Dec. 28, 1948. C. M. OSTERHELD 2,457,596

WATER HEATER

Filed Nov. 19, 1946 2 Sheets-Sheet 1

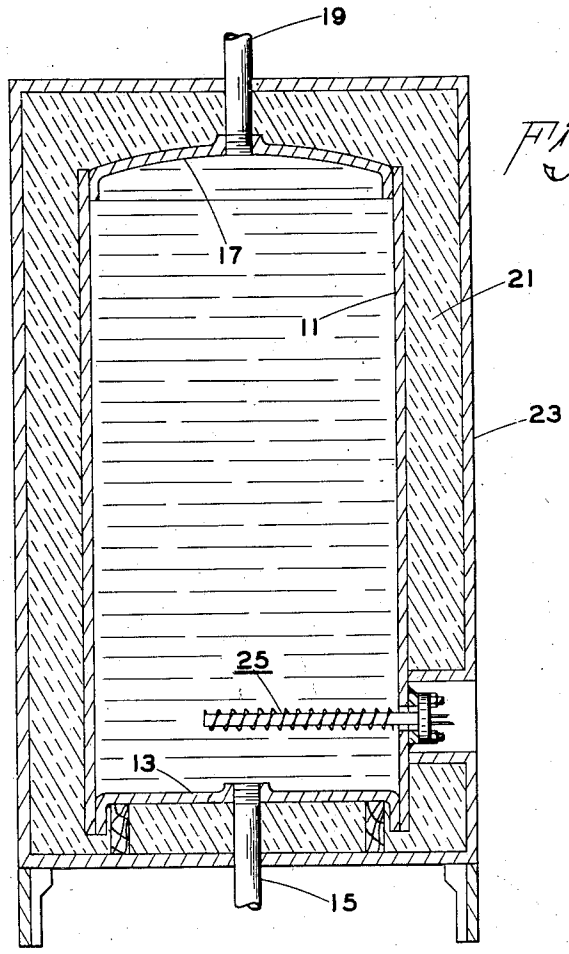


Fig-1

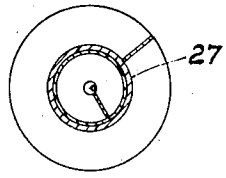


Fig-3

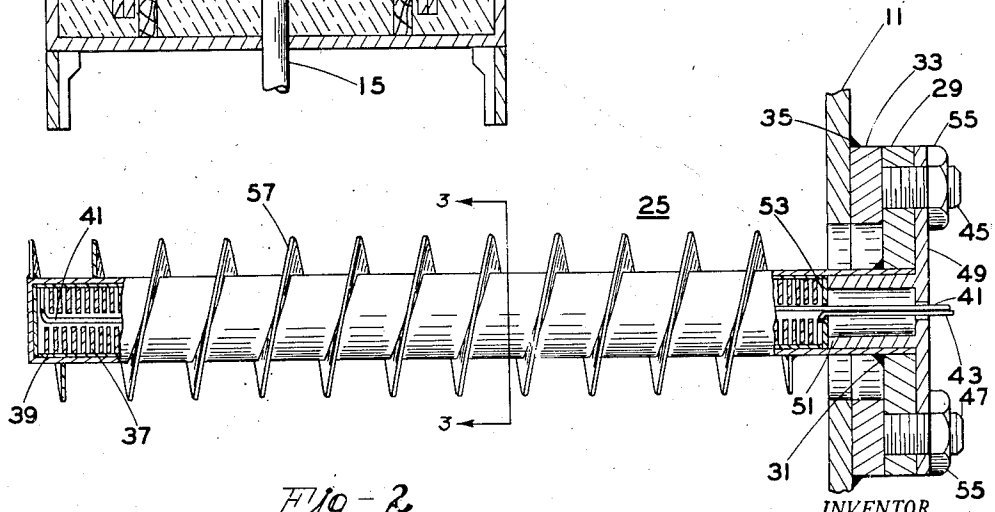


Fig-2

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Dec. 28, 1948. C. M. OSTERHELD 2,457,596

