G. & L. FULLER.

APPARATUS FOR ELECTRICALLY HEATING RUNNING WATER.

APPLICATION FILED JUNE 3, 1909.

957,667. Patented May 10, 1910.

4 SHEETS—SHEET 1.

FIG. 1.

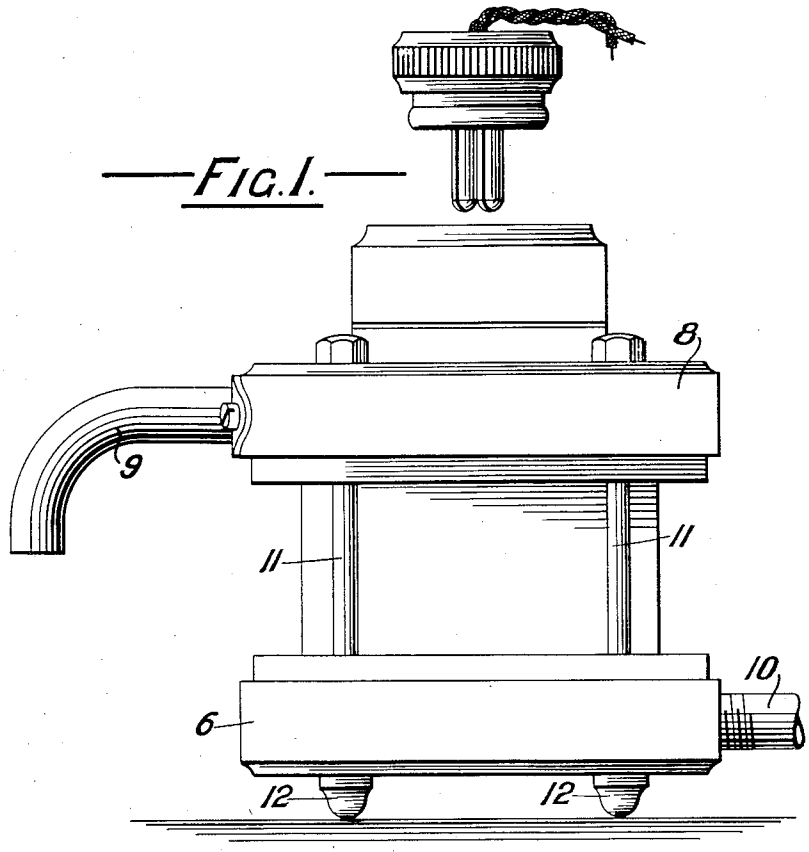
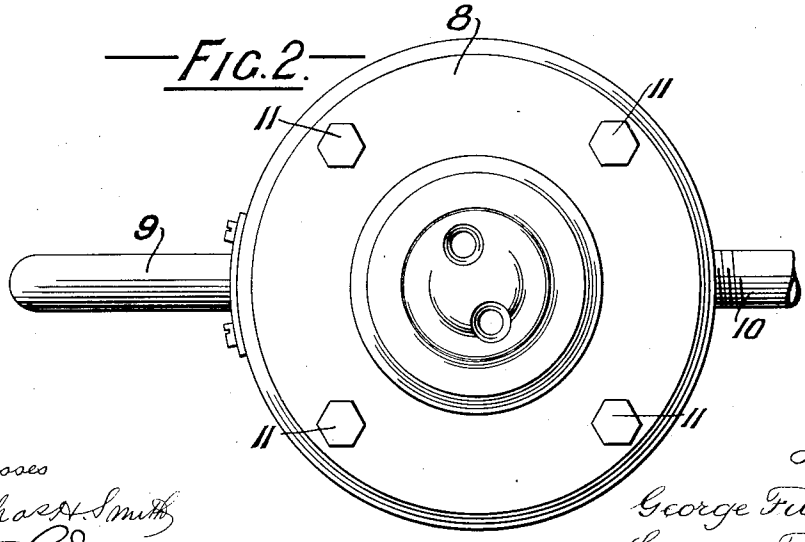


FIG. 2.



Witnesses

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4 SHEETS—SHEET 2.

FIG. 3.

