

Feb. 12, 1935.

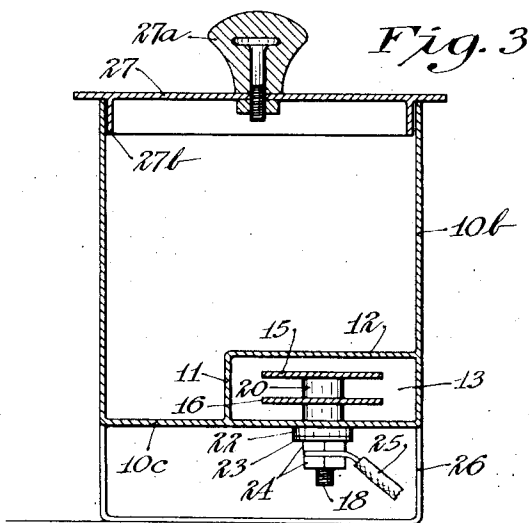
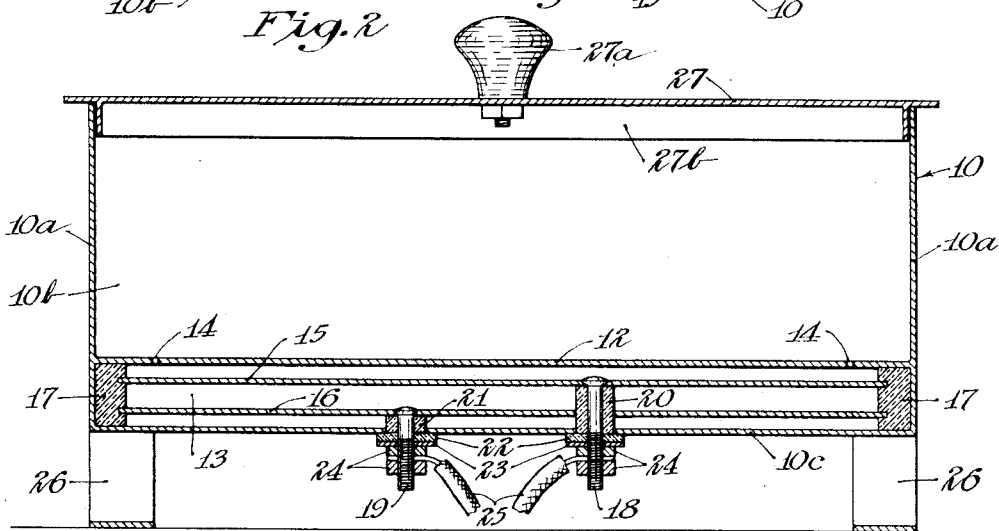
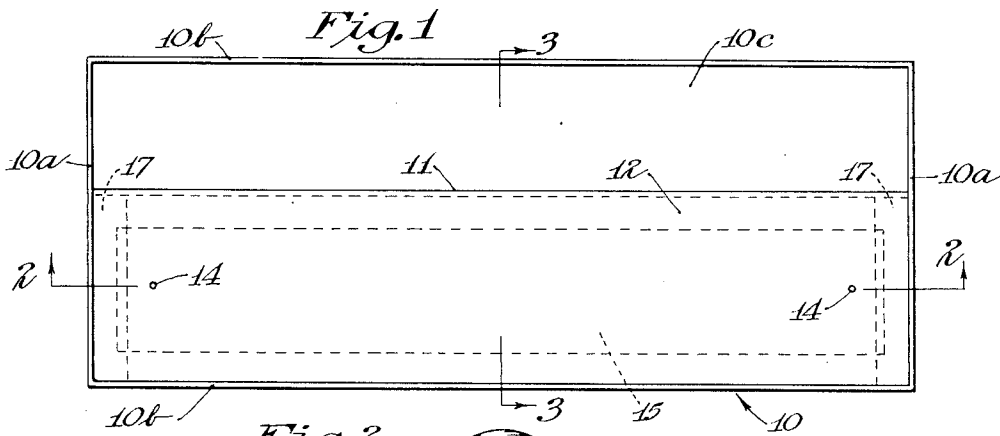
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1,990,790

