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[54] WATER HEATER UNIT

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[51] **Int. Cl.** **B60h 1/00**

[58] **Field of Search** 165/39, 40, 108, 35, 132; 236/23

[56] **References Cited**

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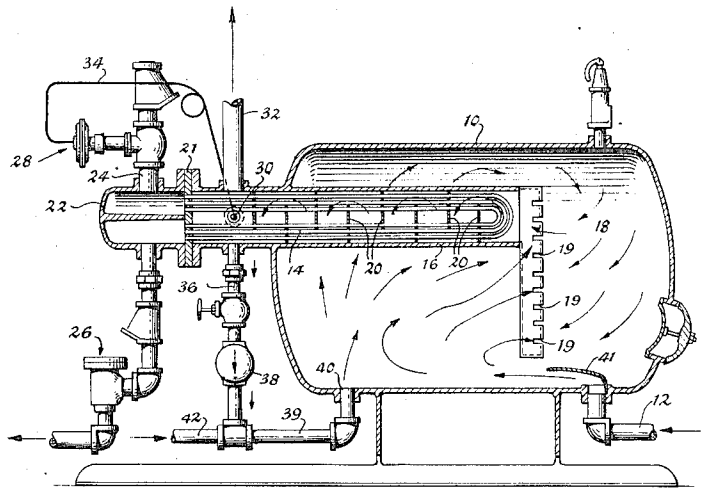
Primary Examiner—Charles Sukalo

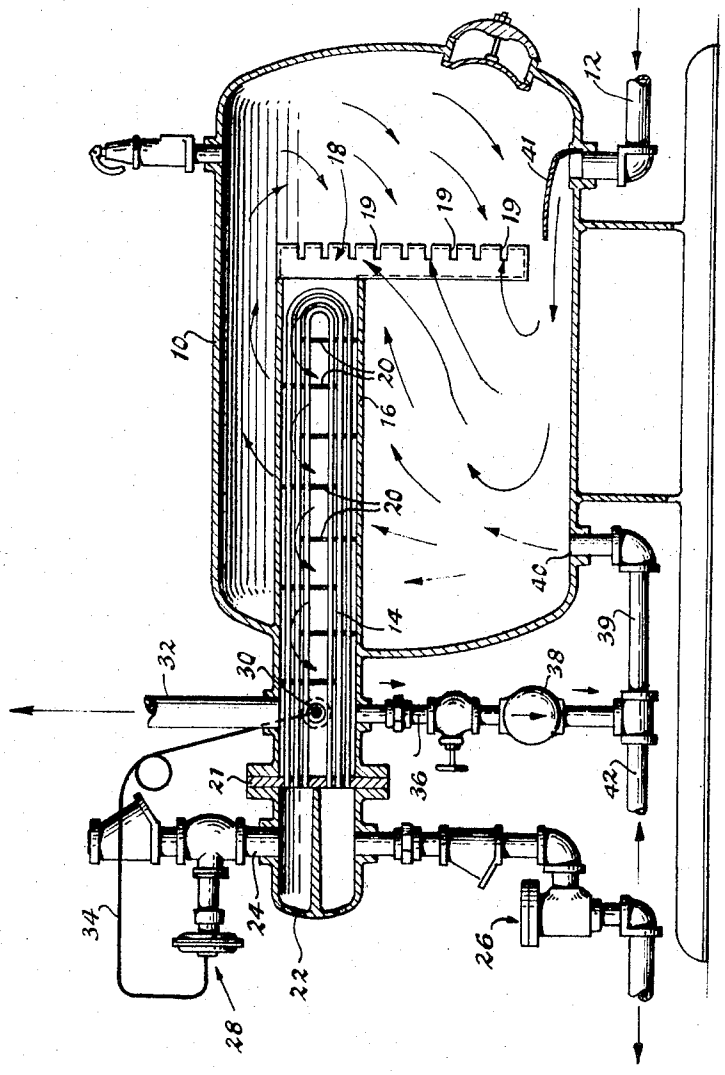
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[57] **ABSTRACT**