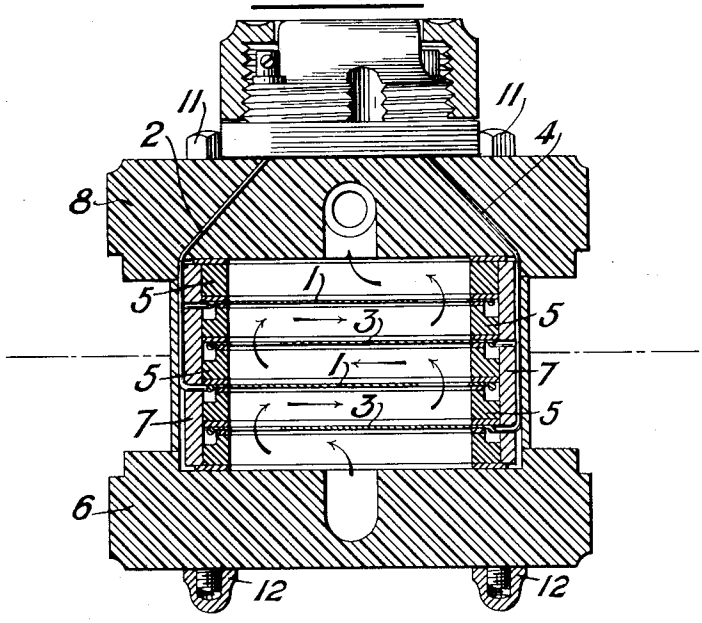
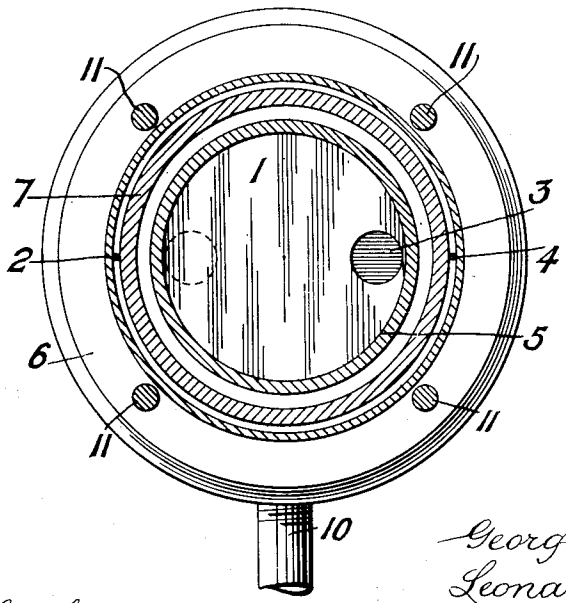


FIG. 4.



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4 SHEETS—SHEET 3.

FIG. 5.

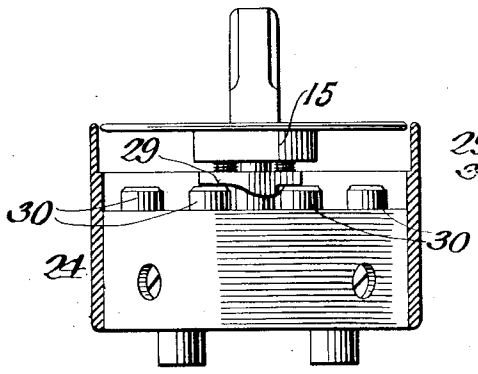


FIG. 7.

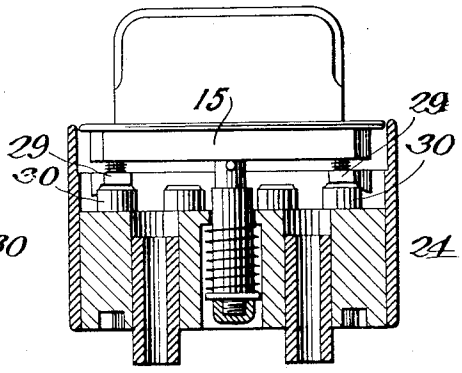


FIG. 6.

