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DIRECT FIRED WATER HEATERS

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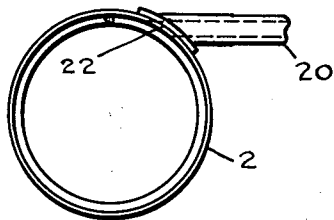


Fig. 3

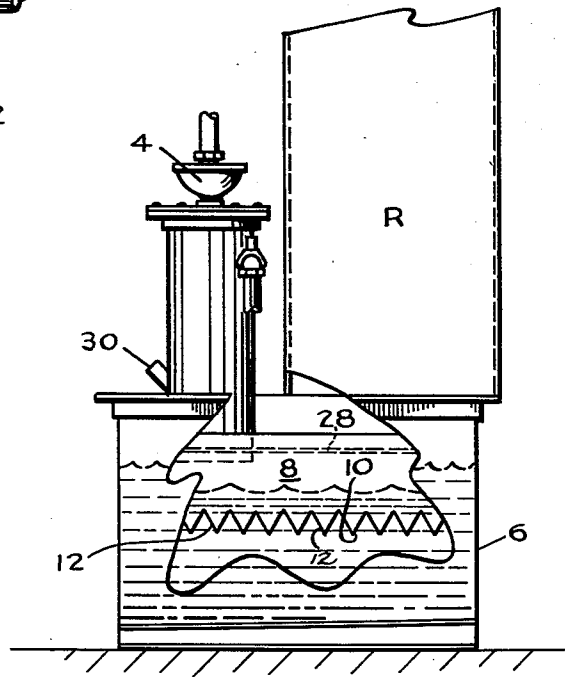
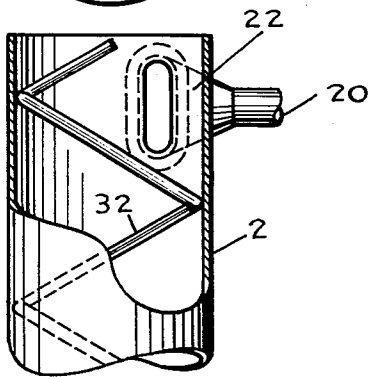


Fig. 4

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DIRECT FIRED WATER HEATERS

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4 Claims. (Cl. 126—360)

My present invention relates to an improved direct fired water heater in which the present construction embodies means whereby a heater tube carries a gas or oil fired burner unit, the flame of which is directed downwardly and interiorly of the heater tube. I propose by the specific means hereinafter described to inject the solution to be heated tangentially against the inner cylindrical surface of the tube so that the solution will flow by gravity in a spiralling manner downward in the tube being in direct contact with the flame and thence passing into a lower tank.

One of the principal objects of my invention is the provision of means to facilitate the exit movement of the hot gas bubbles in the solution from the solution and of course this and other objects will appear more particularly in the following disclosure.

In the accompanying drawings I have illustrated one complete example of the physical embodiment of my invention according to the best mode I have thus far devised but it will be understood that various changes and alterations may be made in the exemplified structure within the spirit and scope of the appended claims.

In the drawings:

Figure 1 is a top plan view of the heater of my invention.

Figure 2 is a front elevation of the device of my invention partially cut away to reveal the arrangement of the solution injecting nozzle.

Figure 3 is an enlarged vertical sectional view of the heater tube and the injection construction showing a modified form including a spirally arranged rod in the heater tube.

Figure 4 is a side elevation of the heater of my invention.

Referring now to the drawings wherein the structure of my invention is illustrated I use a vertically disposed cylindrical heater tube 2 of any suitable type provided with a conventional gas or oil fired heater unit 4 disposed to direct downwardly into the heater tube a flame of suitable length and temperature.

The heater tube 2 is mounted upon a suitable tank 6 and extends through the top plate thereof, the lower extremity of the heater tube 2 being provided with a boot 8 concentric with the tube and enlarged diametrically and the lower edge 10 of the boot 8 is fashioned with a plurality of passages, here shown as notches 12 as best seen in Figure 4 but which obviously may be any suitable type of orifice to allow the gas bubbles in the heated solution to pass from the boot through the main body of the solution thereby at once permitting the escape of the bubbles of gas and the transfer of the heat in the gas to the solution to effect a maximum heat transfer.

The boot 8 is supported in spaced relation from the inclined bottom 16 of the tank 6 by legs 18 and the pressure of the combustion gases in the tank and boot will maintain the level of the solution in the boot somewhat lower than the level of the main solution in tank 6. The notches forming orifices in the boot are obviously

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so located with relation to the solution level in the boot as to readily permit the escape of the hot gas bubbles.

