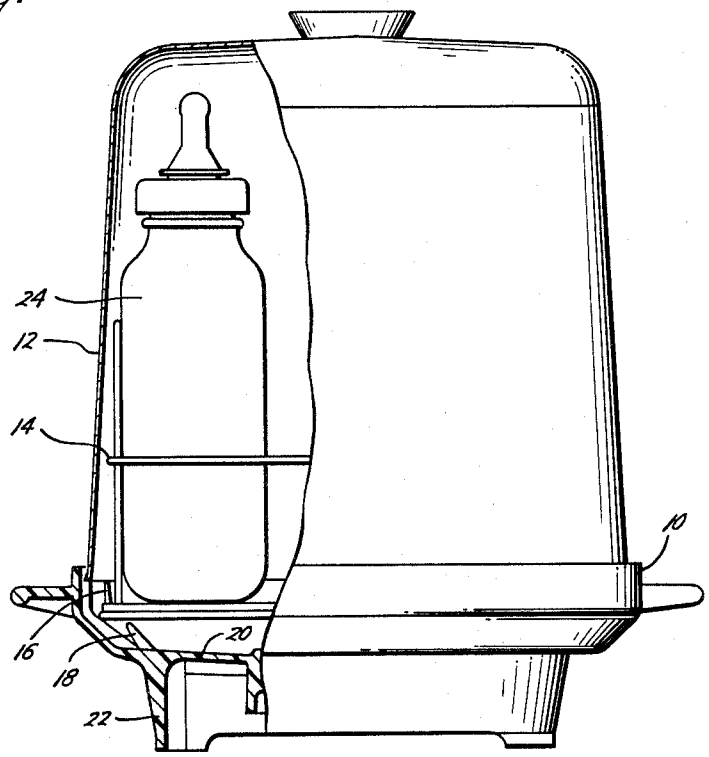
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LIQUID CONDUCTOR HEATING DEVICES

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Fig. 1



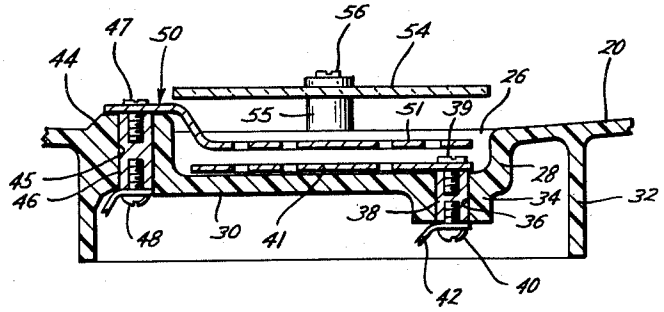




Fig. 2

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Fig. 3

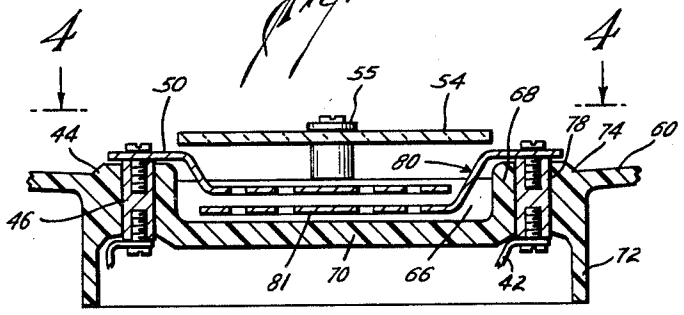
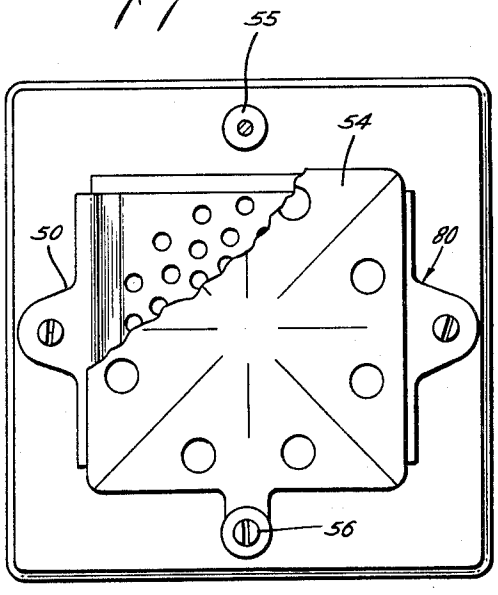