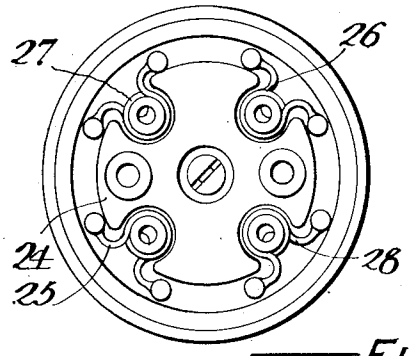


FIG. 8.

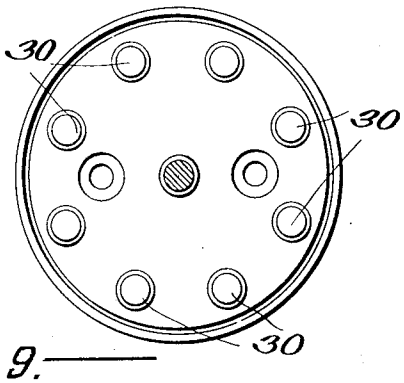
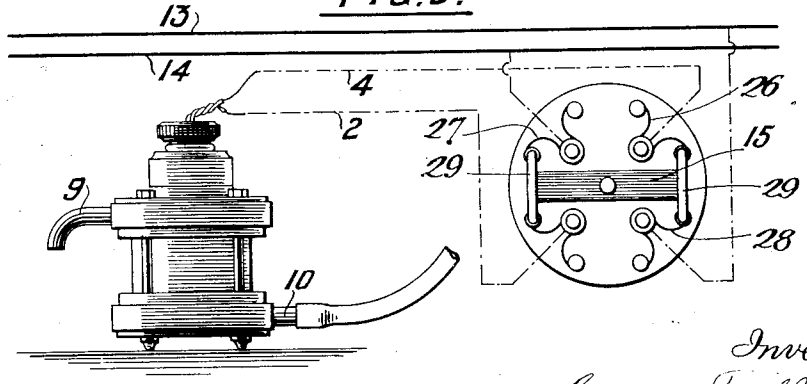


FIG. 9.



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4 SHEETS—SHEET 4.

FIG. 10.

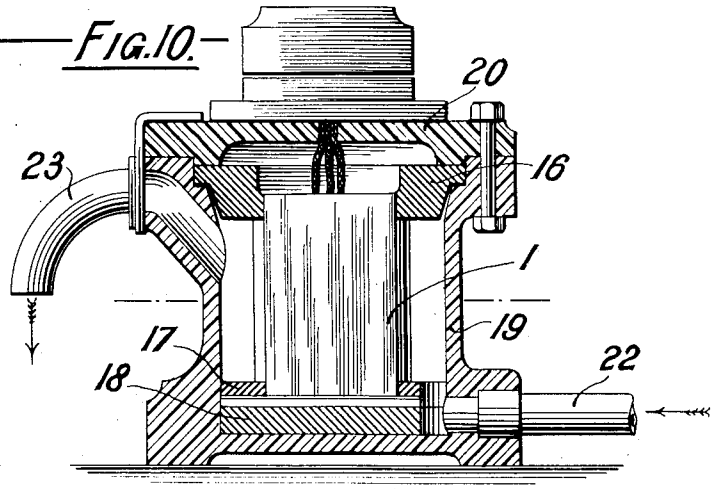


FIG. 11.

