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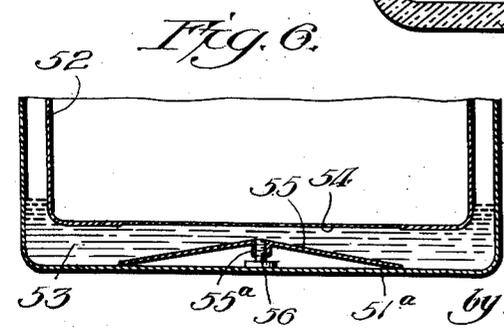
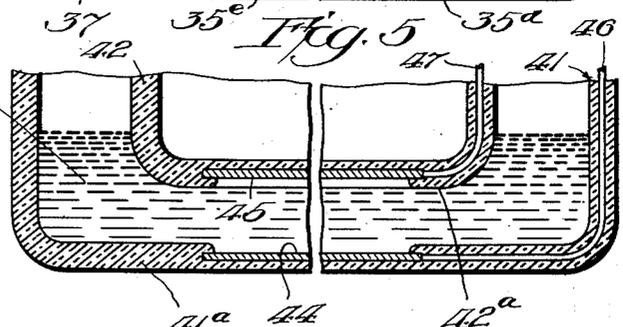
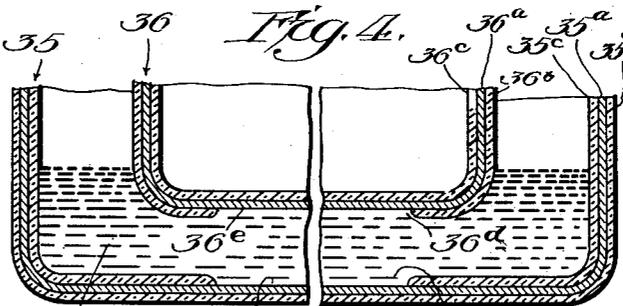
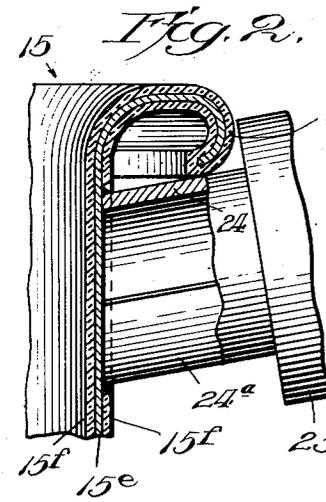
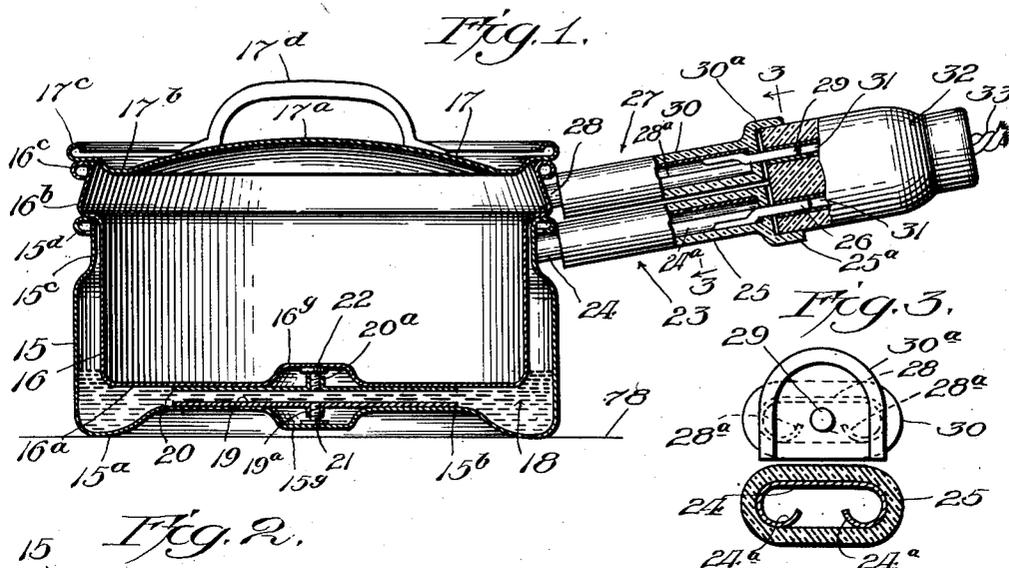
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2,081,537

