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(54) **Water heaters.**

(57) An unvented water heater comprises a tank (10), a cold water inlet (14), a hot water outlet pipe (20) opening into the tank at a location (22) below the minimum water level in the tank, and means for directly or indirectly heating water in the tank. An air space (30) above the water level in the tank accommodates expansion of water in the tank as it is heated. A baffle (40, 140, 240) is positioned adjacent the opening (22) of the outlet pipe (20) to increase the distance from the opening to the free surface (32) of water in the tank. The baffle (40) may be fixed in position (Figures 1 and 2). Alternatively, the baffle (140, 240) may float on the surface of the water (Figures 3 and 4). The presence of the baffle reduces the loss of air from the air space (30) as water is drawn from the tank.

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This invention relates to unvented water heaters.

More particularly, the invention relates to unvented water heaters of the kind comprising a tank, means for heating water in the tank, a cold water inlet through which water is supplied to the tank at a predetermined pressure and a hot water outlet comprising a pipe opening into the tank at a location spaced from the top of the tank, the arrangement being such that, in use, the water level in the tank is above the location of the outlet pipe opening but below the top of the tank, a volume of air being maintained between the water level and the top of the tank to accommodate expansion of the water in the tank as it is heated.

Such an unvented heater has the advantage that it does not require an external expansion tank.

In laboratory tests under certain conditions it has been found that the air at the top of the tank appears gradually to be lost. Eventually, after repeated use of the heater, the volume of air remaining is insufficient to accommodate the expansion of water as it is heated, resulting in operation of the pressure relief valve which is normally fitted to the tank.

It is an object of this invention to provide an unvented water heater in which the loss of air is reduced or eliminated.

This invention consists in a water heater of the kind set forth, in which a baffle is provided adjacent the opening of the hot water outlet or at the surface of water in the tank to increase the distance from the opening to the free surface of water in the tank.

In one form of the invention, the baffle is fixed in position in the tank.

Preferably, the baffle comprises a horizontal plate.

In another form of the invention, the baffle floats on the surface of the water in the tank. The baffle is preferably shaped so that it covers almost all the surface of the water in the tank.

The hot water outlet pipe will normally descend vertically to a location below the water level. In that case, the baffle preferably comprises a horizontal plate surrounding the pipe. In the case of a cylindrical tank, for example, the baffle may be a disc with a diameter smaller than that of the tank. In the case of a fixed baffle, the disc is mounted adjacent the lower end of the pipe. In the case of a floating baffle, the disc has an aperture through which the pipe extends, and can move vertically relative to the pipe. The floating baffle may be a solid disc, of material lighter than water, or may be of a hollow construction.

The hot water outlet pipe usually extends through the top wall of the tank, but may alternatively be arranged to enter the tank through its side wall or bottom wall.

As a result of experiments carried out by the applicants, it is believed that the loss of air in the known unvented water heaters is due to air dissolving in the water in the tank and to the formation of localised vortices as hot water is drawn off through the outlet pipe, bubbles of air entrained by the vortices being carried out through the outlet pipe. The provision of a baffle in accordance with the invention inhibits the formation of the vortices, and also acts to reduce the rate at which air dissolves in water in the tank, by inhibiting the circulation of water above the plate generated by heating the water, in the case of a fixed baffle, or by covering a large part of the surface of the water, in the case of a floating baffle. The baffle thus reduces considerably the rate of loss of air from the tank.

The invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a diagrammatic cross-section through a water heater in accordance with the invention;

Figure 2 is a diagrammatic section through the upper part of a water heater, illustrating the formation of vortices;

Figure 3 is a diagrammatic cross-section through the upper part of a water heater, showing a second embodiment of the invention; and

Figure 4 is a diagrammatic cross section through the upper part of a water heater, showing a third embodiment of the invention.

Referring to Figure 1, a water heater consists of a cylindrical tank 10 surrounded by an insulating jacket 12. A cold water inlet pipe 14 opens into the bottom wall 16 of the tank. The inlet pipe 14 is connected in use to a source of cold water, through a limiting valve (not shown) which reduces the pressure at which water is supplied to the tank to a predetermined value (typically three bar) and also acts as a non-return valve.

A hot water outlet pipe 20 extends through the upper wall 18 of the tank to an open lower end 22 spaced from the top of the tank. A temperature and pressure relief valve 24 is connected to the cylindrical side wall 26 of the tank. Two ports 28 are provided in the side wall 26 to enable electric immersion heaters to be fitted. Alternatively, the tank could be provided with pipework to enable hot water to be circulated within the tank, to provide indirect heating of water in the tank.

The water heater as described thus far corresponds to known unvented water heaters, and operates as follows. Cold water is supplied to the tank 10 through the inlet 14. Air trapped in the space 30 between the top of the tank and the surface 32 of water 34 in the tank is compressed so that its pressure balances the pressure at which water is supplied to the inlet 14. As the water in the tank is heated, the air in space 30 is further compressed to accommodate the expansion of the water.