WATER HEATER

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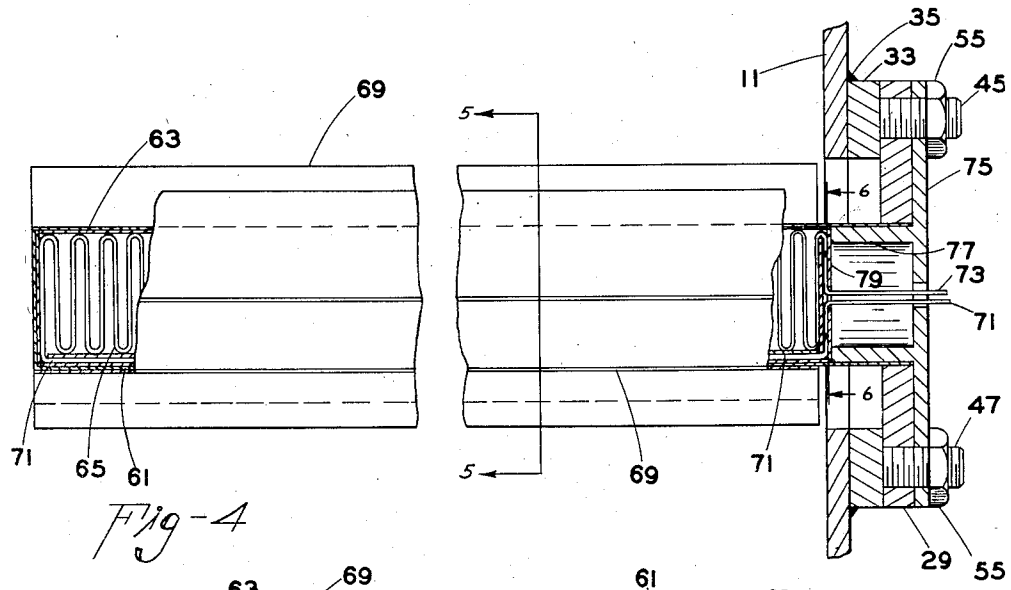


Fig-4

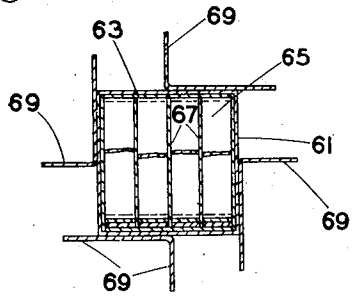


Fig-5

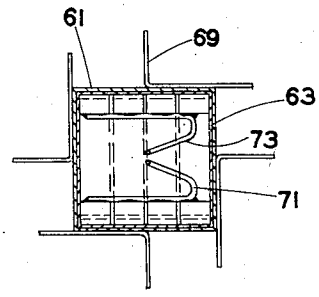


Fig-6

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Patented Dec. 28, 1948 2,457,596

UNITED STATES PATENT OFFICE

2,457,596

WATER HEATER

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Application November 19, 1946, Serial No. 710,774

2 Claims. (Cl. 219—39)

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My invention relates to electric water heaters and particularly to those adapted to be positioned inside of a domestic hot water tank.

An object of my invention is to provide an internal electric water heater of an improved type.

Another object of my invention is to provide an internal electric water heater having a relatively large heat radiation surface.

Another object of my invention is to provide an internal electric water heater using integral and inorganic insulation upon not only the resistance conductor but also upon the casing for the conductor.

In the drawings,

Figure 1 is a view in vertical section through a domestic hot water tank embodying an internal electric water heater comprising my invention,

Fig. 2 is a view mainly in front elevation, with certain parts shown in section, of an electric water heater embodying my invention,

Fig. 3 is a view in section therethrough taken on the line 3—3 of Fig. 2,

Fig. 4 is a view mainly in front elevation with certain parts cut away to show the internal construction thereof, of a modified form of electric water heater,

Fig. 5 is a view in lateral section therethrough taken on the line 5—5 of Fig. 4, and,

Fig. 6 is a view in section taken on the line 6—6 of Fig. 4.