ELECTRIC WATER HEATER

Filed Sept. 22, 1932

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 5

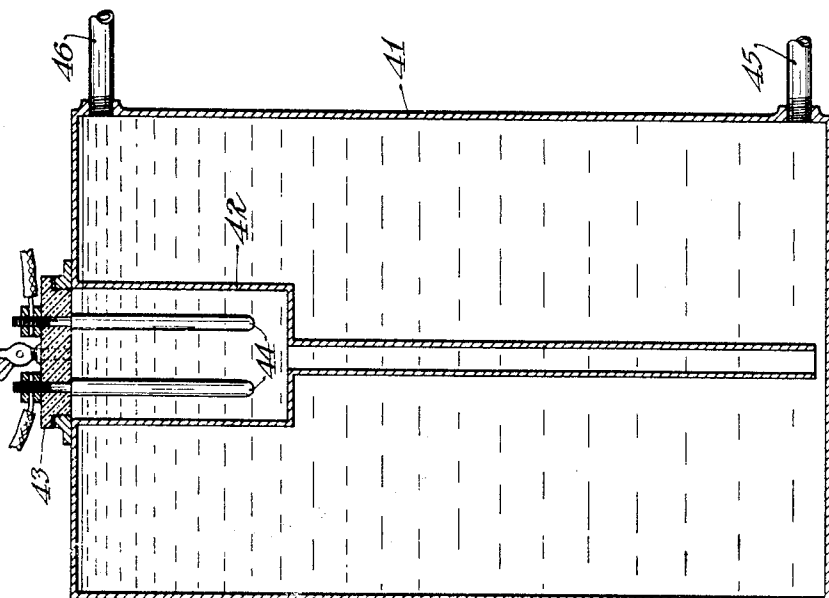
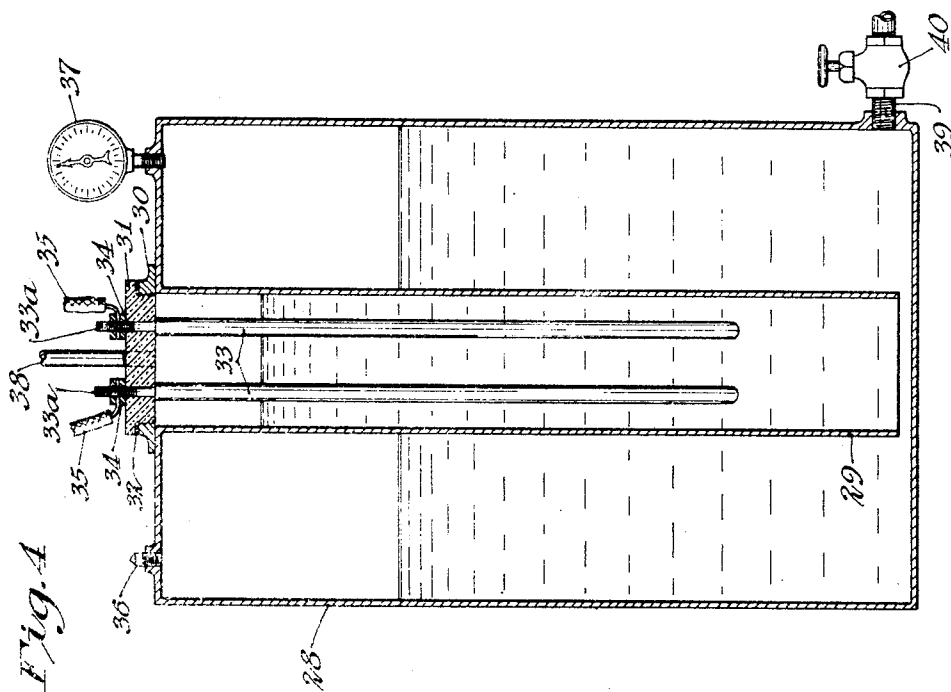


Fig. 4



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UNITED STATES PATENT OFFICE

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ELECTRIC WATER HEATER

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3 Claims. (Cl. 219-40)

My invention relates to electric water heaters and particularly to heaters wherein electricity passes from one electrode to another through the liquid being heated.

It is an object of my invention to provide a novel, simple, compact, and inexpensive heater of the class indicated wherein none of the parts are susceptible of burning out, even if the device remains connected to a source of electrical energy after substantially all of the water in the device has evaporated.

