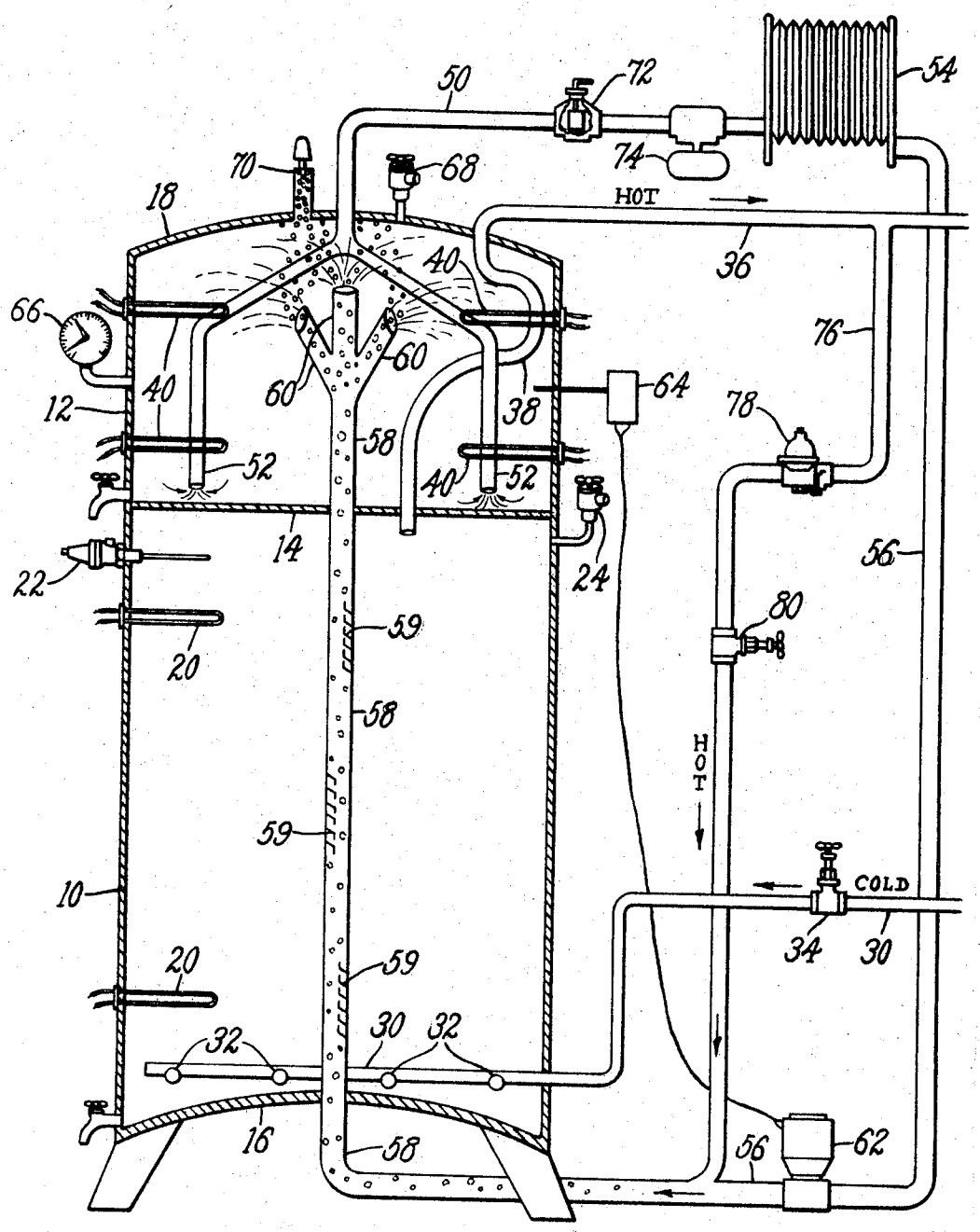
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DUAL PURPOSE HOT WATER HEATING BOILERS

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DUAL PURPOSE HOT WATER HEATING BOILERS

