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[54] **VENT VALVE ASSEMBLY**

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[52] **U.S. Cl.** **137/202**

[51] **Int. Cl.** **F16k 45/02**

[58] **Field of Search** 137/202, 433; 251/368

[56] **References Cited**

UNITED STATES PATENTS

3,401,751	9/1968	Loftin	137/202 X
2,935,990	5/1960	Biddle	137/202
3,315,693	4/1967	Braun	251/368 X
2,388,481	11/1945	Green	137/202
2,949,926	8/1960	Hanin	137/202

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[57] **ABSTRACT**

Vent valve assembly for hot water boiler of type used in aircraft galleys permits trapped air in the boiler to escape during the initial fill. The valve includes a floating ball which rises as the boiler is filled so as to seat against an o-ring for sealing the boiler under pressure. A flow diverting plate positioned under the ball permits escaping air to rise rapidly around the ball without causing the ball to lift and be prematurely sealed against the o-ring. The plate also prevents the ball from blocking the air which must enter the boiler when it is drained.

2 Claims, 5 Drawing Figures

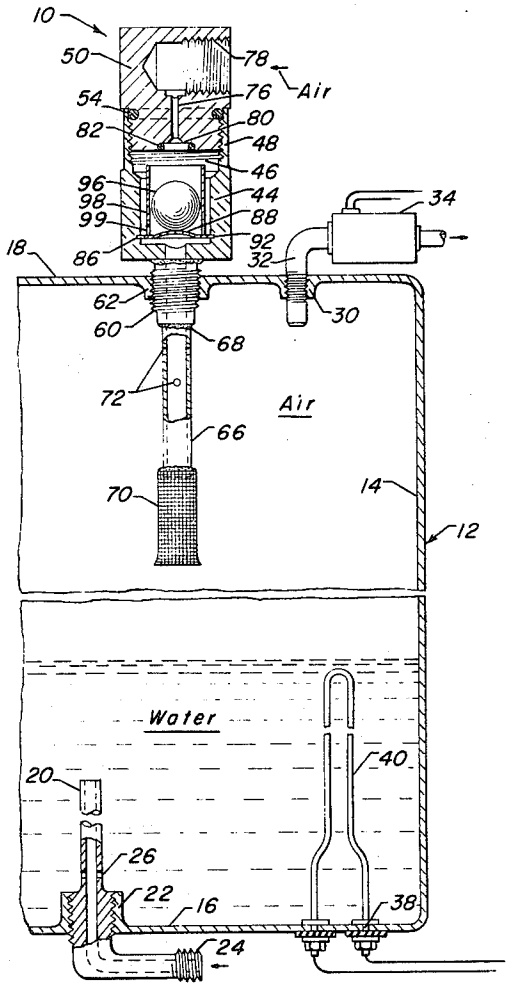


Figure 1

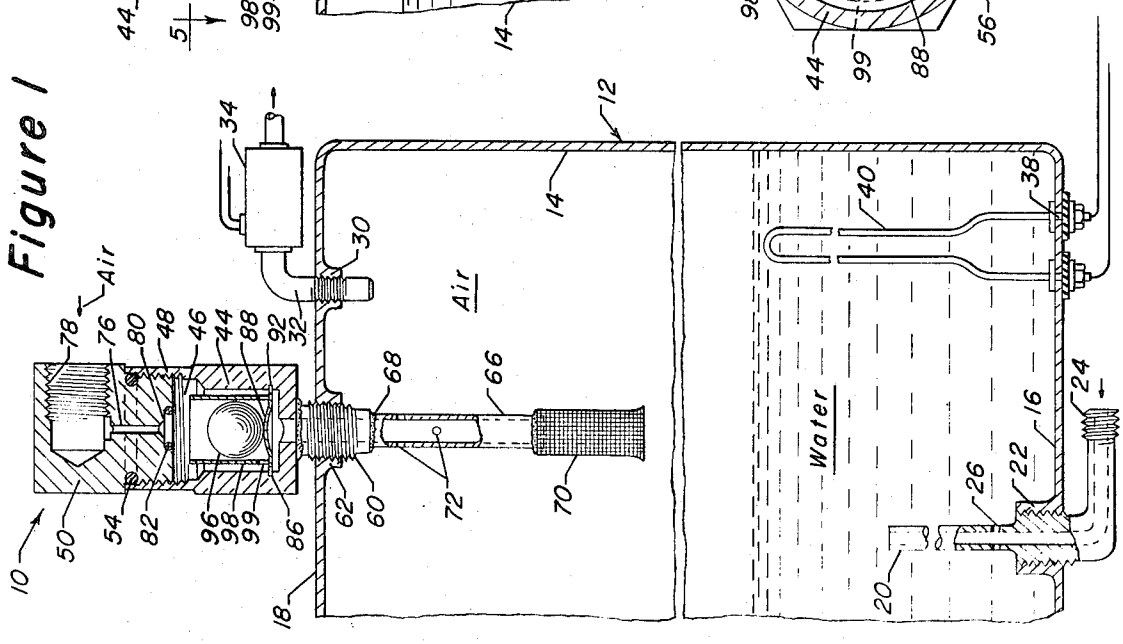


Figure 2

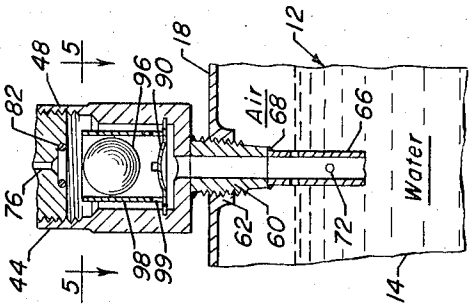


Figure 3