LIQUID CONDUCTOR HEATER

Filed Feb. 15, 1934

2 Sheets-Sheet 1



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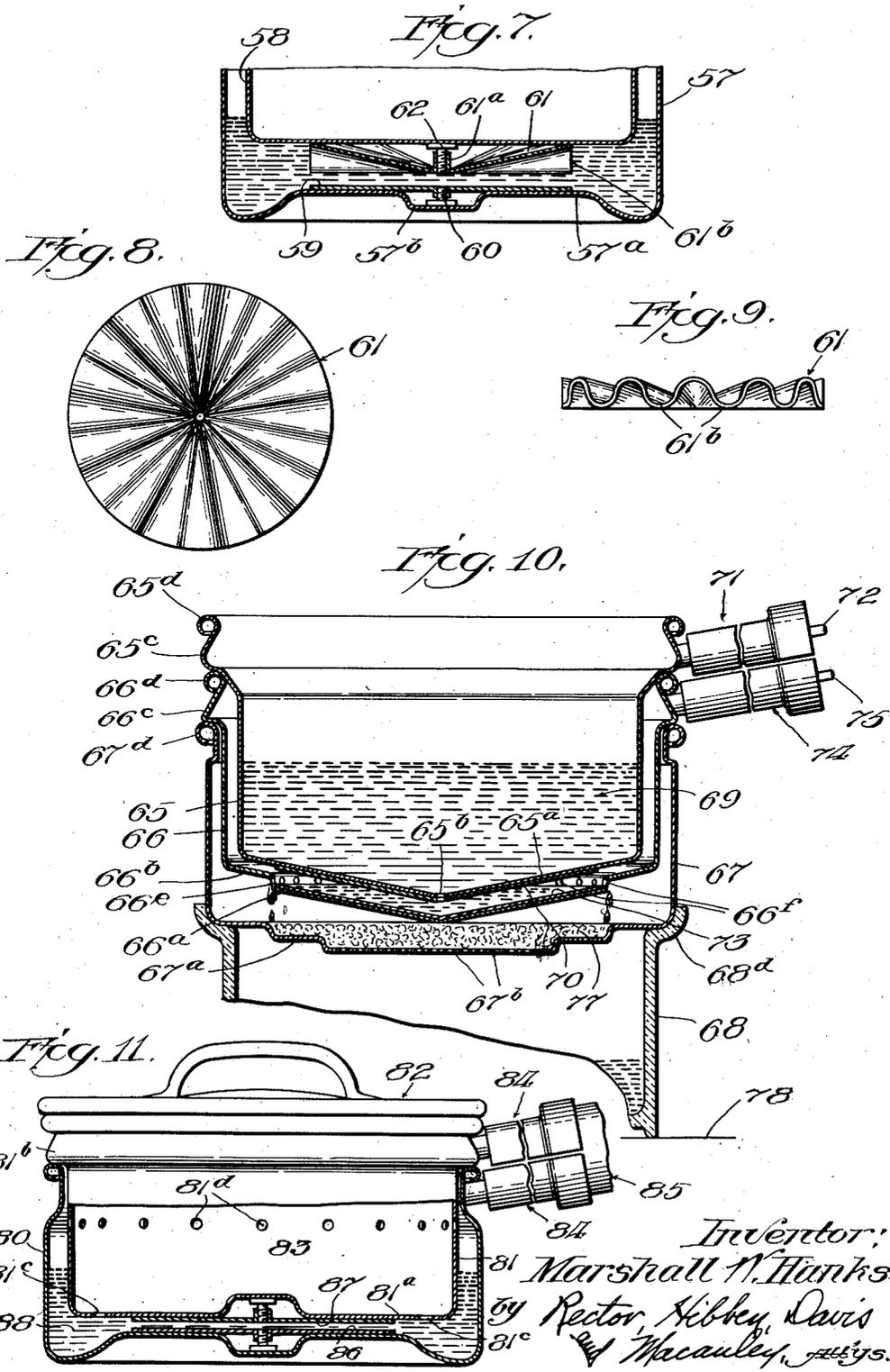
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UNITED STATES PATENT OFFICE