Another object is to provide such a heater wherein water may be heated to its boiling point with great rapidity and wherein automatic means involving no moving parts is provided to constantly maintain water therein substantially at a boiling temperature or steam therein at a certain pressure and to regulate the consumption of electrical energy to a value only sufficient to maintain water at such temperature or the steam at such pressure.

These and other objects and advantages of the present invention will more fully appear from the following description, made in connection with the accompanying drawings, wherein like reference characters refer to the same or similar parts throughout the various views, and, in which

Fig. 1 is a top view of my invention with the cover thereof removed;

Fig. 2 is a longitudinal vertical sectional view of my invention taken along the line 2-2 of Fig. 1, but with the cover in place;

Fig. 3 is a vertical cross sectional view taken along the line 3-3 of Fig. 1, but with the cover in place;

Fig. 4 is a vertical cross sectional view of another form of my invention; and

Fig. 5 is a vertical cross sectional view of still another form of my invention.

Referring to Figs. 1, 2, and 3 of the drawings, an open topped rectangular receptacle 10 is provided and this receptacle has end walls 10a, side walls 10b, and a bottom 10c. A vertical partition 11, rising a short distance above the bottom 10c of the receptacle, extends longitudinally of the receptacle 10 from one end wall 10a to the other end wall 10a, the lower edge of the partition 11 being secured to the bottom 10c in a medial location with respect to the side walls 10b and the respective ends being secured to the end walls 10a. A horizontal partition 12 extends from the upper edge of the vertical partition to one of the side walls 10b and from one of the end walls 10a to the other, the edges of the parti-

tion 12 being respectively secured to the elements between which the partition extends. The partitions 11 and 12 form a compartment or chamber 13. Near each end of the chamber 13 the horizontal partition, forming the top thereof, is provided with a very small aperture 14, the chamber being entirely sealed except for the apertures 14.

A pair of vertically spaced rectangular plates or electrodes 15 and 16, formed of electrical conducting material are disposed, one above the other, within the chamber 13 in spaced relation to the walls thereof. The electrodes 15 and 16 are supported and secured in place by blocks 17, formed of insulating material, respectively abutting the end walls and the end portions of the side, top, and bottom walls of the chamber 13, and having recesses in the inner sides thereof wherein the respective ends of the electrodes 15 and 16 are retained.

Electrical connection studs 18 and 19 are respectively secured at their upper ends to the electrodes 15 and 16 and depend therefrom to a point somewhat below the bottom 10c of the receptacle 10 and chamber 13. The stud 18, connected to the upper electrode 15 extends through a suitably located aperture in the lower electrode 16 and through an aperture in the bottom 10c of the receptacle 10. The stud 19 extends through a second aperture in the bottom 10c. The stud 18 is provided with a bushing 20 and a washer 22, formed of insulating material, to insulate the same from the electrode 16 and the bottom 10c and to seal the stud to the bottom where it passes therethrough. The stud 19 is provided with a bushing 21 and a washer 22, formed of insulating material, to insulate the stud from and seal the same to the bottom 10c. On each of the respective studs, a washer 23 and two nuts 24 are placed below the washer 22. A pair of electrical conductors 25, adapted to be connected to a source of electrical energy, are secured and electrically connected to the respective studs 18 and 19 by means of the nuts 24.

A depending U-shaped support 26 is secured at its free ends to each end portion of the bottom 10c of the receptacle as shown. A cover consisting of a plate 27 having an upstanding handle 27a secured to the central portion thereof and a continuous depending flange 27b adjacent the edges thereof is provided for the open top of the receptacle 10.

If desired the interior of the chamber 13 may be coated with electrical insulating material. Also the exterior of the receptacle 10 may be jacketed with heat insulating material.

In use, the receptacle of my device is filled with water at least to a level above that of the horizontal partition 12. Water will then pass through the apertures 14 and fill the chamber 13 immersing the electrodes 15 and 16. The electrodes are then connected to a source of electrical energy by means of the wires 25 and an electrical current will flow from one electrode to the other through the water in which they are immersed. The flow of current through the resistance of the water will generate heat which will rapidly raise the temperature of the water in the chamber 13 and heat will flow from the water in the chamber through the partitions 11 and 12 to the main body of water in the receptacle 10 to simultaneously raise the temperature thereof.