Fig. 4




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3,119,925

# LIQUID CONDUCTOR HEATING DEVICES

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Continuation of application Ser. No. 862,668, Dec. 29, 1959. This application July 3, 1961, Ser. No. 121,583
4 Claims. (Cl. 219—40)

This invention relates to sterilizers, and more particularly it relates to household electrically operated sterilizers such as are used for sterilizing nursing bottles and other feeding equipment for babies. This application is a continuation of copending application Serial No. 862,668, filed December 29, 1959, and now abandoned.

Such sterilizers generally comprise a container having a pair of electrodes in the bottom. Electric current applied to the electrodes causes a current to flow through the water so that it is heated to the boiling point. Usually a relatively small amount of water is put into the sterilizer, and substantially all of this water is boiled away during the sterilizing process. When the water level drops below the top electrode, current ceases to flow, and heating stops.

As the water level is decreased in the sterilizer, the minerals in the water become more and more concentrated, and are deposited on the surface of the container in the lower portion of the container surrounding and adjacent the electrodes. To eliminate the danger of electric shocks to users of these sterilizers, the containers are made of a thermosetting plastic, such as phenolic resin or other dielectric material. The high concentration of minerals on the surface of this plastic under moist, hot conditions, reduces the dielectric strength of the plastic, thereby allowing a flow of current from each electrode terminal post through the plastic or along its surface to the other electrode or to its terminal post, this phenomenon being known as "tracking." In many cases, where there are close clearances between the electrodes and the plastic surfaces, arcing may also occur. This tracking and arcing causes deterioration of the plastic, thereby further reducing its dielectric strength and gradually destroying the bottom of the container.

It is an object of this invention to provide novel sterilizing apparatus.

It is another object to provide apparatus for boiling water by resistance heating having means for preventing tracking and arcing.

Another object is to provide a plastic sterilizer wherein means are provided for substantially decreasing deterioration of the plastic by stray electrical currents.

Still another object is to provide a container in which water may be evaporated by means of spaced electrodes, and wherein arcing and tracking are substantially decreased.

The accomplishment of these and other objects of the invention will become more apparent upon consideration of the following description and the accompanying drawings, wherein

FIGURE 1 is an elevational view, parts being in section, of a sterilizer embodying the invention,

FIGURE 2 is an enlarged sectional view of a portion of the apparatus of FIGURE 1, showing one embodiment of the invention,

FIGURE 3 is a view similar to FIGURE 2 but showing another embodiment of the invention, and

FIGURE 4 is a plan view of the embodiment of FIGURE 3, taken at line 4—4 of FIGURE 3, parts being broken away for clarity.

In FIGURE 1 a plastic container **10** is shown. In the form of the invention depicted, the container is provided with a cover **12**, and a rack **14** which sit on bosses **16** and **18** respectively which are integral with the container. The bottom **20** of the container is sloped toward the center, and has formed on its lower side an annular depending wall **22** which provides a support for the container. A nursing bottle **24** or other utensil or device to be sterilized is supported by rack **14**.