A water heating and supply system is provided, comprising in combination, a water storage tank having a cold water supply inlet and a heated water service outlet and supply conduit system, and a heater shroud extending into the upper level of the tank; the shroud being arranged at its inner end in closed fluid flow communication with an intake manifold means drawing water from substantially throughout the vertical range of the interior of the tank. A heater is disposed within the shroud and operates under control of a heat supply regulator. A by-pass circulating conduit system is provided including a continuously operating pump having its intake in fluid communication with the interior of said shroud adjacent the outer end thereof and its discharge arranged to deliver water into the bottom level of said tank. The return from the heated water supply system is arranged in open communication with said by-pass conduit system, Hence, whenever water is withdrawn from the service outlet, replacement cold feed water moves through said supply inlet and is thereby mixed into the water being circulated throughout the entire vertical extent of the tank from which the intake manifold draws water from substantially all levels within the tank. A water temperature sensor is disposed in the region of service water withdrawal from the heater shroud, and is operable to regulate the heat supply. The invention features improved water temperature stratification control in systems designed for such purposes.

6 Claims, 1 Drawing Figure





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WATER HEATER UNIT

GENERAL DESCRIPTION

Generally stated, the invention contemplates an improved method of heating water and storing it in a reduced size accumulator tank so as to have it available to supply either constant or intermittent demands for either small or large quantities of hot water. The invention may be practiced in combination with a storage water tank of any preferred shape; and although any suitable type of heat supply medium may be employed, as shown herein a bundle of return-bent steam conveying tubes enclosed within a shroud which extends into the tank is employed as the heater unit. The tube bundle may comprise any desired number of banks of return-bent tubes arranged in spaced relation; and the tubes may be arranged to conduct steam or other hot fluid from any suitable source, and to deliver any condensates through a suitable trap.

The system features an arrangement which may be readily constructed in unit form; fully self-contained, and requiring minimum floor space; and is therefore suitable for installation in out-of-way locations. It is readily connected to existing piping systems, and normally draws upon the associated steam generating boiler or the like in such limited manner as to avoid interference with constant steam pressures at other associated steam operated equipment. Thus, the heater of the present system will normally operate to even-out the boiler load, thereby improving its efficiency and life span.

THE DRAWING

The drawing figure presented herewith is a longitudinal sectional view through a water storage tank embodying a typical water circulation and heater control system of the present invention.

DETAILED DESCRIPTION

As shown in the drawing herewith, the invention may be embodied in a system including a water storage tank **10** having a cold water inlet connection as indicated at **12** leading into the bottom level thereof. A tube "bundle" for heating the water, as indicated at **14** is housed within a shroud **16** which extends into the interior of the tank **10**. The shroud **16** is closed at its inner end by means of an intake manifold such as may be provided by a vertically standing pipe or conduit **18** which is either open or closed at its ends and in any case is provided with water intake means drawing water from substantially all levels of the interior of the tank; such as by being formed at vertically spaced intervals with saw cuts or other apertures as indicated at **19**. A series of staggered baffles are optionally carried by the tubes or otherwise supported in the shroud as shown at **20**, to force the circulating water to traverse a zig-zag path through the tube bundle, as will be explained more fully hereinafter.

At its outer end the shroud **16** is flanged and carries a tube sheet **21** through which the open ends of the tubes **14** extend into open communication at their opposite ends with the interior chambers of a horizontally partitioned bonnet **22** which is similarly flanged and bolted into cooperation with the tube sheet and thus to the end of the shroud **16**. Steam or any other suitable heating fluid is introduced as by means of a conduit **24** into the upper portion of the bonnet, from whence it flows through the return bent tubes **14** and then into the lower portion of the bonnet for discharge through a condensate trap or the like as indicated at **26**. Passage of steam through the conduit **24** and into the system is controlled as by means of a flow regulator as is indicated at **28**. The regulator **28** is in turn controlled by a temperature sensing "bulb or the like, such as is shown at **30** located in the hot water withdrawal area provided by a hot water service outlet conduit **32**, and is connected to the flow regulator **28** by a control line **34**.