Referring first of all to Fig. 1 of the drawings, I have there shown a standard domestic iron hot water tank 11 comprising a lower closure member 13, a cold water inlet pipe 15, as well as an upper closure member 17 and a hot water outlet pipe 19. I provide also a mass of heat insulation 21, such as mineral wool, around the tank 11 which may be held in proper operative position by an outer casing 23.

I provide an electric water heater designated in its entirety by the numeral 25, this water heater being adapted to be mounted inside of the hot water tank 11.

The heater 25 comprises an outer tubular casing 27, the inner end of which is closed and the outer end of which is secured to a plate 29 as by a welding seam 31 therebetween. I provide further a plate 33 which is secured to the outer surface of tank 11 as by a welding seam 35. It will be understood that the engaging surfaces of plate 33 and of the tank 11 are similar as are also the engaging surfaces of plates 29 and 33.

A resistance conductor 37 of strip-type is adapted to be positioned within the tube 27, the strip 37 being helically wound on edge. While

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I have shown the adjacent convolutions of strip 37 as being spaced apart I do not desire to be limited thereto since with the construction used by me in the design and the construction of my improved electric water heater the adjacent convolutions may be in actual contact with each other.

I provide a relatively very thin liner 39 which is in operative engagement with the inner surface of the tube 27, it being held in close engagement with the inner surface of tube 27 by the resistance conductor 37 which is placed within the tube 27 and when in substantially proper operative position therewithin is allowed to expand.

The resistance conductor 37 may be of the kind used at present in rheostats and similar devices or it may be an aluminum strip. The entire outer surface of the resistance conductor 37 is provided with an integral, inorganic, heat-conducting, high-temperature-resisting and electric-insulating coating, the thickness of the coating being on the order of .001". While I have stated that the thickness of the coating is on the order of .001", the thickness of said coating may vary from .0005" to .0015". One method of making a coating of this kind is set forth in Patent #1,526,127.

The thin liner 39 is also preferably made of aluminum and has a thickness on the order of .015" although the thickness of this strip may vary from .01" to .02". The tube 27 is also preferably made of aluminum and the thickness thereof is on the order of .035", the thickness varying from .03" to .04". The entire surface of the liner 39 and at least the inner surface of tube 27 are provided with substantially the same kind of coating as has been hereinbefore set forth in connection with the resistance conductor 37.

I provide a terminal lead 41 which is connected to the inner end of resistance 37, and I provide a similar terminal lead 43 for the outer end of the resistance conductor.

I provide plate 33 with at least two bolts 45 and 47, which bolts are adapted to extend through not only the plate 29 but also through a clamping plate 49, which clamping plate is provided with an inner tubular extension 51, which tubular extension is of such length as to engage a circular spacer 53 adapted to prevent movement of the outer turns of conductor 37 beyond a predetermined distance. Nuts 55 are provided on each of the bolts 45 and 47, which bolts and nuts hold the electric heater 25 in watertight engagement with the tank 11.

In order to make the amount of heat transmitted from the heater **25** to the water, a minimum per square inch of surface, I provide a helically wound fin **57** around the tube **27**. This fin may be welded to the outer surface of tube **27**.

Referring now to Figs. 4 to 6 inclusive, I have there shown a modified form of electric heater, which heater comprises a tube **61** with its inner end closed, which is substantially of square shape in cross section. I provide liners **63** which are placed against the inside surface of the four sides of tube **61**. The material of the tube **61** is preferably aluminum and the thickness of the wall may be on the order of .035'' and may vary between the limits of .03'' to .04''. The thickness of the liners **63** may be on the order of .015'' and may vary between the limits of .01'' and .02''. The material of the liners is preferably aluminum.