2,081,537

LIQUID CONDUCTOR HEATER

Marshall W. Hanks, Madison, Wis.

Application February 15, 1934, Serial No. 711,317

7 Claims. (Cl. 219—40)

This invention relates to improvements in liquid conductor heaters of the type described in the United States Letters Patent of Marshall W. Hanks and Max Mason No. 1,683,071, dated September 4, 1928, and Marshall W. Hanks No. 1,683,070, dated September 4, 1928, in which a pair of spaced electrodes, connected in an electric circuit, are located in a vessel containing a measured quantity of water or other liquid conductor which is heated by the passage of current between the electrodes with the result that the liquid conductor is eventually evaporated to substantial dryness, thereby giving the apparatus a definite time period of operation. The principal object of the present invention is to provide an improved liquid conductor heater of this type in which a plurality of vessels are nested one within the other with parts of the vessels spaced apart and adapted to form the electrodes between which an electric current passes through a liquid conductor contained in one of the vessels. A further object of the invention is to provide an improved liquid conductor heater comprising a pair of vessels nested one within the other, one of the vessels being adapted to contain material to be heated or cooked and the other vessel being adapted to contain a liquid conductor through which an electric current passes between parts of the vessel which form electrodes connected in an electric circuit. Still another object of the invention is to provide a liquid conductor heater comprising a plurality of metallic vessels nested one within the other and insulated from each other by suitable enamel or the like, portions of adjacent vessels having opposed parts thereof uninsulated or provided with metallic coatings or coverings and adapted to serve as electrodes between which an electric current passes through a liquid conductor contained in one of the vessels when the vessels are connected in an electric circuit. A further object of the invention is to provide a liquid conductor heater comprising a vessel formed of bakelite or other insulating material and having molded therein an electrode adapted to be connected in an electric circuit. Another object of the invention is to provide a liquid conductor heater comprising a pair of vessels nested one within the other and having spaced metallic portions adapted to serve as electrodes between which an electric current passes through a liquid conductor contained in the lower vessel, said vessels being provided with means for connecting them in an electric circuit only when they have the proper nested relation with each

other. Other objects relate to various features of construction and arrangement which will appear more fully hereinafter.

The nature of the invention will be understood from the following specification taken with the accompanying drawings, in which several embodiments are illustrated. In the drawings,

Fig. 1 shows a vertical central section through a liquid conductor heater embodying the features of the present invention and comprising a pair of nested vessels and a cover with electrical connections made to each of the vessels for establishing circuit connections with the spaced bottom portions of the vessels which serve as electrodes;

Fig. 2 shows an enlarged vertical section taken through the upper edge of one of the vessels shown in Fig. 1 and through an adjacent portion of the electrical terminal;

Fig. 3 shows an enlarged detail section taken on the line 3—3 of Fig. 1;

Fig. 4 shows a central vertical section taken through a liquid conductor heater similar to that illustrated in Fig. 1, except that portions of the metallic vessels serve directly as the electrodes between which the current passes through a liquid conductor contained in the lower vessel;

Fig. 5 is a sectional view similar to that of Fig. 4, showing another form of construction in which the nested vessels are formed primarily of insulating material having spaced electrodes embedded in their bottom portions and having also embedded therein electrical conductors adapted to be connected in an electrical circuit;

Fig. 6 is a central vertical section similar to that of Figs. 4 and 5, illustrating still another form of construction in which the lower vessel is provided with a special form of electrode which may be desirable when the apparatus is used with certain liquid conductors;

Fig. 7 is a vertical section similar to those of Figs. 4, 5, and 6, illustrating still another form of construction of the electrodes carried by the bottom portions of the vessels;

Fig. 8 shows a top plan view of the upper electrode illustrated in Fig. 7;

Fig. 9 shows a partial side elevation of the upper electrode shown in Fig. 7;

Fig. 10 shows a central vertical section through another form of apparatus embodying the features of the present invention and adapted particularly for making coffee; and

Fig. 11 is a sectional view similar to that of Fig. 1, showing another modification in which

the principles of the present invention are applied to a sterilizer.

