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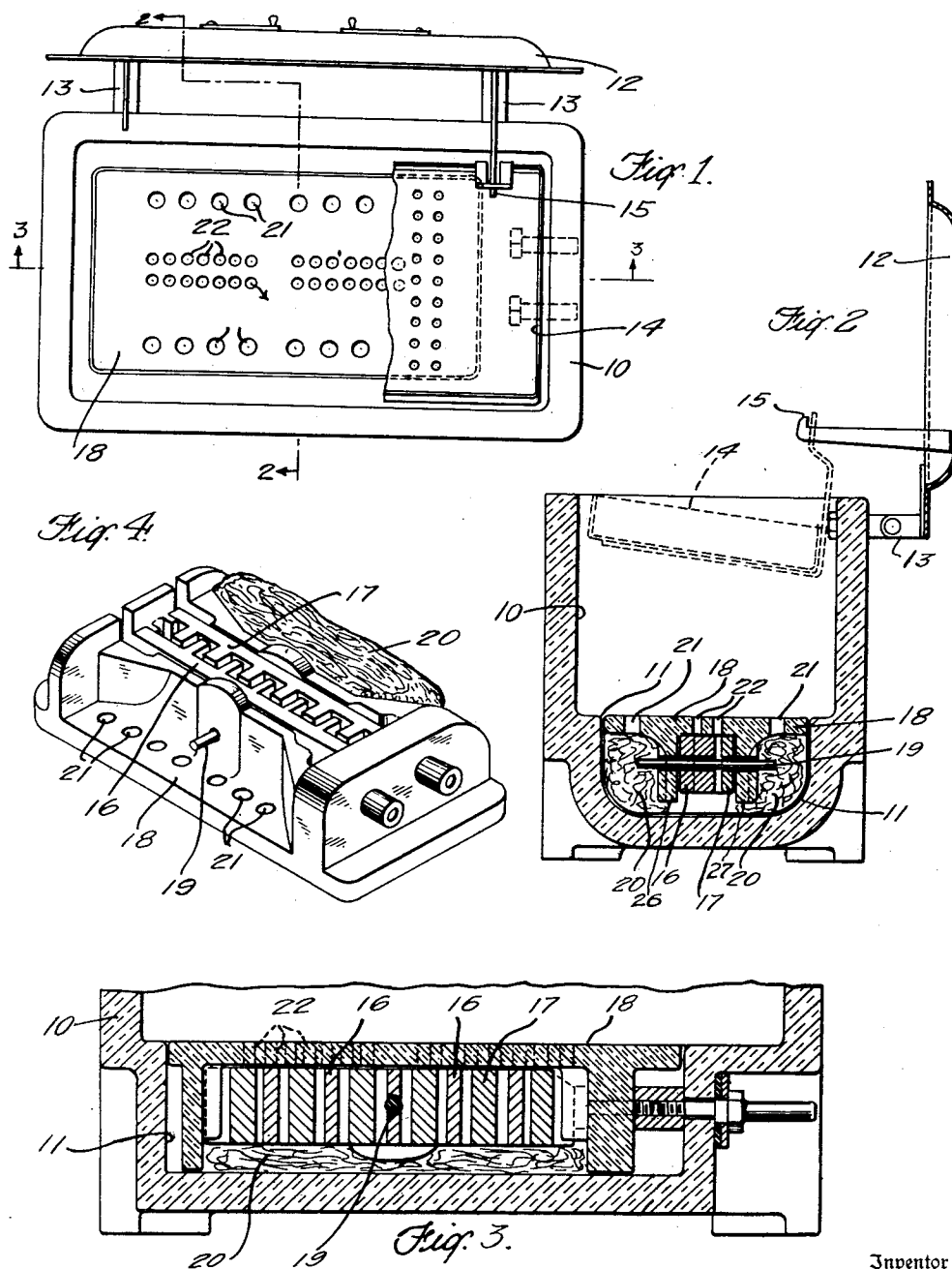
G. HETTINGER

