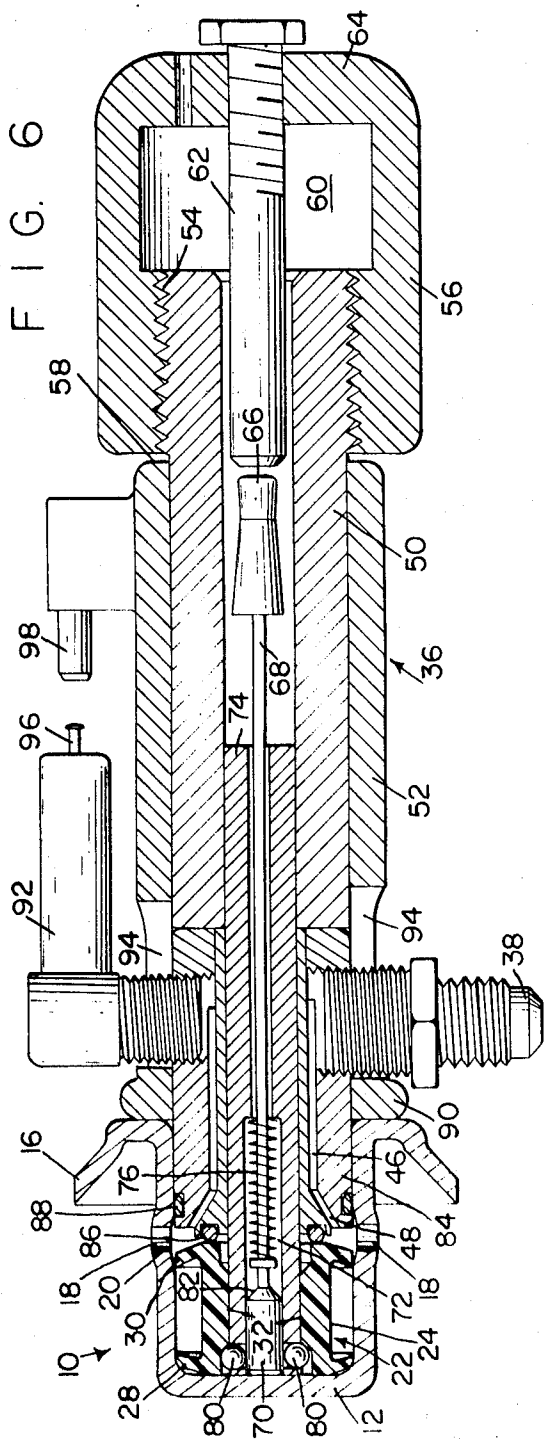
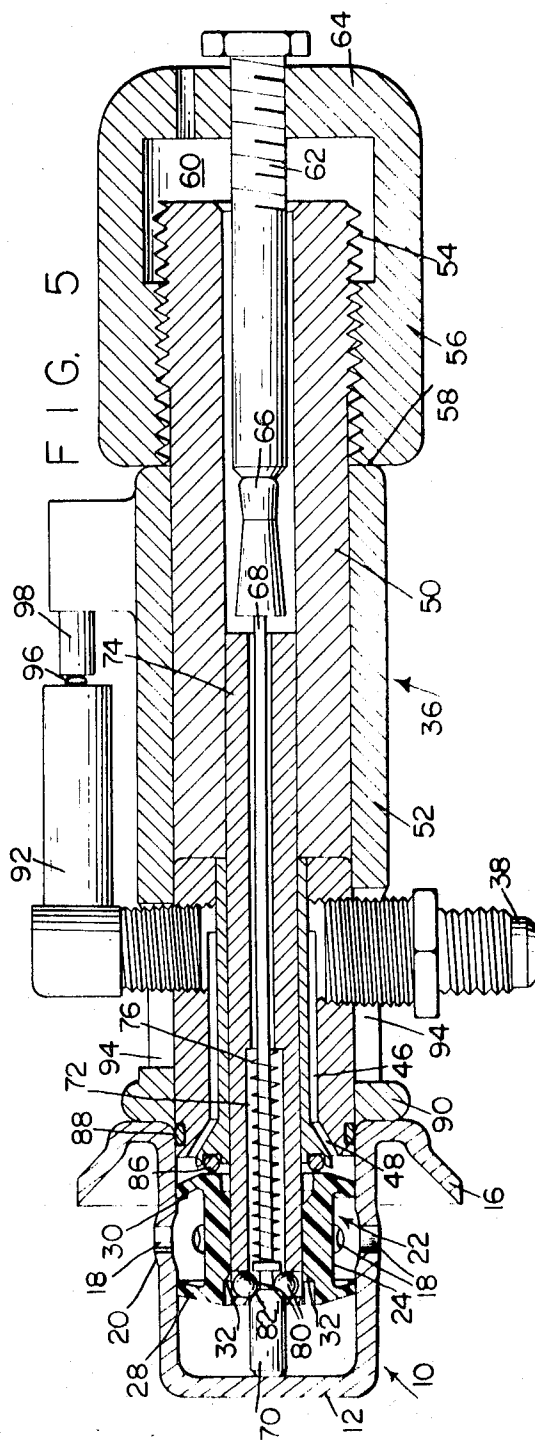
[52] U.S. Cl...... **141/348,**
62/292, 137/322, 251/128