As the water in the chamber becomes heated to the boiling point it will be converted to steam and a small portion of the steam generated will escape through the small apertures 14 to carry additional heat to the main body of water. The steam flowing out of the chamber through the apertures 14 will prevent the entrance of water into the chamber through the apertures. As more and more of the water in the chamber is converted into steam the water level within the chamber will fall until it reaches a level at which it will make only imperfect contact with the upper electrode. With such imperfect contact the flow of electrical current and the production of heat will be only sufficient to maintain the water in the device at substantially boiling temperature.

Should the temperature of the water in the device be reduced to below the boiling point, as through absorption of heat by cold water added thereto or cold articles immersed therein, the steam in the chamber will rapidly condense, the outward flow of steam through the apertures 14 will cease and water will immediately enter the chamber to raise the water level therein to a point at which the electrodes will be immersed. With the electrodes immersed, the flow of electrical current and the production of heat will attain their full rates and the temperature of the water in the chamber will be rapidly brought back to the boiling point.

Obviously, if the water evaporates away to such an extent that the water level in the chamber can no longer reach the upper electrode, no electrical current will flow and the production of heat will cease, thus automatically protecting the device from damage in the event that the device is inadvertently left connected to a source of electricity without the water level therein being maintained within normal operating range.

Another form of my invention, shown in Fig. 4, includes a tank 28 from the central portion of the top of which a tube 29 extends downwardly to a level only slightly above the bottom thereof. A raised or bossed portion 30 of the top of the tank disposed above the tube 29 is apertured and the aperture is internally screw threaded as shown. A flanged externally screw threaded plug 31, formed of electrical insulating material, is threadedly engaged with the screw threaded aperture and a sealing gasket 32 is disposed between the flange portion thereof and the boss 30.

A pair of electrodes 33, formed of electrical conducting material, have externally screw threaded upper end portions 33a, which extend respectively through each of a spaced pair of apertures through the plug 31 and are held in place by nuts 34 to support the electrodes parallel to each other and in spaced relation within

the tube 29. Two electrical conductors 35 are secured and electrically connected respectively to the protruding portions of the screw threaded upper portions 33a of the electrodes 33 by means of nuts 34.

A check valve, having means for connection of an air pump thereto, and a pressure gauge, each of which may be of a conventional type, are mounted in internally screw threaded apertures in the top of the tank 28 as shown.

A steam discharge pipe 38 is threadedly engaged in an internally screw threaded aperture in the plug 31, and runs to a closed chamber or other closed system (not illustrated) where the steam may be utilized.

At the lower portion of the side of the tank 28 a water supply pipe 39, having a normally closed valve 40 connected therein, and being connected to a source of water under pressure, is threadedly engaged in an internally screw threaded aperture in the side of the tank.

This form of my invention is used when it is desired to utilize the steam at a certain pressure. In normal use water is admitted to the tank through the valve 40 to partially fill the tank. An air pump is connected to the check valve 36 and is utilized to produce an air cushion in the upper portion of the annular space between the tank 28 and the tube 29 and to build up in the tank the particular pressure at which it is desired to maintain steam, the pressure attained being indicated on the gauge 37. The electrodes 33 are connected to a source of electrical energy whereupon current passing between the electrodes through the water in which they are immersed will act to heat the water. When the water within the tube 29 has reached the boiling point steam will accumulate in the upper end of the tube and force the water level in the tube downwardly to decrease the electrode area immersed in the water and hence reduce the flow of electrical current and the amount of heat produced. When sufficient steam has been accumulated so that the steam within the tube 29 equalizes the pressure of air in the tank 28, the water level will have been driven downwardly to the level of the lower ends of the electrodes with the result that the flow of electrical current and the production of heat will have been reduced to negligible values. The steam then at the desired pressure runs through the pipe 38 to the point where it is utilized. If desired the pipe 38 may be provided with a discharge outlet and steam at a desired pressure will run through the pipe and discharge at the outlet.