The solution which is normally an industrial type, non-inflammable and undamaged in its function by contamination with carbon dioxide and other combustion gases resulting from the combustion of the gas or oil in the burner, is circulated by suitable pump means, not shown, from the reservoir R by means of pipe 20 which extends through the wall of the heater tube 2 and is connected with a fan-shaped nozzle 22 positioned so as to discharge the solution tangentially of the inner wall of the tube and under gravity control, the injected solution will flow spirally downward around the inner face of the tube 2 during which passage the solution will have transferred to it considerable heat from the flame extending axially of the spiralling solution.

The downwardly flowing solution will then flow into the boot 8 and at this time the solution will be somewhat charged with bubbles of the combustion gases.

The bubbles being lighter than the solution will tend to rise but due to the pressure within the tube and boot will follow the path of least resistance and will flow through the orifice notches into the main portion of the solution and thence into the space maintained between the main body of the solution and the tank. Suitable exhaust means for disposing of the accumulated gas will be provided.

The heated solution in the boot will then mingle with the solution in the tank 6 from which the heated solution may be circulated as desired and when returned to the reservoir R for further heating will move along the inclined bottom wall 24 of the reservoir to the elongated opening 26 through which it will pass onto the depressed top 28 of the boot 8 and thence to the heated solution in tank 6.

An observation tube 30 connected with the heater 2 will permit the operator to examine the conditions within the tube.

As illustrated in Figure 3 of the drawings, if it is desired, the spiral flow of the injected solution from nozzle 22 may be enhanced by the use of a spirally positioned rod 32 about the inner wall of the tube 2. It will be apparent, it is believed, that the use of the spiral guide device here shown as a rod, but which it will be understood may take many suitable forms other than that illustrated will cause the solution injected to follow the guide to the lower extremity of the tube thereby providing maximum contact between the flame and the solution to effect maximum heat exchange therebetween.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a direct fired solution heater, the combination with a cylindrical heater tube having a combustion type heater adapted to direct a flame axially into the tube, a lower solution tank for the heated solution, and means for injecting the solution to be heated into the tube, of an enlarged boot open to and connected below the tube and extending into the solution in the tank, the said boot being closed at its top to the tank contents whereby the pressure of the combustion gases will maintain the solution level in the boot below that of the tank, and means on the boot below the tank solution level permitting the escape of combustion gas bubbles in the solution within the boot into the tank.

2. In a direct fired solution heater, the combination with a cylindrical heater tube having a combustion type heater adapted to direct a flame axially into the tube, a lower solution tank for the heated solution, and means for injecting the solution to be heated into the tube, of an enlarged boot open to and connected below the tube and extending into the solution in the tank, the said boot being closed at its top to the tank contents whereby the

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pressure of the combustion gases will maintain the solution level in the boot below that of the tank, and a serrated lower edge on the boot below the tank solution level forming notches permitting the escape of combustion gas bubbles in the solution within the boot into the tank.

3. In a direct fired solution heater, the combination with a cylindrical heater tube having a combustion type heater adapted to direct a flame axially of the tube, and a lower solution tank for the heated solution, of means for injecting the solution to be heated interiorly of the tube whereby the solution will flow spirally downward about the inner wall of the tube, an enlarged boot open to and connected below the tube and extending into the solution in the tank, the said boot being closed at its top to the tank contents whereby the pressure of the combustion gases will maintain the solution level in the boot below that of the tank, and a serrated lower edge on the boot below the tank solution level forming notches permitting the escape of combustion gas bubbles in the solution within the boot into the tank.

4. In a direct fired solution heater, the combination with a cylindrical heater tube having a combustion type heater adapted to direct a flame axially of the tube, and

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a lower solution tank for the heated solution, of means for injecting the solution to be heated interiorly and tangentially of the tube, and spirally positioned guide means on the inner wall of the tube whereby the solution will flow in a spiral path downwardly about the inner wall of the tube, an enlarged boot open to and connected below the tube and extending into the solution in the tank, the said boot being closed at its top to the tank contents whereby the pressure of the combustion gases will maintain the solution level in the boot below that of the tank, and a serrated lower edge on the boot below the tank solution level forming notches permitting the escape of combustion gas bubbles in the solution within the boot into the tank.

References Cited in the file of this patent

UNITED STATES PATENTS

2,233,675	Narten	Mar. 4, 1941
2,476,185	Gaddard	July 12, 1949

FOREIGN PATENTS

507,066	Germany	Sept. 12, 1930
683,822	France	Mar. 10, 1930