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ABSTRACT OF THE DISCLOSURE

A vertically disposed pressure vessel, separated by a partition into a smaller upper and a larger lower boiler portion, each having its own electrical heating elements, provides a dual purpose hot water heating boiler. A cold water inlet and a hot water outlet are provided for the larger lower boiler portion, which is adapted to serve as a domestic hot water storage heater, while the smaller upper boiler portion is adapted to serve as a house heating water heater and has a hot water outlet and a return pipe. The hot water outlet from the lower boiler portion passes through the upper boiler portion and includes a heat transferring coil within said upper boiler portion, while the return pipe leading to the upper boiler portion passes upwardly through the lower boiler portion and is provided with groups of spiral fins for facilitating the separation of air from the water therein for release through an air bleed valve located in the dome-shaped top of the upper boiler portion.

Background of the invention

This invention relates to improvements in hot water heating boilers wherein a single compact unit is adapted to provide domestic hot water and also hot water for house heating purposes.

Description of the prior art

It is old in the art to provide electric domestic hot water heating boilers of the so-called "Off-Peak" storage water heater type, designed to take advantage of the lower rates offered for "Off-Peak" service, and to provide compact and space saving electrically heated hot water heating boilers for house heating purposes. It has also been previously proposed to provide dual purpose electrically heated hot water heating boilers adapted to supply hot water for domestic use and also for house heating purposes.

Summary of the invention

It is an object of this invention to provide a novel and improved dual purpose hot water heating boiler which is of simple and compact construction and yet is most efficient and dependable in operation.

With this purpose in view and in accordance with a feature of the invention, the herein illustrated boiler comprises a pressure vessel which is preferably vertically disposed and divided into two separate boiler portions by a partition of heat transmitting material, the lower one of the boiler portions being larger than the other and adapted to serve as a storage heater for domestic hot water while the other, upper and smaller, boiler portion is adapted to serve as a heater for house heating water, and each boiler portion being provided with its own independent electrical heating means.

Associated with the larger boiler portion is a cold water inlet and a hot water outlet, the latter, in accordance with another feature of the invention, leading from the upper part of the lower boiler portion, through the heat transmitting partition and the upper boiler portion and including a heat transferring coil within the upper boiler portion.

The upper boiler portion has a hot water outlet and a return pipe and, in accordance with still further features of the invention, the outlet pipe has two branches which extend downwardly within the upper boiler portion to locations adjacent to the heat transmitting partition and also to the side wall of this boiler portion while the return pipe extends upwardly through the lower boiler portion and the heat transmitting partition and terminates centrally of the upper part of the upper boiler portion. Preferably, several groups of spiral fins are so arranged within the return pipe as to set up a swirling action for facilitating the release of air from the returning water in the form of air bubbles and an air bleed device is provided in a dome-shaped end wall of the pressure vessel which forms the top of the upper boiler portion.

The above and other objects and features of the invention will appear in the following detailed description of the embodiment illustrated in the accompanying drawing, and will be pointed out in the claims.

Description of the drawing

In the drawing, the single figure illustrates, somewhat schematically, a dual purpose hot water heating boiler embodying the features of this invention.

Description of the illustrated embodiment

Referring to the drawing, the illustrated boiler is shown in vertical section and comprises a pressure vessel which is divided into a lower boiler portion **10** and an upper boiler portion **12** by a partition **14** formed of heat transmitting material. The pressure vessel may be of conventional construction and, in accordance with usual practice, will be suitably insulated by an outer layer of material, not shown. Inasmuch as the lower portion **10** of the boiler is to be used for heating domestic hot water, its interior walls, including the lower side of the partition **14** and the upper side of a bottom wall **16**, will be lined with some non-ferrous material. Alternatively, the entire boiler, including the partition **14**, the bottom wall **16** and a dome-shaped top wall **18**, may be constructed of such non-ferrous material.