2,230,245

HEATER

Filed Feb. 15, 1938

2 Sheets-Sheet 1



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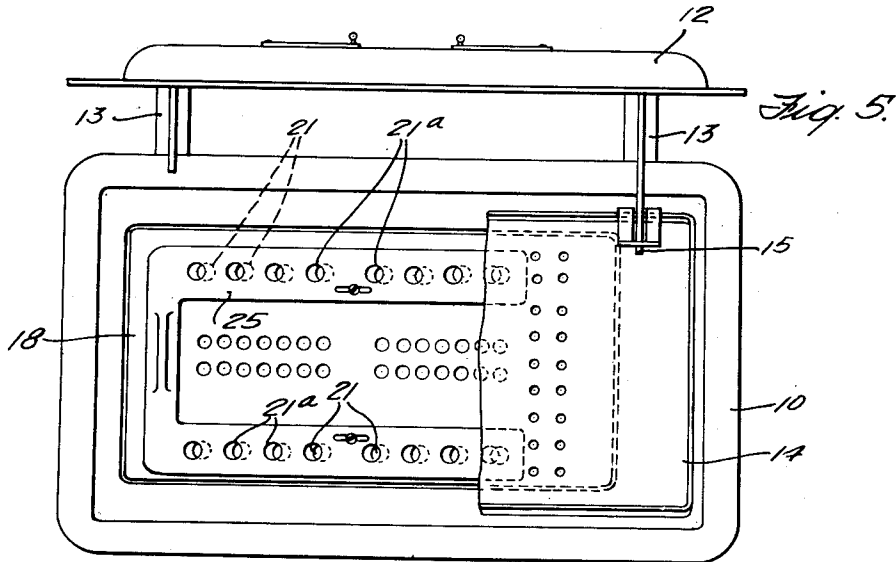
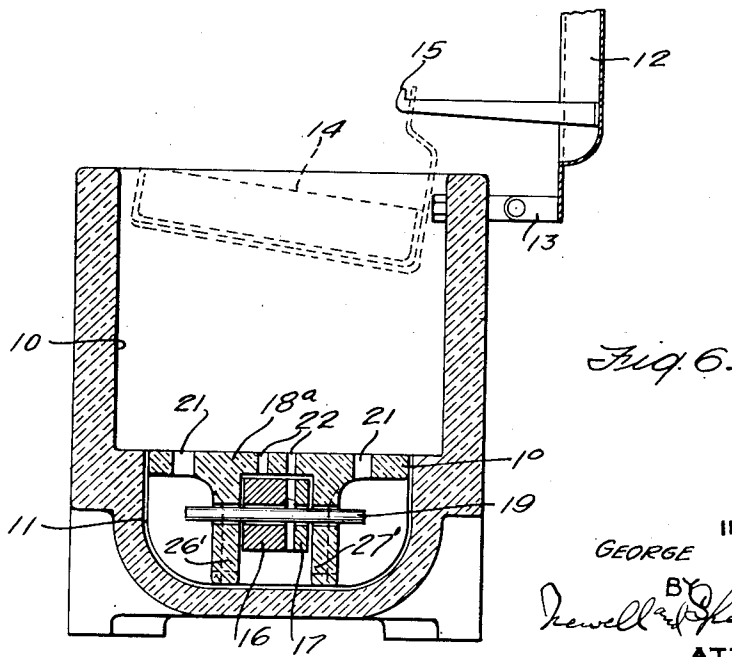
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HEATER

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2 Sheets-Sheet 2



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## UNITED STATES PATENT OFFICE

2,230,245

HEATER

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Application February 15, 1938, Serial No. 190,646

5 Claims. (Cl. 219-40)

This invention relates to a heating or vaporizing device and more particularly to such a device of the electrolytic type, i. e., in which the liquid is heated directly by passage of an alternating current therethrough.

Liquid heating and boiling devices of the electrolytic type have come into common use prior to my invention and it has been recognized that one of the advantages of such devices is that after the liquid has boiled away the circuit is broken between the electrodes and no further current and consequently no further heating occurs.

With this type of heater, however, as with all others, it has ordinarily been necessary to tolerate a substantial delay during which the liquid is being heated to its vaporizing temperature or to provide for a greater current loading than is necessary to maintain the desired vaporization after such temperature has been attained. When the heater is thus overloaded the undesirable result may occur of disintegration of the electrodes resulting in a certain amount of scum or fine black deposit which is particularly objectionable where the device is used as a sterilizer in which instruments or other articles are immersed in boiling water.

Accordingly, one object of the present invention is to provide an automatic control by which the electrodes and circuits may be designed to carry a relatively heavy current loading during the initial heating-up period, but which when the desired vaporizing or boiling temperature is attained will automatically reduce the current loading to one which is just sufficient to maintain the desired temperature or rate of vaporization.

Another object of the invention is to avoid the production of scum or deposit in the boiling liquid and to keep the liquid clean throughout the operation of the device. With these and other objects in view my invention contemplates the control of the rate of flow from the body of the liquid through the space between the electrodes of an electrolytic heater whereby the flow is restricted to less than the vaporizing capacity of the electrodes after the liquid is heated to the boiling temperature.

In the accompanying drawings I have shown a preferred embodiment of my invention and a number of modifications thereof. These are not intended to be exhaustive nor limiting of the invention, but on the contrary are given with a view to explaining fully the invention and the principles thereof and the best manner of em-

bodimenting it in practical use so that others may be fully instructed and enabled to practice the invention in various ways and with numerous modifications each as may be best adapted to the conditions of any particular use.