The hot water take-off connection **32** draws from the outer end of the shroud **16** and delivers hot water which is freshly heated by the tube bundle to the heated water supply system, regardless of from which portion of the storage tank it may have been drawn. Also, leading away from the outer end of the shroud **16** is a water by-pass circulating conduit **36** which leads to a constantly running pump **38** delivering through a conduit **39** into a connection **40** discharging into the bottom of the tank **10**. Hence, operation of the pump **38** draws water through the heating tube bundle and delivers it (as indicated by the flow directional arrows) into the bottom level of the tank whereupon it proceeds to intimately mix into and with the water occupying the upper levels of the tank.

Thus, it will be appreciated that operation of the pump **38** will provide a constant circulation of water drawn through the manifold apertures **19** from substantially all levels of the tank **10**; through the heater shroud, around the sensing bulb **30**; through the conduit **36**; the conduit **39**; and then back into the lower portion of the tank **10**. Hence, the water in the storage system will be constantly circulating in accordance with the directional arrows shown in the drawing herewith. Also, it will be appreciated that whenever heated water is withdrawn through the service conduit **32** corresponding amounts of cold feed water will enter the tank through the inlet **12** and will be directed by the deflector **41** so as to blend directly into the pump circulated stream of water entering the tank through connection **40**. As shown at **42**, the return from the heated water supply conduit system is connected into the pump-circulating conduit system so as to strategically contribute its input to the temperature blending operation.

Thus, it will be understood that because the intake manifold **18** draws water into and through the heater component of the system from all vertical levels of the tank interior, the invention provides an improved stratification system as well as an improved feed water supply system; operating automatically to blend heated water into the cold feed water entering the tank and thereby reducing the water temperature differential within the tank **10** and utilizing formation of temperature stratification patterns within the tank.

It is to be understood that whereas the drawing illustrates employment of a vertically apertured pipe **18** disposed inside the body of the tank **10** for all-level intake of water to the heater shroud, the invention is not limited to use of that specific form of manifold arrangement and contemplates use of any equivalent thereto in combination with the water input, by-pass circulation, and return arrangements as set forth herein whereby an overall improved storage water heating system is provided.

We claim:

1. A water heating and storage system of the immersion heater type comprising,

a water carrying storage tank,

an immersion heater extending into an upper level portion of said tank and comprising an elongate shroud projecting through a wall portion of said tank and having a heat supply means disposed within said shroud for heating water moving therethrough,

a hot water service withdrawal connection into and leading from the outer end of said shroud,

a heat supply regulator responsive to the water temperature in the region of said withdrawal connection,

a storage water circulation by-pass system including a pump drawing water from interiorly of said shroud and discharging into the main body portion of said tank,

and replacement water supply means delivering into said tank,

said shroud having its intake end portion in sealed fluid communication with vertically disposed tank water intake manifold means having fluid flow open communication with the water interiorly of said tank at substantially all vertical levels thereof.

2. A water heating system as set forth in claim **1**, wherein said shroud extends both inwardly and outwardly of said tank wall and wherein said service water withdrawal and circulating by-pass and heat supply regulator devices are connected into the outer end of said shroud.

3. A water heating system as set forth in claim 1, wherein said heat supply means comprises a steam conducting bundle of return bent tubes.

4. A water heating system as set forth in claim 2 wherein said manifold means comprises a conduit extending vertically inside said tank substantially throughout the vertical extent thereof and having intake apertures so arranged as to draw water from substantially all levels within said tank for delivery into said shroud.

5. A water heating system as set forth in claim 4 wherein said replacement water supply means includes a cold water inlet and a heated water return inlet both leading into the bottom level of said tank.

6. A water heating system as set forth in claim 5 wherein said cold water inlet is provided with means causing inflowing water to be deflected away from said manifold means and substantially across the lower level of said tank.

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