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137/322; 141/18, 20, 98, 311, 312, 348, 349,
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ABSTRACT: A balanced reciprocal valve comprising a one-piece, e.g., plastic member in the form of a hollow open-ended barrel having an annular outstanding seal at each end thereof, this valve member being adapted to be placed in a charging cap or thimble having openings for passage of fluid material, and a tool for placing the valve member in closed position wherein the openings in the cap are between the two seals, and selectively in open position so that the openings are clear of the valve member for passage of fluid in either direction.





RECIPROCAL VALVE AND ACTUATOR

BACKGROUND OF THE INVENTION

A problem in pressure vessels, e.g., refrigeration devices, has always been to provide a sufficient amount of fluid to the vessel in a simple and economical manner. Part of the problem lies in closing the vessel, e.g., refrigeration tank, after fluid gas has been inserted, without losing a good deal of the pressure or volume. Another problem has always been the coupling of the fluid source with relation to the appliance tank and uncoupling the same as fast as possible in order not to let fluid escape until the venthole can be plugged by whatever means is used for this purpose.

It is the object of the present invention to obviate all of these difficulties, to inject the fluid and operate the valves substantially simultaneously from a closed to an open position and then to automatically close the valve when the fluid has been supplied to the required degree, it being one of the requirements in this particular case that the valve be positively actuated and positively acting in order to close off the vent permanently without leaking.

SUMMARY OF THE INVENTION

A special thimble-type cap is provided for application to the vessel in which the fluid is to be supplied. This cap comprises a barrel having a flange at one end and being closed at the other end and intermediate the flange and the closed end of the barrel there are provided one or more inlet openings for the passage of fluid, the flange holding the cap in permanent position on the vessel. A very simple plastic valve member is provided which comprises a barrel open at both ends and having outstanding inwardly directed annular flanges at both ends for sliding sealing contact with respect to the inside of the barrel of the cap to close the same off when in a position where the inlet openings for the cap barrel appear between the two flanges. This balances the valve by reason of the fact that reverse pressure from the tank causes both flanges to bear with that much more pressure against the interior wall of said cap. The compression of the flanges is sufficient to provide positive seal at lower pressure, even to absolute vacuum in cases where the flanges are slanted.

Means is provided for moving said valve member inwardly of the cap to for instance a bottoming position against the closed end thereof which leaves the inlet openings for the tank through the barrel of the cap open, and at the same time the device for moving the valve from the closed to the open position includes a source of supply for the required fluid which can be immediately applied so that while the mechanism which moved the valve from the closed to the open position is in place, maintaining the valve in this manner, the fluid flows into the tank through the openings in the cap. Evacuation may be accomplished in the same way. As soon as the required supply is provided, the valve is returned to its closed position, any fluid excess in the line is dumped, and the pressure in the tank holds the valve balanced in its closed position.

BRIEF DESCRIPTION OF THE DRAWINGS

- FIG. 1 is a view in elevation of the tank cap;
 FIG. 2 is a view in elevation of the valve;
 FIG. 3 is a sectional view illustrating the valve inside the tank cap, with the valve in closed position;
 FIG. 4 is a view similar to FIG. 3 showing the valve in open position;
 FIG. 5 is a view in section illustrating the valve actuator and gas injector in closed position of the valve;
 FIG. 6 is a similar view to FIG. 5 showing the valve in its open position and the gas in position to be turned on;
 FIG. 7 is a section on line 7—7 of FIG. 3;
 FIG. 8 is a similar section through the tank cap showing a modification;
 FIG. 9 shows a slight modification of the tool, and
 FIG. 10 is a rear view of the dust cap.

PREFERRED EMBODIMENT OF THE INVENTION

Referring now to FIGS. 1, 2 and 3, there is shown the tank cap generally indicated at 10. This tank cap is closed at one end as at 12 and is open at its opposite end as at 14, see FIG. 3. It has around its open end an annular flange 16 for attachment to the wall of the tank, so that the cap is substantially inside the tank. This cap is provided with a series of openings in the cylinder wall thereof as is indicated at 18. The openings 18 are located in an annular concaved outstanding ridge or bead 20 for a purpose to be described.