In these drawings:

Fig. 1 is a top plan view of a sterilizer which may embody my invention;

Fig. 2 is a sectional view taken on line 2-2 of Fig. 1;

Fig. 3 is a fragmentary sectional view taken on line 3-3 of Fig. 1;

Fig. 4 is a perspective view of the electrodes, the guard in which they are mounted and the flow control devices shown in inverted position;

Fig. 5 is a plan view of another device for regulating the flow of liquid according to my invention; and

Fig. 6 is a view similar to Fig. 2, but showing a modified embodiment of my invention.

Referring first to Figs. 1 to 4 inclusive, I have there shown an immersion type sterilizer which comprises a receptacle 10 for the liquid in which the articles to be sterilized are immersed and having a smaller receptacle 11 at its bottom in which the electrodes and flow control members are received.

At the top of the receptacle a cover 12 is mounted on hinges 13 and a tray 14 for carrying the articles to be sterilized is supported by the hook 15 from the cover 12 so that, as shown in Figs. 1 and 2, when the cover is thrown back the tray is lifted out of the liquid and into a position from which its contained articles can be easily removed.

The electrodes 16 and 17, as most clearly shown in Fig. 4, are, in the preferred embodiment, composed of graphite or carbon with interfitting fingers so as to give a relatively large carrier of electrode surface relatively closely spaced one from the other. It is within this space that most of the heat and vaporization of the liquid occurs. These electrodes 16 and 17 are mounted in a porcelain or other insulating member 18 which, as shown, forms a perforated cover for the electrode receptacle 11. The electrodes are held in place by the pin 19 of insulating material, e. g., Bakelite rod, extending, as clearly shown in Fig. 2, through the porcelain member and the carbon electrodes.

In the preferred form, as shown, the spaces between the sides of the receptacle 11 and the opposite sides 26, 27 of the guard member 18 are filled with a filter mass 20 which serves both to clean out from the circulating water any sus-

pendent particles which otherwise might collect as scum on the articles being sterilized or might interfere with the proper electrolytic action between the electrodes; and more especially, according to the present invention, this filter mass serves to limit the flow of liquid through the space between the electrodes.

The holes 21 and 22 should, of course, be sufficiently large to handle the desired inflow of water and the desired outflow of hot water or steam. In the example shown these holes may be larger than necessary to carry this desired flow and the filter masses 20 are then relied upon entirely to control the rate of flow. It is desirable, however, that the size of these openings should be such as substantially to limit the flow to that which is desired in operation so that, even if the filter mass should become disintegrated or should be removed, the control operation would continue. The openings and the filter mass should preferably be designed to allow a water flow a little more than enough to assure maintenance of a boiling temperature in the sterilizer after it has been brought to boiling.

In the use of this device the receptacles are first filled with water, e. g., as shown in Fig. 2, to a level below that at which the tray 14 rests when the cover is open and above that to which the tray is lowered when the cover is closed. This filling of the receptacle obviously will fill also the space between the electrodes 16 and 17 and will cause them to be completely submerged in the liquid. Under this condition a maximum electrolytic current will flow between them, and the liquid will be rapidly heated to boiling. During this operation, of course, there will be a thermosyphon circulation allowing heated water to pass up through the openings 22 and additional cold water to flow in through the openings 21 and the filter masses 20. Before long, however, the water will be heated sufficiently so that in its passage from the filter mass 20 up through the space between the electrodes 16 and 17 it will be boiled, and when this occurs steam instead of water will pass off through the openings 22. So long as the rate of vaporization remains below the rate of flow permitted by the openings and the filter masses the electrodes will remain submerged and the full electrolytic current will pass between them. As soon, however, as the body of water within the receptacle 10 becomes sufficiently hot so that it is near its boiling point as it enters through the filter masses and into the space between the electrodes, the rate of boiling will begin to increase beyond the rate of flow; and this will result in a depression of the water level in the space between the electrodes, and consequently, a reduction in the electrolytic current which passes between them. Eventually this will reach an equilibrium position at which the rate of flow of the water is exactly equal to the rate of vaporization due to the flow of electrolytic current between the electrodes. Thus, an automatic regulation is secured and a heavy current loading permitted at the outset for heating up the water with a reduced current for maintaining high temperature of the water while the sterilizer is in use.

Although the use of the filter masses 20 is desirable, as already explained above, it will be found that one advantage of my invention is that, even without such filter masses, the scum resulting from disintegration of the electrodes will be greatly reduced or even completely elim-

inated, since the automatic regulation permits the use of much larger electrodes with wider spacing, under which condition less disintegration of the electrodes occurs.