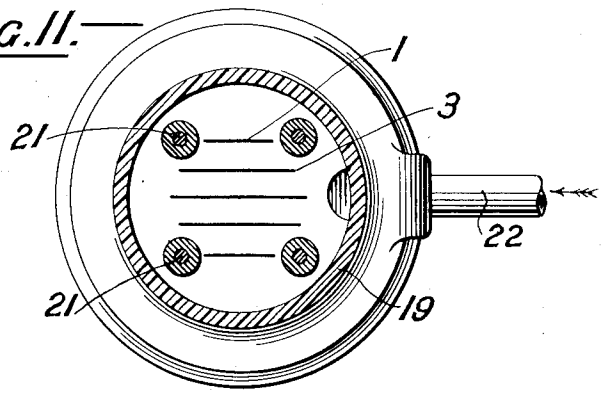
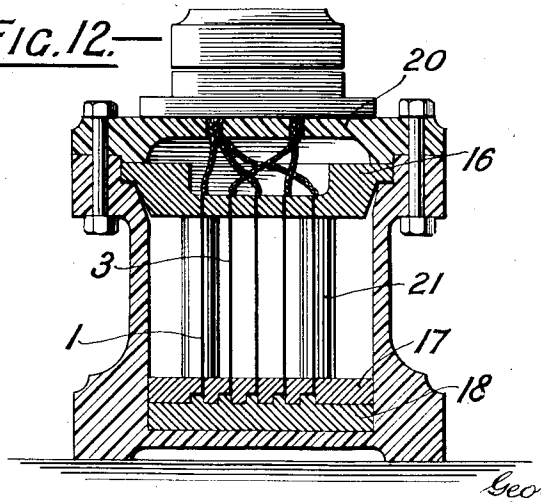


FIG. 12.



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UNITED STATES PATENT OFFICE.

GEORGE FULLER AND LEONARD FULLER, OF BOW, LONDON, ENGLAND.

APPARATUS FOR ELECTRICALLY HEATING RUNNING WATER.

957,667. Specification of Letters Patent. **Patented May 10, 1910.**

Application filed June 3, 1909. Serial No. 500,009.

To all whom it may concern:

Be it known that we, GEORGE FULLER and LEONARD FULLER, subjects of the King of Great Britain, residing at Bow, in the county of London, England, have invented a certain new and useful Improved Apparatus for Electrically Heating Running Water, and of which the following is a specification.

This invention relates to improvements in the construction of electrical heating apparatus for liquids of that type in which electrodes are employed formed of platinum plates, alternately connected to positive and negative poles of a source of electricity and arranged parallel with and at a distance apart for the passage between the plates of the liquid to be heated.

Obviously owing to commercial considerations platinum plates of any substantial thickness cannot in known constructions of apparatus be employed, because although it has been suggested that plates forming electrodes, generally of copper, could be slid into grooves in oppositely located racks which may be of insulated material, yet in such cases the plates must be of a substance substantially self-supporting, although by such frames the edges may be stiffened, yet flexure of the plate, if not sufficiently self-supporting, would draw it away from its grooves.

Now the object of the present invention is to provide an improved construction whereby platinum electrodes can be used, composed of extremely thin sheets of platinum or platinum foil; and to this end we provide edge clamps comprising frames which grip the edges of the plates between them, and hold the same at a distance apart, whereby platinum sheets can be used which have not sufficient substance to support themselves, and the invention consequently consists in the construction and combination of the parts as now described and claimed.

The invention is described with reference to the examples of construction shown on the drawings.

Figure 1 is a side elevation of an example of apparatus constructed for the purpose of heating running water, and Fig. 2 is a plan view of the same apparatus. Fig. 3 shows the heating apparatus in vertical section, and Fig. 4 is a horizontal sectional view of the same. Fig. 5 is a sectional elevation of a switch employed with the heating apparatus for the purpose of switching on and switching off the supply of electric current, and Fig. 6 is a plan view of the terminals of the switch, while Figs. 7 and 8 show respectively sectional elevation and plan of the reversing switch. Fig. 9 shows a diagrammatic view of the switch and heater combined. Figs. 10, 11 and 12 show a modified construction where the thin platinum electrodes are suspended in vertical planes, Fig. 10 being a longitudinal vertical section, Fig. 11 a horizontal section, and Fig. 12 also a vertical section taken at right angles to the views shown at Figs. 10 and 11.

In the construction illustrated at Figs. 1 to 4 the electrodes 1 and 3 are composed of platinum foil sheets, and those sheets indicated at 1 are connected to one pole of an electric circuit by means of the conductor 2, while those sheets of platinum foil indicated at 3 are connected to the other pole of the electric circuit by means of a conductor 4. In the construction now being dealt with, the sheets of platinum foil 1 and 3 are of disk form arranged parallel to each other in horizontal planes, and they are separated and held by distance rings of non-conducting material 5, and the disks and rings are built up into a pile, there being a sufficient number of disks to suit the current to be employed and to allow the water to be thoroughly heated during its passage through the apparatus.