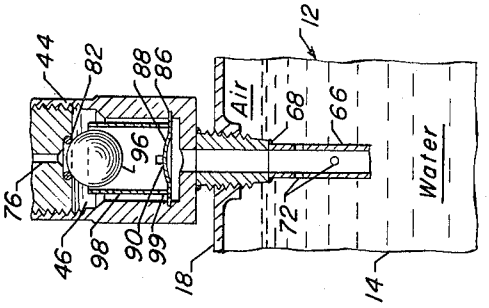


Figure 4

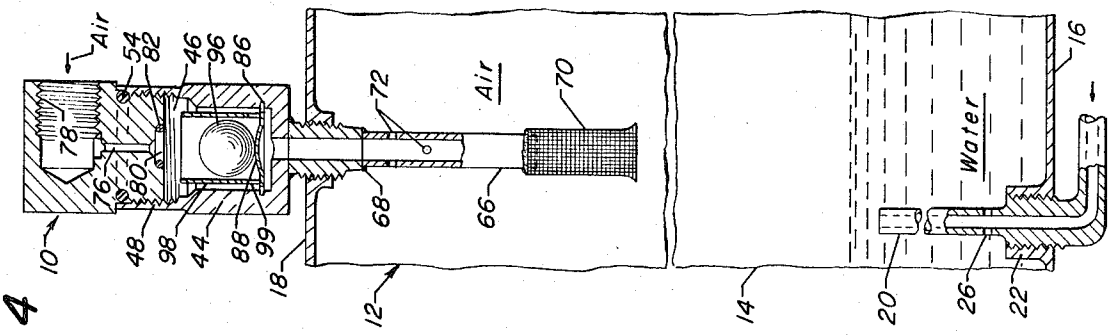
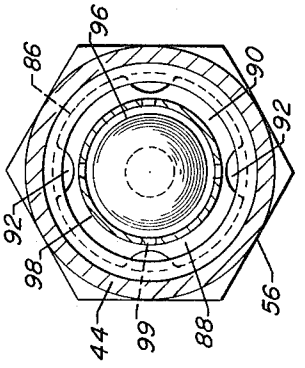


Figure 5



VENT VALVE ASSEMBLY

BACKGROUND OF THE INVENTION

The invention relates to vent valves and particularly to vent valves used on hot water boilers in aircraft galleys to permit air to escape when the boiler is initially filled and to permit air to enter the boiler to displace the water when it is drained, such as when the plane is parked outside in freezing weather. Prior art devices, used for this purpose, including a vent valve with a cylindrical poppet, have functioned satisfactorily to expel dry air. However, when a mixture of pressurized air and water is present, such as when the boiler is being filled after having been drained, it has been found that the mixture will often tend to lift the poppet into sealing engagement with the outlet port when the water level in the boiler is far below the level at which the poppet would be floated into sealing contact with the outlet port. Such a condition will prevent the boiler from heating the designed quantity of water. It can also cause rapid failure of the heating elements which comprise rods which dip into the water since the rods will overheat when they are not completely immersed in water.

