R. R. FOSTER.

ELECTRIC WATER HEATER.

APPLICATION FILED OCT. 14, 1911.

1,036,990.

Patented Aug. 27, 1912.

Fig. 1.

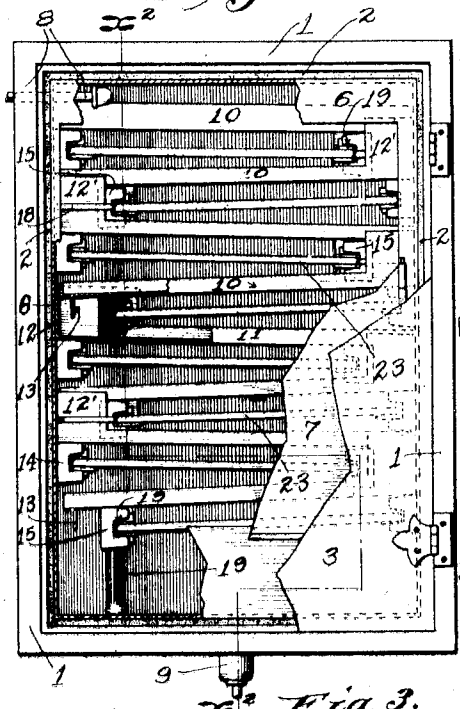


Fig. 2.

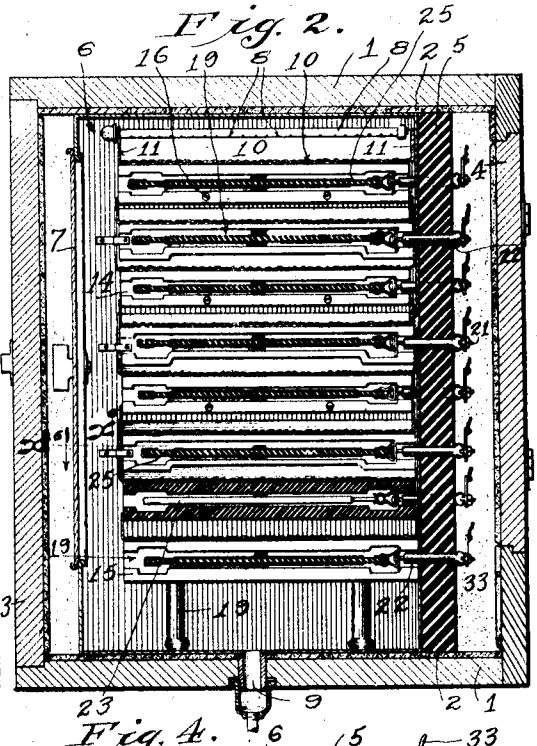


Fig. 3.

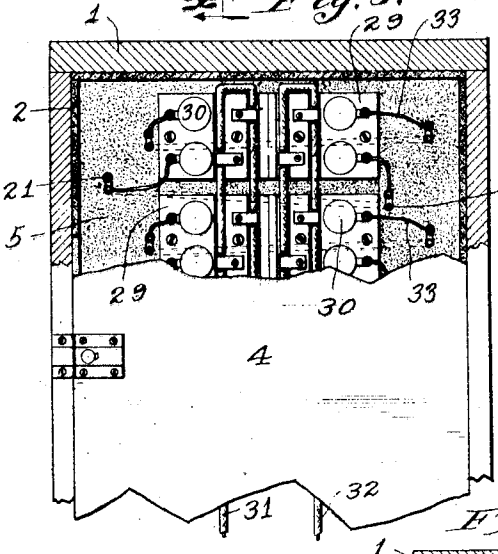


Fig. 4.

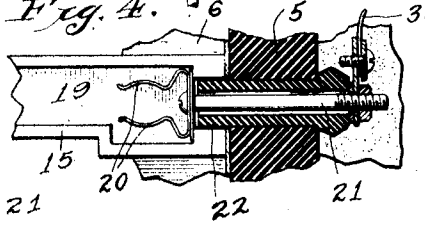


Fig. 5.

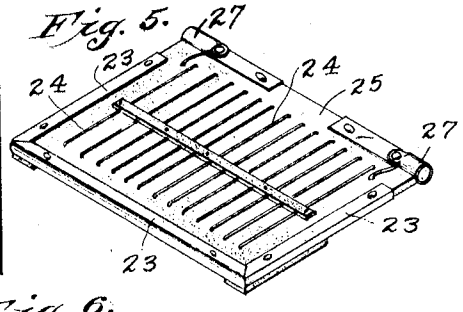
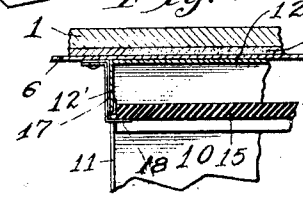


Fig. 6.