In the operation as just described above, the smaller central openings 22 were designed to permit the heated water and any steam which might be formed to flow freely upwardly into the receptacle 10. It will be understood, however, that the control of flow may be by means of these openings. In such case the openings are designed to carry only the maximum amount of steam desired in normal operation. As soon as the vaporization between the electrodes exceeds this amount steam collects beneath the porcelain 18 and drives down the water level between and around the electrodes. The openings 21 and the filter masses 20 may then be designed to allow a greater flow. This arrangement has the advantage that, due to the larger volume of steam as compared with the water from which it is formed the holes may be designed to pass a larger volume of water as a liquid than as steam and thus to permit a more rapid heating up of the entire body of water to the boiling point, with a lower final rate of vaporization.

It is important also that the filter mass 20 is separated from the electrodes so that there is no danger of its becoming charred or damaged by the passage of current therethrough, and so that there is no danger of the deposit of disintegrated electrode material upon the filter mass acting to short-circuit the electrode.

It will be understood that the sterilizer shown in the drawings may be constructed of various materials, as for example, ceramic materials, such as porcelain, already mentioned, infusible molded resinous compositions such as Bakelite, or even metal, provided that suitable insulation is provided to protect the user against shock. Although I have described the electrodes as being made of graphite and I have found this material to be entirely suitable, other materials may also be used especially corrosion-resisting metals.

Moreover, although I have shown in the figures just described a sterilizer adapted for immersion sterilization, i. e., requiring a substantial body of water in the receptacle 10, my invention is particularly applicable also to vapor sterilizers or vapor heaters, in which only a small body of water is maintained and the heating is affected by a continual vaporization of liquid from this body. Obviously, the sterilizer shown could be used in this way merely by filling with the liquid only the smaller receptacle 11 or to only a small height above the guard 18.

In Fig. 5, I have shown a modified form of the invention in which the regulation of the flow is obtained by the holes 21a which, in this case, are made adjustable. A plate 25 is secured above the guard 18 and is provided with holes 21a registering with the holes 21 of the guard 18. This plate 25 has limited longitudinal movement so that the holes 21 and 21a can be made to register or can be moved so as to be at least partially out of register. In this way the effective openings of the holes can be varied, and consequently, the rate of flow through the electrodes can be thus controlled.

In Fig. 6, the partitions 26' and 27' of the guard 18a serve to control the rate of flow of the liquid between the electrodes. In this case the partition members are so closely spaced from the bottom of the receptacle 11 as thus to restrict

the liquid flow therebeneath to that required for the necessary vaporization.

This application is a continuation in part of my prior copending application, now Patent No. 2,158,698, dated May 16, 1939.

What I claim is:

1. In an immersion sterilizer having a liquid container, a heating unit of the exposed electrode type adapted to rest on the bottom portion of the container, comprising a top portion of insulating material having a plurality of spaced apertures therethrough and forming a false bottom for the container, a plurality of strip-like spaced conductors secured under the said top portion and having complementary projections on the inner surfaces of each with their vertical faces so closely spaced as to restrict the flow of liquid therebetween to less than the vaporizing capacity of the electrodes, and a filter mass in the path of the circulating liquid adapted to filter out foreign particles from the liquid and to further limit the circulation, whereby the rate of vaporization after the liquid is heated to its boiling point depends in part upon said spacing.
2. In an immersion sterilizer, the combination with a porcelain box or container adapted to contain water, of a pair of spaced carbon elements of rectangular cross section near but spaced from the bottom of said box and extending substantially the length of the box, a porcelain support for said elements, to the bottom of which said elements are secured, said support having restricted

apertures therethrough, said elements having complementary projections on the inner surface of each, giving large exposed areas, and absorbent material packed loosely behind said elements, whereby the water is filtered and current consumption reduced.

3. A sterilizer comprising a receptacle for a sterilizing liquid, electrodes in the bottom of said receptacle for passing an alternating current directly through said liquid to heat it to sterilizing temperature, a perforated support fixed in the bottom of the receptacle above the electrodes forming a false bottom and adapted to support articles to be sterilized in the sterilizing liquid, guards extending downwardly from said support on the outside of each electrode, and filter means between the electrode and each guard in the path of liquid circulation for removing from the liquid any material disintegrated from the electrodes.

4. A sterilizer as defined in claim 3 in which the filter means is placed in the path of liquid circulating toward the electrodes and the circulation of liquid from the electrodes is unobstructed by the filter means, and baffle means is provided to direct through the filter means substantially all of the liquid flowing to the electrodes.

5. An immersion sterilizer as claimed in claim 1 having means for varying or adjusting the size of said spaced apertures whereby the rate of boiling may be adjusted by the user.

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