6 is a base-plate within a recess in which the insulating rings and disks making up a pile are made to stand, and 7 is a cylinder of insulating material for inclosing the insulating rings and making a water-tight joint between its opposite ends and the base 6 and head 8 of the apparatus which is also provided with a circular recess for receiving the said cylinder 7 and the non-conducting rings and disks. The head 8 and base 6 are held together by connecting bolts 11, the nuts 12 of which form feet on which the apparatus stands. The head 8 carries a connecting socket for receiving the plug of an electric light or electric heating circuit, by means of which the two terminals of an electric current may be brought into contact with the connections of the conductors 2 and 4. The said head 8 also contains a passage which communicates with a spout 9 (seen in Fig. 1), and the base portion 6 also contains a passage which communicates with the inlet pipe 10.

The disks 1 and 3 are formed with perfo-

rations to enable the water to pass through the apparatus from the pipe 10 to the spout 9, and these apertures are preferably arranged in the disks out of direct line, so as to cause the water in its passage through the apparatus to take as circuitous a course as possible. By this construction water can be readily heated by passing an electric current to the disks by way of the electrical conductors 2 and 4, because in order to complete the circuit the current has to pass betweeen the disks 1 and 3, and in doing so it heats the water in such a manner that the water which comes in through the base of the apparatus follows the circuitous course between the disks and thus becomes gradually heated, until when it leaves the spout of the apparatus it is at a high temperature. The quantity of heat imparted to the water can be regulated by altering the speed of flow of water through the apparatus.

Although in the drawings Figs. 1 to 4 the thin sheets of platinum forming the electrodes are circular in plan view and therefore have been spoken of as being disks, yet it will be understood that obviously they might equally well be of other shape in plan.

In order to prevent deposits taking place upon the conducting plates 1 and 3, or some of them, and so causing the efficiency of the apparatus to deteriorate, we provide means whereby the direction of the current of electricity is changed on each occasion when the apparatus is employed. Thus the negative plates become the positive plates, while the positive plates are changed to the negative plates. This reversing of the current has the effect of throwing off any deposit from the plates which may have accumulated during the previous use of the apparatus.

A suitable reversing pole switch 24 for use with this apparatus is illustrated in Figs. 5 to 9 in which the conductors 2 and 4 are connected respectively with two of the terminals 25 and 26 of the switch, while the source of electricity carried by the conductors 13, 14 is connected to the other two terminals 27 and 28 of the switch. Each terminal has two contact studs 30 which are arranged in a circular manner about the center of the switch, and which are suitable for engaging with rubbing contacts 29 on a switch bar 15 which is mounted so as to be capable of turning in one direction, thus causing the ends of the switch bar 15 to remain seated at each of its ends on two of the contact studs 30.

When the switch bar 15 is in the position illustrated at Fig. 9, it will be seen that the conductor 14 is made to communicate with the conductor 2, while the conductor 13 is made to communicate with the conductor 4. If the switch bar 15 is given one eighth of a revolution, then the current is cut off, because the running contacts 29 of the switch rest only on the terminals of the conductors 13 and 14, but on giving a still further one eighth of a turn movement to the switch bar 15, the conductor 13 is made to communicate with the conductor 2, and the conductor 14 is made to communicate with the conductor 4, thus reversing the direction of the flow of current in the conductors 2 and 4, and consequently reversing the direction of flow between the plates 1, 1 and 3, 3.

At Figs. 10 to 12 the thin sheet platinum electrodes are shown of other than disk form, and are there arranged parallel to each other but in vertical planes, and their edges—or more properly speaking the upper and lower edges—are held in slots in upper and lower plates within the chamber instead of between rings. Thus in the construction shown in these figures, the upper edges of the sheets 1 and 3 are passed through slots in an inner and upper cover-plate 16, while the lower edges of the electrodes are passed through slits or slots in a lower inner plate 17. The upper edges of the electrode sheets are retained in the slots by soldering or by affixing a wire to the said edges after they have passed through the slots, and the lower edges of the sheets, after passing through the slots of the plate 17, are bent into grooves in the under-face of the said plate 17, and a locking plate 18 having ribs is provided, which ribs enter the said grooves and lock the lower edges of the platinum foil electrodes. These two plates 16 and the compound plates 17, 18 are fitted, in the construction now shown, into a box 19 of porcelain or earthenware, or a box of other non-conducting material, the plates 16, 17 and 18 being also of non-conducting material, and a cover plate 20 is fixed to the box 19.