Arranged within the lower portion **10** of the boiler is an array of electric immersion heaters, two of which appear in the drawing and are designated by the reference characters **20, 20**. These heaters will be connected to a suitable source of electrical energy and controlled, in the usual manner, by means of an Aquastat, not shown. As suggested above, the lower portion of the boiler is intended to serve as a so-called "Off-Peak" electric storage water heater. Thus, in accordance with usual practce, electrical energy will not be available to the heaters **20, 20** during certain hours of the day, e.g., from 5 p.m. to 10 p.m. Also associated with this lower boiler portion are a Pressure-Temperature Relief Valve **22** and a Vacuum Release Valve **24**. Preferably, and as herein illustrated, the capacity of the lower boiler portion **10** is about seventy gallons or a little more than twice that of the upper boiler portion which is thirty gallons. It will, of course, be understood that these values are not critical and may be varied to suit particular operating conditions without departing from the spirit of the invention.

Extending into the lower boiler portion **10** is a cold water inlet pipe **30** having a series of discharge orifices **32, 32**, arranged in close proximity to the bottom wall **16**. A hand valve **34** is provided for controlling the flow of cold water through the pipe **30**. Extending through the partition **14** and opening to the upper part of the lower boiler portion **10**, adjacent to this partition, is a hot water outlet pipe **36** which leads to the domestic hot water outlets, not shown. As illustrated in the drawing, this outlet pipe passes through the upper boiler portion **12**, the partition **14** and the top wall **16**. Within the upper boiler por-

tion this outlet pipe is in the form of a helically wound coil, generally similar to the coils used in the so-called "tankless" hot water heaters, this coil being schematically illustrated by the curved portion **38** of the pipe **36**.

The upper portion of the boiler is used for heating water for house heating purposes. Thus, there is arranged within this upper boiler portion an array of electrical immersion heaters, four of which are shown in the drawing and identified by the reference characters **40, 40, 40, 40**. These heaters are connected to a source of electrical energy and are controlled in the usual manner by an Aquastat, not shown. An outlet pipe **50**, having two branches **52, 52** within the upper boiler portion **12** is connected to the house heating system, herein illustrated by a single radiator **54**. From the heating system a return pipe **56** leads back to the upper boiler portion and this return pipe has a riser **58** which extends upwardly through the bottom wall **16**, the lower boiler portion **10** and the partition **14**. Preferably, and as schematically illustrated in the drawing, three groups of spiral fins **59, 59, 59**, are arranged within the riser **58**. These groups of fins are adapted to set up a vortex or swirling action in the water to facilitate the liberation of air from the water returning to the upper boiler portion from the heating system, as will be explained below. The riser **58** terminates near the top of the upper boiler portion **12**, and centrally thereof, in three branches indicated by the reference characters **60, 60, 60**.

Hot water is circulated through the heating system by means of a pump **62** in response to the action of an electrical control device **64** which is sensitive to signals from a room thermostat, not shown, and also to the temperature of the water in the upper boiler portion. As shown, a conventional pressure gauge **66** is associated with the upper boiler portion together with a Vacuum Release Valve **68**. Also, a float type Air Bleed Valve **70** is in communication with the highest part of the upper boiler portion through the dome-shaped top wall **18**. Located in the outlet pipe **50**, ahead of the radiators, are an Off-On Valve **72**, which is adapted to be controlled by the action of the pump **62**, and a conventional expansion tank **74**.

Preferably, and as herein illustrated, make-up water for the hot water heating system is taken from the domestic hot water outlet pipe **36** through a by-pass pipe **76** in which there is located a pressure reducing valve **78** and a manual Off-On Valve **80**. The valve **78** is adapted to reduce the pressure from about 40 to 60 p.s.i., which is maintained in the lower boiler portion **10** and in the domestic hot water system, to 10 to 20 p.s.i. in the upper boiler portion and in the hot water heating system, thus complying with usual municipal plumbing code regulations.