In accordance with the invention, a baffle 40 is provided, surrounding the opening at the lower end 22 of the hot water outlet pipe 20. The baffle 40 consists of a disc, for example of stainless steel, having a central opening through which the pipe 20 fits, so

that the disc can be secured to the pipe near to its lower end 22. The disc 40 has a diameter somewhat less than the inside diameter of the tank 10, so that the periphery of the disc is spaced from the cylindrical wall of the tank. In use, the baffle is immersed in the water in the tank, a short distance below the water level 32.

As mentioned above, it is found that with known unvented water heaters, the air contained in the expansion space above the water is gradually lost. In experiments carried out by the applicants, it has been found that, as water is drawn off through the outlet pipe 20, localised vortex pools 36 (illustrated diagrammatically in Figure 2) are formed at the surface 32 of the water 34 in the tank. Air in the space 30 is drawn by the vortices into the outlet pipe 20, and bubbles of air entrained in the water drawn through the pipe 20 escape from the tank. A small amount of the air in space 30 is therefore lost each time hot water is drawn from the tank. The provision of the baffle 40, shown in broken lines in Figure 2, increases the distance between the surface 32 of the water and the opening of the outlet pipe 20, and inhibits the formation of the vortex pools.

It will be appreciated that the size and shape of the baffle may be varied to suit the water heater to which the baffle is to be fitted. The baffle may be made of any suitable material, such as stainless steel.

Figure 3 illustrates a second embodiment of the invention. Instead of the fixed baffle of the embodiment shown in Figure 1, the embodiment of Figure 3 has a baffle 140 in the form of a flat plate of material lighter than water, which floats on the surface 32 of water in the tank 10. The baffle 140 has a central aperture 142 of diameter slightly larger than the outside diameter of the outlet pipe 20, so that the baffle 140 can slide up and down on the pipe 20 as the water level in the tank changes. An enlargement 120 is formed near the mouth 22 of the outlet pipe 20, for example by fixing a small disc to the pipe, to ensure that the baffle 20 does not become disengaged from the pipe if the water level falls below the mouth 22 of the pipe 20, for example if the tank is drained for any reason.

The baffle 140 may be made of any suitable material enabling the baffle to float on the surface of the water, for example of polyethylene or polypropylene, or of closed cell expanded polyethylene.

The baffle 140 increases the distance between the mouth of the outlet pipe 20 and that part of the surface 32 of water in the tank which is open to air 30 in the tank. As with the embodiment of Figure 1, this inhibits the formation of vortex pools. In addition, the baffle reduces considerably the area of the surface of the water which is open to the air in the tank, and so reduces considerably the rate at which air dissolves in the water and the rate of loss of air from the tank. The baffle may have an outside diameter only slightly less than that of the inner diameter of the tank, leaving only sufficient clearance to enable the baffle to move freely up and down. The baffle will then effectively cover almost all the surface of the water.

As with the embodiment of Figure 1, the shape and dimensions of the baffle 140 can be varied or suit the tank in which the baffle is installed. If the outlet pipe extends into the tank through the side wall or bottom wall of the tank, the baffle 140 need not have a central aperture.

Figure 4 shows an embodiment similar to that of Figure 3, having a baffle 240 which floats on the surface of water in the tank 10. The baffle 240 is hollow, having a flat bottom wall 242, a frusto-conical top wall 244, and a central cylindrical wall 246 which surrounds the outlet pipe 20 so that the baffle 240 can move vertically in relation to the pipe. One or more holes 248 are provided in the top wall 242 of the baffle to equalise the pressure in the air space 30 in the tank 10 and the pressure in the space 230 inside the hollow baffle 240. An annular plate 220 is fixed to the lower end of the outlet pipe 20 to prevent the baffle 240 becoming disengaged from the pipe if the water level falls too low.

The baffle 240 may be made of plastics as in the embodiment of Figure 3. Alternatively, since the baffle is hollow, it may be made of a material heavier than water, e.g. of metal.

The baffle 240 operates in the same way as the floating baffle of the embodiment of Figure 3.

The shape of the upper wall 244 of the baffle 240 allows any droplets of water which might condense from the airspace 30 at the top of the tank to drain from the baffle. However, it will be appreciated that the baffle could be made in other shapes, for example with a flat upper wall so that the baffle is generally disc shaped. If the outlet pipe 20 extends into the tank through the side wall or bottom wall of the tank, the baffle need not be provided with a through bore to receive the pipe.