As better seen in FIGURE 2, a well **26** is formed in the center of bottom **20** of the container, the well being formed by a circumferential wall **28** and a well bottom **30**. A depending annular wall **32** surrounding and spaced away from the outer surface of well **26** provides an enclosure for the protection of wiring connections. Well bottom **30** is provided with a boss **34** having an aperture **36** extending therethrough and through the well bottom, the aperture providing a water-tight fit for a terminal post **38** extending from exteriorly of the well to its interior. Terminal post **38** is tapped for retention of bolts **39**, **40**. Bolt **39** retains a lower electrode **41** in electrical contact with terminal post **38**, preferably spaced slightly away from the well bottom **30**. The edges of electrode **41** are also spaced away from wall **28** of the well. Bolt **40** retains a conductor **42** in electrical contact with terminal post **38**.

Another boss **44** is formed in the bottom **20** of container **10** adjacent well **26**, and has an aperture **45** extending therethrough and opening into the interior of container **10** at a level above the surface of its bottom **20**. A terminal post **46** is proportioned for a water-tight fit in aperture **45**, and is tapped for retention of bolts **47**, **48**. Bolt **47** in turn retains and positions an upper electrode **50** in electrical contact with terminal post **46**. The upper electrode is shaped so that a major portion of it, and substantially all the electrode which can be effective in heating the water, is positioned below the top of boss **44**. Thus the main body **51** of the upper electrode is preferably positioned within the well **26**, approximately parallel to lower electrode **41**, and closely adjacent thereto, but spaced away from the wall of well **26**.

A ceramic or plastic insulating disc or cover member **54** is positioned over well **26**, supported on a pair of bosses **55** and retained by bolts **56** (see also FIGURE 4). This cover member serves to protect the electrodes from damage and to prevent utensils being sterilized from falling onto the electrodes.

In FIGURE 3, another embodiment of the invention is shown. In this embodiment, the bottom **60** of the container of a sterilizer has formed in its center a well **66** having a circumferential wall **68** and a well bottom **70**. A depending annular wall **72** surrounding and spaced away from well **66** provides an enclosure for the protection of wiring connections. In this embodiment, a lower electrode **80** is attached to a terminal post **78** sealingly engaged with and extending vertically through a boss **74** which projects above the surface of the bottom **60**. Terminal post **78** also projects through the lower end of boss **74** for connection to a conductor **42**. The lower electrode **80** is shaped similarly as electrode **50** in the embodiment shown in FIGURE 2, in that most of the electrode is positioned below the top of the boss through which its terminal post extends, so that the main body **81** of the electrode is positioned in the well, preferably adjacent the bottom of the well.

In the embodiment shown in FIGURE 3, the upper electrode **50** is positioned and arranged similarly as the corresponding upper electrode in the embodiment of FIGURE 2. Thus it is attached to a terminal post **46** which extends through a boss **44**, projecting upwardly from the boss at a level higher than the main body and active portion of the electrode, which is positioned above, substantially parallel to, and closely adjacent to the main body **81** of bottom electrode **80**. An insulating disc **54**

is positioned above the electrodes on bosses 55 and retained by bolts 56, as in the embodiment of FIGURE 2.

In use, a relatively small amount of ordinary tap water is placed in the sterilizer, usually little more than enough to barely cover the bottom of the container. The sterilizer is then connected to a source of electrical current, such as ordinary 110 volt house current. The flow of this current between the electrodes beneath the water level causes the water to be heated, due to its resistance, to the boiling point. The boiling of the water continues, forming steam to sterilize the nursing bottles or other apparatus in the sterilizer, until the water level drops below the lowest point of the upper electrode, so that the circuit is broken and the heating ceases.

As the water level drops in the container, it eventually drops below the point of attachment of the top electrode to its terminal post and below the exposed portion of the terminal post. As the amount of water in the container decreases, the concentration of the natural minerals in the water increases greatly, so that by the time the water level drops to the top of the well 26 or 66, the minerals begin to be deposited on the surface of the container. This greatly reduces the dielectric strength of the plastic from which the container is made. If both terminals were below the water level at this point, current would flow along the surface of the plastic from one terminal to the other, causing excessive heating and eventual destruction of the plastic. However, in the construction of this invention, this tracking is avoided, since at least one of the terminals is above the water level when the minerals have been highly concentrated. Due to the heat, this terminal and the surrounding plastic are dried quickly, so that current cannot flow through or on the surface of the plastic, even if some minerals are deposited there. The electrodes continue to conduct current through the water remaining in the well, without any tracking, until the water level drops below the level of the portion 51 of the top electrode, so that the circuit is broken and heating ceases.