The form of the invention illustrated in Figs. 1, 2, and 3 comprises a pair of vessels 15 and 16, which are nested one within the other, and a cover 17 which rests upon the upper vessel 16. The lower vessel 15 is adapted to rest upon a table or other support 17 and to contain a quantity of water or other liquid conductor 18 through which an electric current is adapted to pass from one vessel to the other when these vessels are connected in an electric circuit. The lower vessel 15 preferably has the central portion of its bottom 15^a concaved upwardly as shown at 15^b and the outer cylindrical wall of this vessel is preferably contracted adjacent its upper edge as shown at 15^c, the extreme upper edge being turned outwardly to form an annular bead 15^d upon which the upper vessel 16 rests. The vessel 16 is provided adjacent its upper part with an outwardly extending annular projection 16^b which forms a shoulder adapted to rest upon the bead 15^d and to space the bottom 16^a of the upper vessel from the bottom 15^a of the lower vessel. The annular projection 16^b is inclined upwardly and inwardly and terminates in an annular bead 16^c which is adapted to form a support for the cover 17. This cover is provided with a dome-shaped central portion 17^a terminating around its edge in an annular depressed portion 17^b, around which there is formed, at a higher elevation, an outwardly projecting annular beaded portion 17^c which rests upon the bead 16^c of the upper vessel. The central portion 17^a of the cover is provided with a handle 17^d.

Both of the vessels 15 and 16 and the cover 17 may be formed of stainless steel or iron or other material adapted to be coated with an insulating enamel or the like and all of these parts are preferably constructed as illustrated in Fig. 2, where the lower vessel 15 is shown as comprising a central metal body 15^e having an insulating coating of enamel 15^f or the like applied to both sides thereof. With this construction, the vessels are electrically insulated from each other so that no current passes between them through the liquid conductor 18 except at those places where the metallic body portions of the vessels may be exposed to serve as electrodes. In the construction illustrated in Fig. 1, the bottom portions of the vessels are preferably provided with separate electrode plates 19 and 20 which are secured to the bottom portions of the vessels 15^a and 16^a, respectively. These plates may be formed of copper, brass, or other material adapted to serve as electrodes without substantial corrosion or disintegration during use and although they may be arranged to contact directly with the metallic portions of the bottom walls of the vessels from which the insulating enamel is absent, the bottoms of the vessels are preferably coated and they are connected thereto by metallic fastening members. The lower electrode 19 has the central portion thereof punched downwardly to form a sleeve 19^a which is internally threaded for engagement with a stud 21 which has its head welded or otherwise secured to the bottom wall of the vessel 15 within a depression 15^g which is formed in the bottom wall. When the electrode 19 is screwed downwardly onto the stud 21, its lower surface contacts with the insulated upper surface of the bottom wall 15^g, and an electrical connection with the metallic vessel is established through the stud. In a similar way, the electrode plate 20 has its central portion punched upward-

ly to form a sleeve 20^a which is internally threaded for engagement with a stud 22 which is welded or otherwise secured to the upwardly projected portion 16^g of the bottom wall of the vessel 16. When the electrode 20 is applied to the stud 22, as shown in Fig. 1, the upper surface of the electrode contacts directly with the enameled surface of the vessel 16 and an electrical connection is established with that vessel through the stud. The metallic portions of the two vessels are connected to the opposite terminals of an electric circuit, as hereinafter described.