In the embodiments shown in Figures 3 and 4, the disc or plate (120 or 220) fixed to the lower end of outlet pipe 20 to retain the floating baffle may also have the effect of acting as secondary anti-vortex baffle, preventing the formation of local vortices at the opening 22 of the outlet pipe 20, further reducing the risk of air being drawn into the pipe. The size of the disc or plate may be chosen to provide optimum effect in reducing the formation of vortices.

Claims

1. An unvented water heater comprising a tank, means for heating water in the tank, a cold water inlet through which water is supplied to the tank at a predetermined pressure, and a hot water out-

let comprising a pipe opening into the tank at a location spaced from the top of the tank, the arrangement being such that, in use, the water level in the tank is above the location of the outlet pipe opening but below the top of the tank, a volume of air being maintained below the water level and the top of the tank to accommodate expansion of the water in the tank as it is heated, in which a baffle is provided adjacent the opening of the hot water outlet or at the surface of the water to increase the distance from the opening to the free surface of the water in tank.

2. A water heater as claimed in Claim 1, in which the baffle is fixed in position in the tank.

3. A water heater as claimed in Claim 2, in which the baffle comprises a horizontal plate.

4. A water heater as claimed in Claim 3, in which the hot water outlet pipe descends vertically to an opening below the water level, and the baffle comprises a horizontal plate surrounding the opening of the pipe.

5. A water heater as claimed in Claim 4, in which the tank is a cylindrical tank, and the baffle is a disc with a diameter smaller than that of the tank, mounted adjacent the lower end of the pipe.

6. A water heater as claimed in Claim 1, in which the baffle is adapted to float on the surface of water in the tank.

7. A water heater as claimed in Claim 6, in which the baffle is a flat plate of material lighter than water.

8. A water heater as claimed in Claim 6, in which the baffle is a hollow body having a flat lower wall which engages the surface of water in the tank.

9. A water heater as claimed in any one of Claims 6 to 8, in which the hot water outlet pipe descends vertically to an opening below the water level, and the baffle has an aperture through which the outlet pipe extends, the aperture being slightly larger than the pipe in horizontal cross-section so that the baffle can move vertically relative to the pipe.

10. A water heater as claimed in any one of Claims 6 to 9, in which the baffle is shaped so that it covers almost all the surface of the water in the tank.

Fig.1

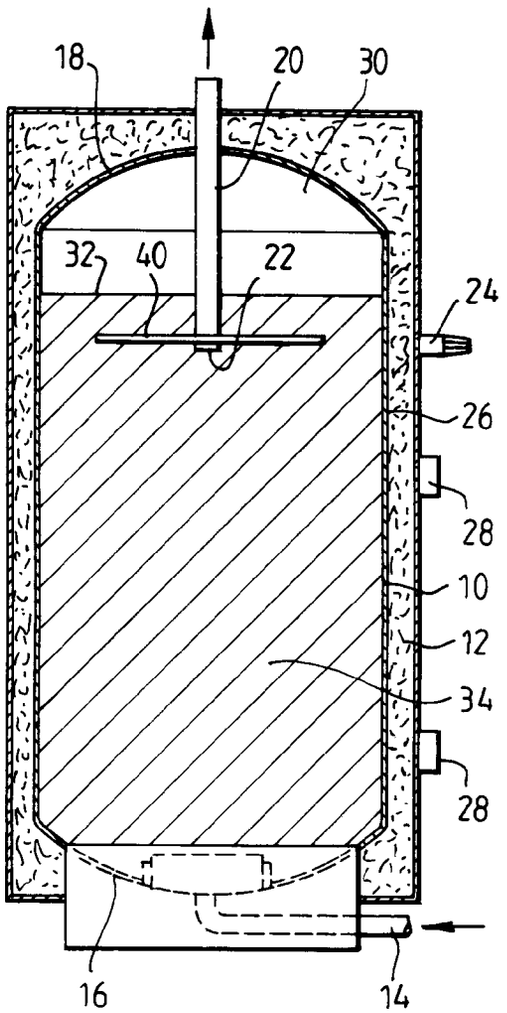
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Fig.2

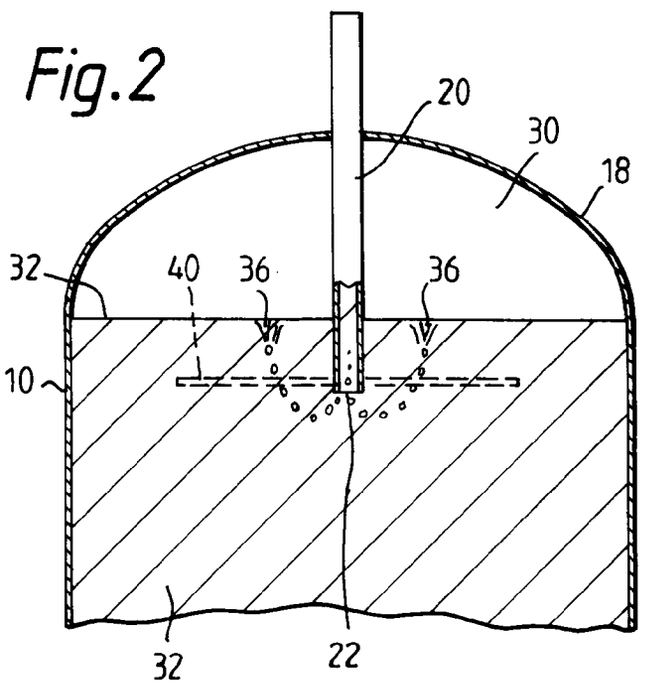
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Fig.3