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UNITED STATES PATENT OFFICE.

ROY RALEIGH FOSTER, OF COLTON, CALIFORNIA.

ELECTRIC WATER-HEATER.

1,036,990. Specification of Letters Patent. Patented Aug. 27, 1912.

Application filed October 14, 1911. Serial No. 654,790.

To all whom it may concern:

Be it known that I, ROY RALEIGH FOSTER, a citizen of the United States, residing at Colton, in the county of San Bernardino, State of California, have invented a new and useful Electric Water-Heater, of which the following is a specification.

The main object of the present invention is to provide means for rapidly and economically heating water by electric current.

A further object of the invention is to provide for heating the water as it passes continuously through a chamber, by communication of the heat from the electric heating means to the water by direct contact of the air in the chamber with said heating means and with the water, the water being discharged as it is heated.

Another object of the invention is to eliminate the liability of explosion in the water heater by providing means for causing the water to travel through the heating chamber in a sheet or layer, freely exposed to the air in the chamber, thereby doing away with inclosed pipes in which the water is confined and in which excessive pressure is liable to be generated by the heating of the water.

Another object of the invention is to provide for convenient assemblage and renewal of the parts of the heater.

Another object of the invention is to provide for free passage of the water, by gravity through the heater.

Other objects of the invention will appear hereinafter.

The accompanying drawings illustrate the invention, and referring thereto:

Figure 1 is a front elevation of the heater, with the main and inner doors broken away, and with parts in section. Fig. 2 is a section on line x^2—x^2 in Fig. 1. Fig. 3 is a rear elevation partly broken away. Fig. 4 is a section of one of the circuit connectors. Fig. 5 is a perspective of one of the heating elements. Fig. 6 is a section on line x^6—x^6 in Fig. 2.

The heater is inclosed in a box or case 1 which may be of wood, lined as at 2 with heat insulating material such as asbestos, and closed at the front by a door 3 and at the back by a door 4. A partition 5 extends across the box near the back, the connection being made in the rear side of this partition and the heating devices being located in front thereof. A casing 6 of sheet metal is inclosed within lining 2 and inner door 7 is hinged in the casing 6 opposite the main door 3 to give access to this inner casing. A series of troughs or plates 10 extend across the inner casing 6 from side to side, said plates being supported on supports 14 and 15, and alternate plates dipping or inclining in opposite directions, and each having its lower end somewhat above the upper end of the next lower plate. Each plate 10 has a raised flange 11 along its front and rear edges and a higher flange 12 along its upper edge, said high flange having extensions 12′ embracing the lower end of the next higher plate 10, so as to insure that any water running from any plate 10 will fall on to the next lower plate. A bracket 17 secures the flange 12 to the side of the case. Each plate 10 is separated at its lower end from the flange 12 of the next lower plate to allow passage of water and a drip flange 13 depends from each plate near its lower edge to insure dripping off of the water. The several plates 10 may be corrugated or grooved as at 10′ to facilitate running of the water along the same, and enable the water to pass under the supports 15. A water supply pipe or connection 8 leads into the upper part of casing 6 so as to discharge water on to the higher part of the uppermost plate 10, said pipe being perforated at 8′ to drip water into the grooves or corrugations of the top plate. The casing 6 is provided with a discharge pipe or outlet 9 at its bottom to carry off the water from the casing.

The supports 14 are of suitable insulating material, such as porcelain, and are mounted at each side of the inner casing 6, being secured in position, for example, by screws 16 entering the outer casing. The support 14 at one side, alternate, as regards vertical position or elevation, with the supports 14 at the other side, and the higher ends of the respective plates 10 rest on said supports 14. Opposite to, but a little lower than each support 14 and near the farther side of the case, is arranged one of the supports 15, secured in position, for example, by bracket 18. The grooves 19 in opposing supports 14 and 15 face each other, forming ways to receive and guide the heating elements when they are inserted in the apparatus. The lowermost insulating supports 15 may be supported by insulating posts 19 extending from the bottom of the casing.

Connections are provided at the rear end of the grooves in the supports 14 and 15, for making connection with the heating elements when inserted. Said connections may consist of spring clips 20, secured to bolts 21, passing through insulating bushings 22 in the partition 5, said bolts being connected to the supply wires as hereinafter set forth.