In the construction shown in FIGURES 3 and 4, both terminals are positioned so that their exposed surfaces are above the active portion of the top electrode, the active portions of the electrodes being those which are closest to each other, where current will flow from one to the other to heat the water. In this construction, the possibility of small currents flowing along the surface of the well bottom 30 from electrode 41 to terminal 38 (FIGURE 2) is avoided. Such currents are minor, since the electricity will prefer to flow through the best conductor, i.e. the electrode, so that the advantages of this invention are attained even where only one terminal is positioned above the level of the electrodes.

The invention has been described herein in terms of its application to sterilizers for nursing bottles, for example, however, it will be apparent to those skilled in the art that it has equal application to other electrical heating devices which utilize a pair of electrodes in water for direct resistance heating of the water. For example, many nursing bottle warmers use this type of heating. In these, a few tablespoons of water are put into the warmer and it is connected to an electrical source. The amount of water used is that which is just sufficient to bring the food in the nursing bottle to the desired temperature when all the water is boiled away and the flow of current interrupted.

Although specific embodiments of the invention are shown and described herein, the invention is not limited to these embodiments, but only as set forth by the following claims.

I claim:

1. A heating device for direct resistance heating of water comprising a container made of a dielectric material, a well in the bottom of said container, a bottom wall in said container sloping downwardly toward said well, a first terminal post extending through the bottom of said well and having an exposed inside surface in said well adapted for connection to an electrode, a first electrode attached to said exposed inside surface and extending adjacent the bottom of the well, a second terminal post extending through the bottom wall of said container and having an exposed inside surface above the bottom of said container adapted for connection to an electrode, and a second electrode attached to said exposed inside surface of said second terminal post, a major portion of said second electrode extending downwardly from the point of attachment to the terminal post, into the well and closely adjacent said first electrode.

2. A heating device as defined by claim 1 wherein substantially all the second electrode is within the well and closely adjacent and spaced away from said first electrode, and is spaced away from the sides of the well.

3. A heating device as defined by claim 1 wherein said well has a substantially flat bottom, said first electrode is a substantially flat plate lying closely adjacent said flat bottom and in a plane substantially parallel thereto, and a major proportion of said second electrode is a substantially flat plate, all portions of which are substantially equidistant from said first electrode.

4. A heating device for direct resistance heating of water comprising a container made of a dielectric thermosetting plastic material, a relatively shallow flat bottom well in the bottom of the container, a bottom wall in said container sloping downwardly toward said well, a first terminal post extending through the bottom of said well and having an exposed inside surface in said well adapted for connection to an electrode, a first electrode attached to said exposed inside surface and extending adjacent but displaced slightly away from the bottom of the well, said first electrode comprising a substantially flat plate lying closely adjacent the flat bottom of the well and in a plane substantially parallel thereto, a second terminal post extending through the bottom wall of said container and having an exposed inside surface above the bottom of said container adapted for connection to an electrode, and a second electrode attached to said exposed inside surface of said second terminal post, a major proportion of said second electrode being a substantially flat plate which is positioned downwardly from the point of attachment to the terminal post, said flat plate portion being entirely within said well and closely adjacent to but spaced slightly away from and substantially parallel to said first electrode, whereby when water is evaporated in said container from an initial level above the point of attachment of the second electrode to a final level below the flat portion of said second electrode, there is no tracking or flow of current along the surface of the well and the container even though one of the exposed terminal inside surfaces is still under water.


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