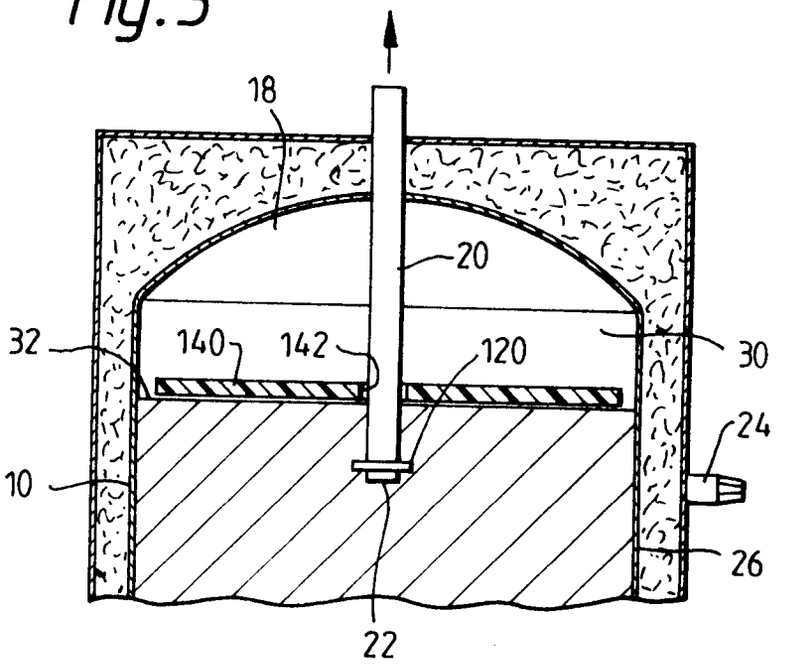
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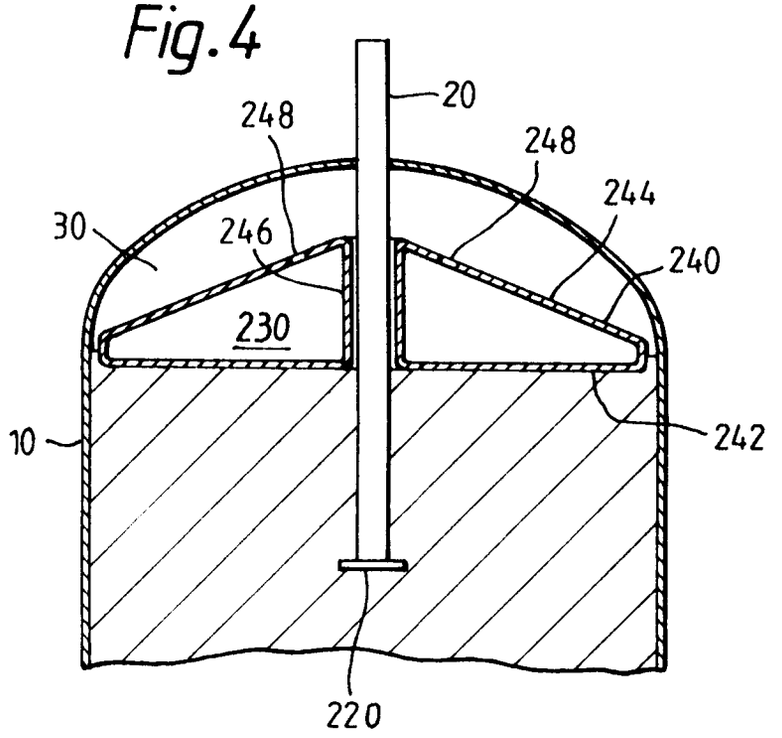
Fig.4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EUROPEAN SEARCH REPORT

Application Number
EP 93 30 7992

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
A	GB-A-2 238 104 (VOLD-JOHANSEN) * abstract * ---	1	F24H9/12 F24H1/18
A	AT-A-370 507 (WAAGNER-BIRO AG) * the whole document * -----	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.5)
F24H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	10 January 1994	Van Gestel, H

CATEGORY OF CITED DOCUMENTS

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