The valve itself is a one-piece molded plastic device generally indicated by the reference character 22, comprising a cylindrical barrel or thimble 24 with open ends, see 26 in FIG. 3. At each end of the barrel or thimble 24 there is a reversely directed inclined annular flange as at 28 and 30, and these are self-sustaining but have a certain degree of flexibility, and interiorly there is an annular bevel-ended rib of substantial length as at 32.

It will be seen that when the parts are in the position of FIG. 3, the openings 18 in the wall of the cap 12 are closed to the atmosphere and any pressure directed through these openings and inwardly with relation to the cap from the tank in which it is set, will tend to move the flanges 28 and 30 relatively outwardly to impinge with greater force upon the inside surface of the cap, thus maintaining the tank closed to the atmosphere (as at 14) with greater force the greater the pressure inside the tank.

As seen in FIG. 4, the valve is shown as open and the reason for the outwardly directed annular concave ridge at 20 is that when the valve is pushed between open and closed positions, its annular flange 30 would tend to become scored or otherwise damaged by contact with the edges or rims of apertures 20 as it slides past, but with the outwardly directed annular ridge 20, these edges are avoided by the edges of flange 30 which therefore do not become scored or worn.

A gun or tool generally indicated at 36 may be provided for instance with a fitting 38 for attachment to a source of gas under pressure and a valve for opening and closing this is provided but not shown. When this valve is open, the gas will pass through the fitting into an annular cylindrical chamber 46 and out at 48.

The gun 36 comprises a cylinder 50 longitudinally slidable in a casing 52 threaded at 54 for engagement by a rotary actuator 56. When the latter engages the end 58 of casing 52, and is turned in the proper direction, the cylinder 50 will be moved bodily to the right partially into chamber 60. A rod 62, longitudinally adjustable in a portion 64 of actuator 56, will engage the end 66 of a rod 68, holding it in its position. Rod 68 has a forward head 70 slidable in a chamber 72 in a member 74 that supports rod 68 and this head is normally projected from its chamber by a spring 76, see FIG. 5. The member 74 also has a circumferential series of balls 80, 80, normally held in an inward position against bevel 82 on head 70, but capable of being forced outward by the head, see FIG. 6.

A continuation or extension 84 of cylinder 50 has a front exposed O-ring 86 to abut and push the valve 24 and a gasket 88 sealing the inside of the cap 10. Further, casing 52 is provided with a stop 90 to abut the cap flange 16 to protect the valve 24 from excess pressure when the gun is forced to the left to open the valve. The numeral 92 indicates a dump valve housing for relieving pressure in the fitting 38 as the valve 24 is once again closed after the tank is charged. The fitting and its support, extension 84, are allowed to move relative to casing 52 by reason of slots 94, and at the proper time interval, a dump valve actuator 96 is operated by a stop abutment 98 on casing 52.

FIG. 5 shows the valve 24 in closed position. The head 70 is thrust into the valve, passing through it, and the member 74 having a diameter approximately the same as the inside diameter of the rib 32 on the valve. In any event the head 70 comes to rest against the inside wall of the closed end 12 of the cap 10 as shown in FIG. 5, and at this point the valve 24 has not

been affected in any way. Shortly thereafter however upon continued pressure of the gun towards the left in FIG. 5, the O-ring 86 impinges on the valve 24 pushing it to the left. The rod 68 of course is held in position, but the rest of the gun moves and the forward end portion of the member 74 presses on the balls 80 so that they run off of the inner edge of the rib 32 against the inside of the valve and are forced radially outwardly as shown in FIG. 6 by the head 70. This motion causes the forward portion of member 74 to also bottom on the closed end 12 of the cap 10, and the balls force the valve element against O-ring 86, assuring tightness. The valve has been moved to the left and it also becomes bottomed against the closed end 12 of cap 10, opening the vents 18 with respect to chamber 48 and supply pipe 38. The supply valve (not shown) is now actuated to provide for the gas to flow into the tank until a required pressure is achieved, with the parts all as shown in FIG. 6.

When the correct pressure has been achieved, the supply valve is closed and actuator 56 is rotated with drawing cylinder 50 and fitting 38, actuating the dump valve. The valve 24 is forced to move to the right under influence of balls 80 which ride along the surface of the head 70, which remains bottomed. When the shoulders thereof at 82 are reached, the balls move inwardly by rib 32, releasing the valve 24 which then stays in the closed position shown in FIG. 5, and the entire gun is then merely moved out and the operation is complete.