Each heating element consists of wires or conduits 24 of high resistance, wound on a plate 25 of suitable insulating and heat proof material, for example, asbestos, the ends of said wires being connected to pins 27 arranged at the rear corners of the plate and adpated to engage the clips 20 of the connections aforesaid, when the plates are pushed into the respective guideways formed by the grooved supports 14 and 15. The supply wires 31 and 32 for the two sides of the circuit, lead up into the space at the rear of the partition 5 and are connected to blocks 29 from which connection is made through fuses 30 and wires 33 to the bolts 21 aforesaid. Plate 25 may be reinforced at its edges by strips 23 of metal.

In assembling the apparatus, the plates of the heating elements are pushed into the grooves of supports 14 and 15 and are retained in position by said supports and by engagement of their terminals 27 with the terminals 20 from the connection board. The water receiving plates 10 are set in position above each heating element after it is put in place, each plate 10 resting on the supports 14 and 15 beneath it, and being retained in position by the extension around said plate, of the upwardly extending flanges 12′ of the next lower plate. When assembled in this manner the several heating elements are interposed between the series of water receiving plates, so that each water receiving plate is directly above a heating element.

The operation is as follows: When a supply of hot water is desired, water is supplied through pipe 8 and current is turned on through wires 31 and 32. The water flows by gravity over the series of inclined troughs or plates 10, running from the lower end of each plate to the upper end of the next plate, and eventually falling into the lower part of the casing 6 and running out at outlet 9. The heating elements being heated by the passage of current through wires 24, and the heat so generated being communicated to the plates 10, the water flowing over the plates becomes heated, so that it issues from the outlet 9 as hot water, the apparatus heating the water as it passes through the same in a continuous stream. The air in the chamber being in contact with each electric heating element takes up the heat therefrom and communicates heat directly to the water flowing over the exposed upper face of each inclined plate 10, so that it is not necessary for the heat to pass through a solid body in being communicated from the air to the water and the apparatus is thereby rendered extremely efficient and of large capacity. The water is also heated by direct radiation from the overlying heating element. A portion of the heat is directly communicated from the electric heater through the intervening air to the plate 10 next above said heater, and such portion of the heat is conducted through the plate and taken up by the water, but a large portion of the heat is directly communicated to the water through the air in direct contact with the water as above stated. Another important advantage of the invention is that as the water is freely exposed at all times to the air in the chamber, instead of being confined in pipes, there is no possibility of generation of excessive pressure by heating of the water and the risk of explosion is thereby done away with.

What I claim is:

1. A water heater comprising a series of plates arranged one above another, each plate being provided with means at each side for retaining water on the plate, said plates forming open topped water receivers, and alternate plates being inclined in reverse directions to cause the water to flow from each plate to the next plate, and electrical heating elements interposed between the plates.

2. An electric water heater comprising a chamber, electric heating means for heating the air in said chamber, water supply means and a plate supported in inclined position in said chamber to receive water from said water supply means and to expose it to the heated air in said chamber, while running over said plate.

3. A water heater comprising a case, a series of plates arranged in said case, one above another, means for supplying water to the top plate, alternate plates being inclined in opposite directions to cause the water to descend by gravity on said plates and from each plate to the next lower plate, means for withdrawing water from the lower part of said case, and electrical heating elements interposed between said plates, said plates being corrugated longitudinally and provided with raised flanges at each side and at the upper end.

4. An electric water heater, comprising a chamber, an electric heating element in said chamber for heating the air therein, a plate supported in inclined position in said chamber and having its upper face exposed in said chamber, means for supplying water at the upper end of said plate to cause the water to run by gravity over said exposed upper surface of said plate and to be heated by direct contact with the air in the cham-

ber and by contact with the plate, said plate being above said electric heating element to receive heat directly therefrom.

5. A water heater comprising a case, a series of water conveying devices arranged in said case, one above another, said water conveying devices being reversely inclined, each water conveying device discharging at its lower end onto the upper portion of the next lower water conveying device, means in said case for supporting said water conveying devices, said supporting means being provided with grooves and with electrical contacts and electrical heating elements removably seated in said grooves and provided with contacts engaging the contacts on the supporting devices to establish circuit connection to the heating elements.

6. An electric water heater, comprising a chamber, a plate supported in said chamber, and having its upper face exposed in said chamber, means for supplying water to the upper face of said plate, to cause the water to run by gravity over said exposed upper surface of said plate, and an electric heating element in said chamber directly above said plate for heating the water running on said plate by direct radiation from said heating element.

In testimony whereof, I have hereunto set my hand at Colton, California this seventh day of October, 1911.

ROY RALEIGH FOSTER

In presence of—
P. D. BAILEY,
C. W. CURTIS.