I provide four parallel extending resistance conductors **65** comprising a plurality of transversely extending end-connected convolutions and while I have shown these convolutions as being spaced an appreciable distance from each other I do not desire to be limited thereto since the spacing as well as the thickness of the resistance conductor **65** may be made an amount which will give the desired resistance to permit of the generation of a desired amount of heat in each heater. I provide three liners **67** between the four resistance conductors.

I provide a plurality of longitudinally extending fins **69**, each fin being of substantially L-shape in lateral section and extending over substantially the entire length of the heater. These fins may have a thickness on the order of .015'' although I do not desire to be limited to this particular dimension since I may make the thickness of the fins **69** as great as .035''. A good conducting connection is provided between each fin **69** with the outer surface of tube **61** so that the fins **69** may receive and transmit a relatively large proportion of heat generated by the resistance conductor **65** within tube **61** to the water.

I provide a terminal lead **71** for the inner end of resistance conductor **65** and I provide a terminal lead **73** for the outer end of resistance conductor **65**. There will thus be provided four terminal leads for the inner ends of resistance conductor **65** as well as four terminal leads for the outer ends and it is possible to connect these in different combinations in order to meet the requirements of the supply circuit voltage.

I provide an outer clamping plate **75** having an inner extension **77** thereon which extension **77** is of square shape in lateral section and is adapted to engage a plate **79** which is preferably made of aluminum. Bolts **45** and **47** and nuts **55** are adapted to hold the heater in watertight engagement with the outer surface of the tank **11**.

While I may use a resistance conductor material of the kind now generally used I preferably make the resistance conductor **65** of aluminum and make the liners **63** and **67** also of aluminum. I provide the entire outer surface of conductor **65** with an integral, inorganic, heat-conducting, high-temperature-resisting and electric-insulating coating, the thickness of which is on the order of .001'', although the thickness thereof may vary from .0005'' to .0015''. The thickness of the liners **63** and **67** is on the order of .035'' although this dimension may vary between the limits of .03'' and .04'' and the material is preferably aluminum. I may also provide the entire outer surface of the liners **63** and **67** with substantially the same coating as was hereinbefore set forth as used upon conductor **65**. I may also provide substantially the same kind of coating upon the entire inner surface of tube **61**.

The device embodying my invention thus provides an internal electric water heater which can be easily installed and removed from a tank and which in one form thereof is provided with helically wound fins extending from one end of the heater to the other, while the other form thereof is provided with longitudinally extending fins extending substantially the entire length of the heater.

The provision of the hereinbefore described coating of electric insulating material permits of making external dimensions of the tube a minimum and not increasing to too great an extent the amount of heat energy transferred from the tube to the water per square inch of surface.

Various modifications may be made from the device embodying my invention without departing from the spirit and scope thereof and I desire that all such modifications clearly coming within the scope thereof shall be considered a part of my invention.

I claim as my invention:

1. An electric water heater adapted for insertion into a hot water tank comprising a round, tubular, metallic casing having a closed inner end and consisting of a metal having high heat conductivity, a relatively thin metallic liner of high heat conductivity in said casing, a helically wound-on-edge metallic resistance strip adapted to expand its helix when in its operative position inside said liner and casing to hold said liner in close engagement with the inside surface of said casing and a metallic fin secured to the outside surface of said casing and extending helically therealong, said fin consisting of metal of high heat conductivity, said resistance strip and said liner having thereon an integral, inorganic, heat-conducting, high-temperature-resisting and electric-insulating coating.

2. An electric water heater adapted for insertion into a hot water tank comprising a thin aluminum casing substantially square in cross section and having a closed inner end, a plurality of relatively thin aluminum liners in said casing, a plurality of aluminum resistor strips within said liners and casing bent to provide a plurality of transversely-extending end-connected convolutions, relatively thin aluminum liners between adjacent resistor strips and aluminum fins secured to the outside of said casing and extending longitudinally thereof, said resistor strips and said liners each having on their outer surfaces an integral, inorganic, heat-conducting, high-temperature-resisting and electric-insulating coating.

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