Instead of concave ridge 20, the material of the cap, between openings 18, may be bumped inwardly as at 99 in FIG. 8 and this will serve also to prevent contact of the edge of flange 30 with the rims of openings 18, as the flange will be deflected inwardly sufficiently by such bumps. The valve element may also have its seal deflected on one end to provide clearance while passing by holes in body.

The flanged end 16 of the valve cap as shown is designed to be resistance welded into the tank. However this flanged end may be secured in any way desired, or the cap itself may be preformed integral with tank. Also the valve member 10 could be made of other suitable materials and may have O-rings incorporated at its ends to serve as seals instead of the flanges 28 and 30, which are preferably slanted as shown, but in some cases could be merely normal to the axis of the valve member.

Referring to FIG. 9, wherein like numerals indicate like parts in FIGS. 5 and 6, a modification is presented including an outstanding forwardly extending flange or rim 100 on the element 84 of cylinder 50 will engage the periphery of flange 30 and flex it down or in, to avoid the edges of apertures 18', thus avoiding wear on the flange. In this case, the outstanding groove 20 is not necessary. Otherwise the parts are the same as before.

As shown in FIGS. 4 and 10, a dust cap of suitable resilient material is snapped into the open end of cap 10 and closes it, once the fluid has been satisfactorily inserted. This dust cap is applied by hand but cannot be removed by hand. It comprises a disc 102 having a rear ridge 104 forming a U-shaped channel 106 with a center protrusion 108, and the outer side of ridge 104 tightly frictionally engages the inside of the cap 10 at its open end, with the peripheral area of the disc closely engaging the flange 16 at its exposed surface. The bevel at 110 prevents gripping the disc, but in any case the tight fit of the ridge 104 with the cap 10 prevents removal in the absence of a special tool for the purpose. By pressing outwardly on the exterior walls of the protrusion, the ridge is deflected from the cap.

I claim:

1. A valve comprising a cap, the cap having an open-ended

bore; and at least one aperture formed in the wall of said bore, a valve member movable inside said bore, said valve member comprising a central body portion having a diameter less than the diameter of the bore, a seal at each end of the central body portion, the valve member being adapted to be located in the cap wherein the aperture in the cap is located between the two seals on the central body portion, said seals closely engaging the inside surface of the bore of the cap, said valve member being capable of being moved inwardly of said bore away from the open end thereof so that said aperture is open to the open end of the cap,

means to move said valve member between open and closed positions of the valve, and means on the cap engaging and tending to deflect a portion of one of the seals to avoid contact with the edges of the aperture.

2. The valve of claim 1 including a closed end formed on the inner end of said bore in said cap the means to move said valve member between the opened and closed positions of the valve comprising a frame, a rod on said frame, said rod being movable relative to said frame and extending therefrom, the central body portion of the valve member being hollow and the rod extending through the same to bottom on the closed end of the cap and means associated with said rod for engaging and moving said valve member to a position wherein one end of the valve member is adjacent the closed end of the cap.

3. The valve of claim 2 including separate means associated with said rod for moving said valve member in a reverse direction to close the valve upon retraction of the rod.

4. The valve of claim 3 including a connection for a source of fluid under pressure to lead said fluid into the cap and through the aperture therein.

5. The combination of a valve for a tank, with means for opening and closing the valve including means for injecting fluid material into said tank through said valve,

said valve comprising a cap in said tank, said cap having a bore formed with a closed end interiorly of the tank and being open at the periphery of the tank, apertures in the wall of said bore communicating with the interior of said tank,

a movable member in the bore of the cap, said movable member comprising a generally cylindrical hollow body portion having a flange at each end, said flanges being spaced on said body portion such that when the member is in the valve closed position the apertures are located between said flanges the peripheries of both flanges engaging the interior of the bore so as to close said apertures to the atmosphere, said movable member being adapted to be pushed inwardly of said cap so that one of said flanges clears said apertures and allows the same to communicate with the atmosphere,

the means for opening and closing the valve including means for moving said movable member between positions where said apertures are opened or selectively closed, and means causing gas under pressure to flow into said tank through said apertures when the member is inward of the cap in a position where said flange clears the apertures.

6. The combination of claim 5 wherein the means for moving said movable member includes a rod, interengaging means on the rod and the movable member comprising an inwardly directed ridge in the member, expanding means on the rod, and means causing engagement of said expanding means with said ridge when expanded with respect to said rod such that the member may be pulled from the closed end of the cap to the closed position of the valve with respect to said apertures.

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