SUMMARY

It is among the objects of this invention to provide a vent valve for a hot water boiler which will: allow either trapped air or a mixture of pressurized air and water in the boiler to escape as the boiler is initially filled; close when the water level reaches a desired height so as to maintain the boiler under the same pressure as the water supply; allow air to enter the boiler rapidly during a draining operation to displace the drained water; and allow a small portion of air to remain in the boiler when it is filled with water to allow for expansion in the event that freezing of the water takes place.

These and other objects are attained by the vent valve assembly of the present invention which comprises an elongated vertical chamber having a lower inlet port in communication with the top of the boiler and an upper outlet port which is exposed to the atmosphere. The chamber has a flow diverting plate or splitter positioned near its bottom. The flow splitter is solid except for small apertures at its peripheral edges which direct the inlet flow upwardly along the walls of the chamber. A spherical floatable ball, which may be made of a plastic such as polypropylene, and having a diameter less than the diameter of the chamber, is positioned in said chamber for movement between a lower rest position in contact with the flow splitter and an upper sealing position where it engages a soft o-ring, which may be formed of rubber. In normal operation of the vent valve assembly, the rapid flow of water into the empty air filled boiler will cause pressurized air, usually mixed with water droplets, to flow upwardly through the valve inlet, around the flow splitter and ball and out through the valve outlet. When the water level in the boiler reaches a point where all possible air has been expelled through the vent valve, additional water will rise in the valve chamber and float the ball into sealing engagement with the o-ring at the outlet. The ball will remain sealed as additional water enters the boiler to replace water drawn off for use, such as to make coffee. When the system is to be drained, the ball will drop as the drain is opened and permit air to enter freely to displace the drained water. The presence of the flow splitter will prevent the ball from sealing off the lower opening in the valve assembly during the draining operation.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary, sectional front plan view of a hot water boiler showing the improved vent valve assembly in the position assumed as water enters an empty boiler;

FIG. 2 is a view similar to FIG. 1 except that the entering water is at a level just short of the level necessary to close the vent valve;

FIG. 3 is a view similar to FIG. 1 except that the water is at its maximum height, thereby causing the valve to be closed;

FIG. 4 is a view similar to FIG. 1 except that it shows the water being drained; and

FIG. 5 is a top sectional view taken on the line 5—5 of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, the improved vent valve assembly is indicated generally at 10 in its normal use position mounted at the top of a boiler indicated generally at 12 which has side walls 14, a bottom wall 16 and a top wall 18. Although the boiler shown may supply hot water for any purpose, its principle use is as a source of very hot water in an aircraft galley for a coffee brewer or for use in making tea or soup.

Water is supplied from the pressurized supply of the aircraft through a water supply tube 20 which is mounted in a threaded opening 22 in the bottom wall 16 of the boiler. A threaded fitting 24 at the inlet end of the water supply tube 20 may be alternatively connected, such as by valving means (not shown), to either the water supply source or to a drain (not shown). Although the improved vent valve assembly includes means to prevent the boiler from being entirely filled with water so as to provide expansion space in case of freezing, it is desirable to drain the boiler when the aircraft will be parked, unheated, in freezing weather for an extended period.

A threaded opening 30 in the top wall 18 provides a mounting for a water outlet tube 32 connected by appropriate tubes and valves to coffee brewing appatatus (not shown). A solenoid valve 34 is preferably connected to the water outlet tube 32 to regulate the flow of water from the boiler in response to sensing devices (not shown) associated with the coffee brewing apparatus. Openings 38 in the bottom wall 16 support sealed electric heating elements 40 which can be energized, when the boiler is filled with water, in response to a thermostatic water temperature control switch (not shown) which senses the temperature of the water in the boiler. Preferably, a plurality of heaters are provided.

As previously explained, in order for the boiler to be initially filled and to be drained, it is necessary to have a vent valve that will permit air to be expelled from the boiler as it is filled with water and which will permit air to be drawn into the boiler to displace the water when the boiler is being drained. In order to insure an adequate supply of hot water and to prevent the heater elements 40 from burning out, it is essential that the vent valve be capable of venting either dry air or a mixture

of air and water droplets until the boiler is filled to its desired capacity.