In use, during the heating season at least, the aquastats associated with the upper and lower boiler portions will be so adjusted that the water in each of these boiler portions will be heated to a temperature of approximately 200 degrees F. by the electrical heaters **20, 20** and **40, 40, 40, 40**. Circulation of hot water through the heating system by the pump **62**, in response to the action of the control device **64**, of course results in a cooling of the water in the upper boiler portion but this heat loss is almost immediately restored by the heaters **40, 40, 40, 40**. Similarly, as hot water is drawn out of the lower boiler portion **10** through the various outlets of the domestic hot water system, it is replaced by cold water, thus lowering the temperature of the water in this boiler portion. Heaters **20, 20**, now come into action to raise the temperature of the water to approximately 200 degrees F.

During the so-called "Peak Load" hours, however, no electrical energy can be supplied to the heaters **20, 20**. Thus, although the capacity of the lower boiler portion **10** is such as to provide sufficient hot water storage for ordinary usage, unusual demands on the domestic hot water system might result in a lowering of the temperature of the water to an undesirable level. This difficulty is, however, quite effectively avoided with the novel arrangement of this invention, just described above. Thus, the helical coil **38** of the outlet pipe **36**, being immersed in 200 degree F. water in the upper boiler portion now functions the same as a "Tankless" water heater to raise the temperature of the water in the outlet pipe **36** to, or very nearly to, the desired 200 degree F. level. It will be understood that the temperature of the domestic hot water, as delivered from the several service outlets, may be reduced to a suitable lower temperature by means of a conventional tempering valve, not shown.

A very similar action will be obtained even during the summer months, when the electrical energy supplied to the heaters **40, 40, 40, 40**, is either greatly reduced or entirely cut off. Now, during the so-called "Off-Peak" hours, the body of water in the lower boiler portion **10** will be maintained at approximately 200 degrees F. by the heaters **20, 20**. Because of the heat transmitting character of the partition **14**, which is made of heat conductive material, the temperature of the water in the upper boiler portion **12** will also eventually be heated to nearly the same temperature inasmuch as there will be no loss of heat therefrom as a result of circulation through the hot water heating system. Accordingly, during the so-called "Peak Load" hours, as hot water is withdrawn from the lower boiler portion **10**, heat will not only be transmitted back to the water in the lower boiler portion through the partition **14**, but also water which is withdrawn from this lower boiler portion will be heated as it passes through the coil portion **38** of the outlet pipe **36**. Thus, because of the actions of the heat transmitting partition **14**, common to the upper and lower boiler portions **10** and **12**, and the coil **38**, the effective capacity of the lower boiler portion as an "Off-Peak" storage water heater is greatly increased. In effect the body of water in the upper boiler portion **12** serves a heat storage body from which heat may be returned to the domestic hot water in the lower boiler portion **10** or as it flows out through the outlet pipe **36, 38**. The action of the partition **14** in transmitting heat from the water in the lower boiler portion to the water in the upper boiler portion is facilitated by the tendency of the hottest water to rise to the upper part of the lower boiler portion. Thus, this stratification in the lower boiler portion, considered objectionable in conventional domestic hot water heaters, becomes an advantage in the novel arrangement of this invention.

On the other hand, this heat transmitting action of the partition **14** is of benefit to the hot water heating function of the dual purpose boiler. Thus, even during the non-heating season, when the supply of electrical energy is usually cut off from the heaters **40, 40, 40, 40**, should the room temperature drop sufficiently to actuate the room thermostat, hot water from the upper boiler portion, heated as a result of the action of the partition **14**, will be circulated through the heating system. The volume of hot water thus available in the upper boiler portion would be enough to warm the house, at least on chilly days in the Spring or Fall.

As shown in the drawing and explained above, the two branches **52, 52** of the outlet pipe **50** open into the lowermost part of the upper boiler portion **12**, close to the partition **14**, while the three branches **60, 60, 60**, of the riser portion **58** of the return pipe **56** empty into the upper part of this boiler portion and centrally thereof. This arrangement of outlet and return tends to set up a circulatory invention of the water within the upper boiler portion, generally as indicated by the dashed lines in the drawings. This circulatory motion of the water has a tendency to clean the inside walls of the upper boiler portion and also provides what may be termed an inverse stratification within the upper boiler portion which brings the hottest water down to the vicinity of the ends of the branches **52, 52** of the outlet pipe **50** and adjacent to the partition **14**. This makes the hottest water available for circulation through the heating system and also facilitates

the transfer of heat through the partition **14** to the water in the lower boiler portion **10**, for the purpose mentioned above.