The plates 16 and the compound plates 17 and 18 are held the requisite distance apart by pillars 21 as shown at Fig. 11, so that these parts 16, 17 and 18 along with the electrodes which they carry, can be easily lifted out of the box 19 after the removal of the cover-plate 20.

The box is provided with an inlet pipe 22 and an outlet pipe 23, and the electrical connections are made substantially as has been shown with reference to Figs. 1 to 3, and the water or liquid to be heated passes between the platinum electrodes as before described.

It is obvious that circulating water can be heated in the same manner as running water in the apparatus described.

What we claim as our invention and desire to secure by patent is:—

1. In apparatus for electrically heating water; the combination with a casing having an inlet and an outlet passage oppositely located for the passage of liquid to be

heated; of a plurality of extremely thin platinum plates, edge clamps comprising frames, located in the said casing to grip the edges of the said plates between them and hold same at a distance apart the form of such plates and the manner in which they are mounted being such as to permit said liquid to pass from the said inlet passage between said plates to said outlet passage, means for supporting said frames in said casing, a negative electric terminal, an electric conductor extending from alternate platinum plates to said negative terminal, a positive electric terminal, and an electric conductor extending from the remaining platinum plates to said positive terminal.

2. In apparatus for electrically heating water, the combination with a casing having an inlet and an outlet passage oppositely located for the passage of the liquid to be heated, of a plurality of horizontally arranged superposed extremely thin platinum plates each having a through aperture to permit of the passage of the liquid between and through said plates from said inlet to said outlet, edge clamps comprising frames, located in the said casing to grip the edges of the said plates between them and hold same at a distance apart, a negative electric terminal, an electric conductor extending from alternate platinum plates to said negative terminal, a positive electric terminal, and an electric conductor extending from the remaining platinum plates to said positive terminal, substantially as set forth.

3. In apparatus for electrically heating water, the combination with a casing having an inlet and an outlet passage oppositely located for the passage of the liquid to be heated, of a plurality of horizontally arranged superposed extremely thin platinum plates each alternate plate having a through aperture adjacent to one side of the interior of the casing and the remaining plates having an aperture adjacent to the opposite side of the casing to permit of the circuitous passage of liquid through and between the said plates from said inlet to said outlet, edge clamps comprising frames horizontally arranged in said casing to clamp said platinum plates at their edges, a negative electric terminal, an electric conductor extending from alternate platinum plates to said negative terminal, a positive electric terminal, and an electric conductor extending from the remaining platinum plates to said positive terminal, substantially as set forth.

4. In apparatus for electrically heating water, the combination with a plurality of horizontally arranged superposed extremely thin platinum plates each having a through aperture for the passage of liquid, a series of superposed horizontally arranged edge clamps comprising frames between the adjacent surfaces of which the edges of said platinum plates are located and clamped, of an open-ended casing into which said frames and said plates are placed, a closure plate for one end of said casing having an inlet passage formed therein communicating with the interior of said casing for the inlet of liquid, an end closure plate for the opposite end of said casing having a passage for the outlet of the liquid from said casing, means for clamping the end closure plates to the ends of said casing to form a water-tight joint and to press said frames gripping said platinum plates together, a negative electric terminal, an electric conductor extending from alternate platinum plates to said negative terminal, a positive electric terminal, and an electric conductor extending from the remaining platinum plates to said positive terminal, substantially as set forth.

In witness whereof we have hereunto set our hands in the presence of two witnesses.

GEORGE FULLER.
LEONARD FULLER.

Witnesses:
WILLIAM A. MARSHALL,
THOMAS W. ROGERS.