Vent valve assembly **10** includes a hollowed out lower body member **44** which defines an elongated internal chamber **46** terminating at its upper end in a threaded female body portion **48.** An upper threaded male closure portion **50** is adapted to be threaded into mating engagement with lower body portion **48** and sealed thereto by an o-ring sealing member **54.** To facilitate the threading together of the lower body member **44** and the upper closure portion **50,** each of these members may have its outer surface formed in a hexagonal shape as shown in FIG. **5** to permit a wrench to be used thereon. Body member **44** has a threaded mounting portion **60** integrally formed therewith at its lower end which is adapted to be received in a threaded opening **62** in the upper wall **18** of the boiler. An inlet tube **66** is welded to the mounting portion **60** by a weld bead **68.** A strainer portion is preferably welded to the lower end of inlet tube **66** for preventing any particles which may be in the water supply from passing into the vent assembly **10** and possibly preventing its internal members from sealing to each other. In order to determine the maximum water level of the boiler **12** and to provide an expansion area into which the water may move in the event that freezing is inadvertantly permitted to take place, one or more vent holes **72** are placed in the inlet tube **66.** These holes determine the water level in the boiler as can be seen in FIGS. **2** and **3.**

The upper or closure portion **50** of the vent valve **10** includes a small bore outlet opening **76** which communicates with a threaded outlet **78** which may be connected to a vent tube (not shown) for directing the vented air and any vented water droplets to any desired location. Surrounding the outlet opening **76** at the lower end of the closure portion **50** is a recessed area **80** into which is mounted an o-ring sealing member **82.**

The hollowed out body member **44** is grooved at a short distance from the lower end of chamber **46** for permitting it to retain a flow splitter member **88** which is preferably formed of a thin piece of spring stainless steel which can be elastically deformed during assembly to the body **44** so as to be pressed into the groove **86** which will then retain it. The flow splitter **88** includes a solid central area **90** and a plurality of notches **92** around its outer periphery. The solid area **90** is preferably of a greater dimension than the diameter of ball **96** which performs the sealing function of the valve assembly so that air and suspended water droplets can pass around the outside of the ball but will be unable to lift it into sealing contact with the o-ring **82.** The ball **96** has a specific gravity less than that of water so that it will float in water and be carried upward by water rising in the elongated chamber **46** as the boiler is filled (FIG.2) until it is forced against the sealing o-ring **82** as the water approaches the top of the elongated chamber **46** (FIG.3). Once the boiler is filled, the ball **96** will remain sealed against the o-ring **82** by the line pressure of the water passing into the boiler from the water supply (not shown). To eliminate any possibility of the ball not sealing on the o-ring **82** (FIG.3), a guide sleeve **98** may be positioned in the chamber **46.** The sleeve **98** is slotted at **99** to permit water to flow under the ball.

FIG. **4** illustrates the position of the ball **96** when the boiler **12** is being drained. It will be noted that the flow splitter plate **88** holds the ball **96** at a distance from the inlet tube **66** and thus insures that air can pass downwardly through the valve assembly **10** to displace water being drained out through water supply tube **20.** Although water supply tube **20** extends a considerable distance into the boiler so that cold water being introduced into the boiler can be more quickly sensed by the thermostatic sensing element (not shown) it includes drain openings **26** near the bottom of the boiler which permit almost all of the water in the boiler to be drained.

Preferably, the vent valve assembly should be formed of stainless steel or other non-corrosive material. Although other materials could be used, one material that has proved satisfactory for the o-rings is buna rubber. Polypropylene has proved to be quite satisfactory for the ball member although obviously other materials could be used which will float on water.

We claim:

1. A vent valve assembly adapted to be attached to the upper portion of a pressurized hot water boiler for permitting air to be vented from the boiler as it is initially filled and drawn into the boiler as it is drained, said valve assembly comprising a body portion defining an elongated hollow chamber having a lower inlet opening and an upper outlet opening, the upper outlet opening being surrounded by an o-ring sealing member, a floating ball member of a diameter less than the diameter of said hollow chamber positioned in said hollow chamber for movement toward and away from sealing engagement with said o-ring sealing member, a guide sleeve for guiding said ball mamber, a flow diverting member mounted in an annular groove in the wall of said hollow chamber adjacent said lower inlet opening, said flow diverting member comprising a dished plate which supports said guide sleeve and includes a solid central portion with an area larger than the cross-sectional area of the ball member and at least one peripheral aperture for permitting air to flow upwardly in said hollow chamber and around the outer dimension of said ball, said ball having a specific gravity which is less than the specific gravity of water so that water entering said hollow chamber will lift said ball into sealing engagement with said o-ring but air or a mixture of air and water droplets entering said chamber incident to the filling of said boiler with water will pass around the outside of said ball to said outlet opening without lifting it into engagement with said o-ring.

2. The vent valve assembly of claim **1** wherein said ball member is formed of polypropylene.

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