If the quantity of steam in the upper portion of the tube 29 is reduced either through condensation or through use of steam, the water level in the tube 29 will be forced upwardly by the air cushion in the upper portion of the tank 28 and the electrodes will again be at least partially immersed. Electrical current will then flow between the electrodes and produce heat to convert a portion of the water to steam and thus replace the steam which had been used or condensed. The steam within tube 29 will thus be constantly maintained at approximately a definite pressure having but slight fluctuations. The water may, of course, be replenished at any time by opening the normally closed valve 40.

Still another form of my invention, shown in Fig. 5, includes a tank 41 similar to the tank 28 of Fig. 4. A tube 42 is attached at its upper end to the top of the tank 41 in the same manner as the tube 29 of Fig. 4. The middle and lower

portions of the tube 42 are of considerably reduced diameter as shown and extend to a level only slightly above the bottom of the tank 41.

A plug 43, identical in construction with the plug 31 of Fig. 4, is mounted at the top of the tank 41 in the manner described in connection with Fig. 4. A pair of electrodes 44 depend from the plug 43 to a level somewhat above the level of the top of the reduced portion of the tube 42.

A water inlet pipe 45 is connected to the lower portion of the tank 41 and a water outlet pipe 46 is connected to the upper portion of the tank. An air release valve 47 is engaged in the threaded aperture in the plug 43.

This form of my invention is used when it is desired to heat water in systems of piping such as water supply systems operating under pressure, hot water building heating systems, and others.

In normal use, the inlet pipe 45 is connected to the source of the water to be heated and the outlet pipe 46 runs to the point or points at which hot water is to be utilized.

When first filled with water and occasionally thereafter any air entrapped in the upper end of the tube 42 is released by temporarily opening the normally closed air relief valve 47. Both the tank 41 and the tube 42 will then be filled to the top with water.

When electrical energy is supplied to the electrodes 44 the water in which they are immersed will be heated in the manner previously explained. The production of heat will be automatically regulated in a manner similar to that described in connection with Fig. 4 to maintain at all times a certain quantity of steam in the upper portion of the tube 42. Heat will be transmitted through the walls of the tube 42 from the steam and hot water therewithin to the water in the annular space between the tank 41 and the tube 42. When hot water is drawn through the outlet pipe 46 from the upper portion of the tank 41, cold water will be delivered through the inlet pipe 45 to the lower portion of the tank to replace the hot water which is removed. The cooler water will absorb heat rapidly enough to condense at least part of the steam in the upper part of the tube 42 and hence permit the water to rise in the tube to immerse the electrodes 44 and thereby cause production of heat to produce steam and to again bring the water in the tank up to normal temperature.

In all three of the forms of my invention shown it is obvious that lack of water will stop the flow of electrical current and the production of heat rather than to cause damage to the de-

vice. Any of the forms shown can be operated on either alternating or direct current but it is somewhat preferable to use alternating current in order to minimize the effects of electrolysis on the electrodes.

It is apparent that I have invented a novel, inexpensive, efficient, and compact electrically operated water heating device wherein the consumption of electrical energy and the production of heat are automatically regulated to maintain the water temperature substantially at the boiling point or steam at substantially constant pressure, and wherein shortage of water will stop the consumption of electrical energy and the production of heat.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the various parts without departing from the scope of the present invention.

What is claimed is:—

1. In an electrical water heater, a receptacle adapted for holding water, a chamber formed in the lower portion of said receptacle, there being a small perforation in the upper portion of the walls of said chamber to provide a restricted passage between the interior of said chamber and the interior of said receptacle, said chamber, with the exception of said perforation, being entirely closed, a pair of electrodes located within said chamber, and means connecting said electrodes to a source of electrical energy.

2. In an electrical water heater, an open topped receptacle adapted for holding water, partitions connected to the lower portion of said receptacle to form in conjunction therewith a chamber, said partitions being provided with an aperture communicating with said chamber in the upper portion thereof and said chamber otherwise being entirely closed, a pair of electrodes located within said chamber, and means for connecting said electrodes to a source of electrical energy.

3. In an electrical water heater, an open topped receptacle adapted for holding water, partitions connected to the lower portion of said receptacle to form in conjunction therewith a chamber, said partitions having a small aperture in the upper portion thereof to provide a restricted passage between the respective interiors of said chamber and said receptacle and said chamber otherwise being completely closed, a pair of electrodes located within said chamber, and means for connecting said electrodes to a source of electrical energy.

OTTO A. LENZ.