The water which is returned to the upper boiler portion **12** is preheated somewhat as it travels upwardly through the riser **58** which is immersed within the body of hot water in the lower boiler portion **10**. Thus, the efficiency of the upper or house heating boiler portion **12** is enhanced. Also, as this returning water is preheated, there is a tendency for air entrained therein to form into bubbles, as indicated in the drawing. These bubbles, as they emerge from the branches **60, 60, 60**, of the riser **58**, immediately rise into contact with the dome-shaped top wall **18** along which they travel to the air-bleed valve **70**, through which they escape. As suggested above, this formation of the entrained air into bubbles is greatly facilitated by the action of the groups of spiral fins **59, 59, 59**, in setting up a swirling or vortex motion of the returning water as it travels upwardly in the riser **58**.

From the above description of the herein illustrated embodiment it will be seen that the novel arrangement of this invention provides a most efficient and dependable dual purpose hot water heater which not only combines but adds to the advantages of a so-called storage hot water heater and those of an electrically heated hot water heating boiler. Moreover, this improved dual purpose boiler affords an especially convenient replacement either for a conventional domestic hot water heater, since it occupies substantially the same floor space and only a little more headroom, or a worn-out house heating boiler. Connections to the cold water supply, the domestic hot water system and to the house heating system may be made with a minimum amount of labor and expense.

Having described the invention, what is claimed as new and desired to secure by U.S. Letters Patent is:

1. A dual purpose hot water heating boiler comprising a vertically disposed closed pressure vessel, a horizontally disposed partition of heat transmitting material separating the interior of said vessel into upper and lower boiler portions, a cold water inlet extending into, and a first hot water outlet leading from, said lower boiler portion, a second hot water outlet leading from, and a return pipe leading to, said upper boiler portion, and separate and independent means for heating water in each of said boiler portions.

2. A dual purpose hot water heating boiler as set forth in claim **1** wherein the first mentioned hot water outlet extends through, and in heat transferring relation to, the water in said other boiler portion.

3. A dual purpose hot water heating boiler as set forth in claim **2** wherein the first mentioned hot water outlet includes a heat transferring coil within the water in said other boiler portion.

4. A dual purpose hot water heating boiler as set forth in claim **1** wherein said lower boiler portion is larger than said upper boiler portion and adapted to serve as a domestic hot water storage heater while the smaller upper boiler portion is adapted to serve as a hot water house heating boiler.

5. A dual purpose hot water heating boiler as set forth in claim **4** wherein said cold water inlet extends into the lower part of the lower boiler portion and said first mentioned hot water outlet leads from the upper part of the lower boiler portion, adjacent to the mentioned partition.

6. A dual purpose hot water heating boiler as set forth in claim **4** wherein the hot water outlet leading from the upper boiler portion extends within said boiler portion to a location adjacent to the mentioned partition while the return pipe extends through the partition and terminates in the upper part of the upper boiler portion.

7. A dual purpose hot water heating boiler as set forth in claim **6** wherein said return pipe also extends through the lower boiler portion.

8. A dual purpose hot water heating boiler as set forth in claim **7** wherein means are provided within said return pipe for facilitating the release of air from the water in the form of bubbles and wherein an end wall of the pressure vessel which forms the top of the upper boiler portion is dome-shaped and provided with an air bleed device.

9. A dual purpose hot water heating boiler as set forth in claim **8** wherein the means for facilitating the release of air comprises several groups of spiral fins.

10. A dual purpose hot water heating boiler as set forth in claim **6** wherein said hot water outlet has a plurality of branches extending within the upper boiler portion to locations adjacent to said partition and to the side wall of the upper boiler portion and wherein said return pipe terminates in the upper part of said boiler portion and centrally thereof.

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