The vessel 15 is provided with an outwardly projecting handle 23 which comprises a metallic member 24 secured to the metallic body of the vessel 15 and an outer insulating cover 25. The metallic portion 24 of the handle is in the form of a sheet metal member having its lateral edges turned downwardly and inwardly to provide beads 24^a, as shown in Fig. 3, which give strength and rigidity to the structure. The inner end of the member 24 is welded or otherwise secured to the metallic body 15^e of the vessel, as shown in Fig. 2, and at its other end, the member 24 has secured thereto, between the beads 24^a, a projecting terminal 26. The vessel 16 is similarly provided with a handle 27 which is made up of an inner metallic member 28, having the same cross-sectional form as the member 24 and having its inner end welded or otherwise secured to the metallic body portion of the vessel 16. The member 28 is similar in cross-section to the member 24, having beaded portions 28^a along its edges, and a metallic terminal 29 is welded or otherwise secured to the outer end thereof to extend parallel to the terminal 26. The upper handle 27 comprises an outer insulating portion 30 which is mounted on the member 28. The members 25 and 30 extend substantially throughout the length of the members 24 and 28, which are enclosed by them, and, at their outer ends, these insulating members are provided with housing portions 25^a and 30^a which are U-shaped in cross-section, as shown in Fig. 3, with their openings directed toward each other so that they form a composite socket in which the terminals 26 and 29 are located.

When the vessel 16 is in nested relationship to the vessel 15, the two handles 23 and 27 extend parallel and in proximity to each other so that the terminals 26 and 29 may then be caused to engage the tubular conducting members 31 which are embedded in an insulating plug 32 in which the members 31 are connected to supply conductors 33 leading from a source of electrical current. The plug fits within the composite socket formed by the U-shaped members 25^a and 30^a on the ends of the handles and in this way a connection may be quickly and easily made with the supply circuit by which the electrical heating device is to be operated. It will be apparent that the plug 32 and the conductors carried thereby may be brought into connection with the terminals 26 and 29 of both of the vessels 15 and 16 only when these vessels are in proper nested relationship with each other and with the handle 27 arranged to extend parallel to and above the handle 23, thus insuring against the operation of the device unless it has been properly arranged and prepared for use. Assuming that the device illustrated in Fig. 1 is to be employed for cooking material placed in the vessel 16, a quantity of water is first placed in the vessel 15, before bringing the vessel 16 into nested relationship with the vessel 15, whereupon the

cover 17 is put in place and the plug 32 connected with the terminals 26 and 29 carried by the handles. The current then passes through the liquid conductor 18 between the electrode plates 19 and 20 with the result that the liquid conductor is heated and vaporized and heat transmitted through the walls of the vessel 16 to the material to be cooked. Unless the circuit connection is interrupted, this operation continues until the liquid conductor 18 in the vessel 15 disappears by evaporation, whereupon the electrical connection between the electrode plates 19 and 20 is broken and the operation of the apparatus is terminated. The cooking apparatus may thus have a definite predetermined time period of operation if a measured quantity of the liquid conductor 18 is initially placed in the vessel 15.

In Fig. 4, there is illustrated a modification of the invention in which two vessels 35 and 36 are nested one within the other in the same manner as the vessels 15 and 16 and are provided adjacent their upper edges with handles similar to those illustrated in Fig. 1, by which the metallic portions of the vessels may be connected to opposite sides of an electric circuit. In this modified construction, the vessel 35 comprises an inner metallic body portion 35^a which is provided on its outer side with an insulating coating of enamel or other material 35^b and on its inner side with a similar coating of insulating material 35^c. The vessel 36 is of similar construction, being made up of an inner metallic vessel 36^a provided with an outer insulating covering 36^b and an inner insulating covering 36^c. In the bottom of the vessel 35, the insulating lining 35^c is omitted over a central area of considerable size, as shown at 35^d, thus leaving an exposed portion 35^e of the metallic vessel 35^a which serves as an electrode and which may be circular in form. The bottom portion of the upper vessel 36 is so constructed that the insulating covering 36^b is omitted on the bottom of the vessel, as shown at 36^d, over an area which is the same as the area of the exposed portion of the metallic body 35^e of the metallic portion 35^a of the lower vessel, thus providing an electrode 36^e which is located opposite to the electrode 35^e so that when the two vessels are connected in an electric circuit, current will pass from one electrode to the other through the liquid conductor 37 which is contained in the lower vessel 36. This construction is capable of use where it is not desired to provide the additional electrode plates shown in Fig. 1 and will function satisfactorily, particularly if the exposed portions 35^e and 36^e of the metallic vessels be coated with conducting material to prevent corrosion or disintegration thereof.

Instead of making up the nested vessels of inner metal vessels covered over substantially their entire areas with insulating material, it may be desirable to form the vessels almost entirely of insulating material with the electrodes and their connections embedded therein, as shown in Fig. 5. In this construction, an outer vessel 41 and an inner vessel 42 are nested one within the other, in substantially the manner illustrated in Fig. 1, and each of these vessels is formed of porcelain, bakelite, or other insulating material. When the vessels are nested one within the other, the bottom of the vessel 42 is spaced upwardly from the bottom of the vessel 41, leaving a space which is occupied by the liquid conductor 43 which partially fills the lower vessel. The cen-

tral portion of the bottom wall 41^a of the vessel 41 is provided with an electrode 44 in the form of a metal plate which is embedded in the insulating material of the bottom wall with its upper surface exposed to direct contact with the liquid conductor 43. The bottom 42^a of the upper vessel 42 has another electrode 45 of conducting material embedded therein and exposed on its under side to the liquid conductor 43 so that when the electrodes are connected in an electric circuit, current will pass between them through the liquid conductor. For the purpose of establishing a connection with the circuit, the electrode 44 is connected to a conductor 46 and the electrode 45 is connected to a conductor 47. These conductors 46 and 47 may be comparatively narrow and they are embedded in the walls of the vessels 41 and 42, respectively, with their upper ends terminating adjacent the upper edges of these vessels where they are connected to the conducting portions of handles, similar to those shown in Fig. 1, whereby a connection may be established with the terminals of a supply circuit.

In Fig. 6 there is shown another form of construction comprising an outer vessel 51 and an inner vessel 52 which are nested one within the other in the manner heretofore described, the outer vessel being adapted to contain a liquid conductor 53. The upper vessel 52 has an exposed electrode 54 formed as a part of or attached to its bottom wall and connected in the circuit in the manner shown in Fig. 2, or in the manner illustrated in Fig. 5. The lower vessel 51 is provided with an opposed metallic electrode 55 which is constructed in the form of a cone having an apex provided with a threaded sleeve 55^a adapted for engagement with a stud 56 which is welded or otherwise secured to the metallic portion of the underlying bottom wall 51^a of the vessel. The metallic portion of the bottom wall 51^a may be connected to one branch of a circuit in the manner heretofore described. This construction may be of peculiar advantage in employing a body of water or other liquid conductor 53 whose characteristics are such that the apparatus may not operate with the highest degree of efficiency when employing parallel flat electrodes. One advantage of the cone-shaped electrode is that it allows a ready escape of bubbles from the region between the electrodes.

In Figs. 7, 8, and 9 of the drawings there is illustrated another form of the invention which is like that illustrated in Fig. 1 except that the vessels 57 and 58 which are nested one within the other are provided with modified forms of electrodes. In this arrangement, the outer vessel 57 has a bottom wall 57^a provided with a metallic portion which contacts directly with an electrode plate 59 having a threaded engagement with a stud 60 which is secured to the central depressed portion 57^b of the bottom wall. The metallic portion of the vessel 57 being connected in an electric circuit, a connection is established through the vessel with the electrode 59 and current may then pass from this electrode to another electrode 61 which is secured upon the bottom of the vessel 58. The electrode 61 is in the form of a metallic plate having a central sleeve 61^a which threadedly engages a stud 62 attached to the bottom of the vessel 58 and the plate 61 is fluted radially from the center with portions of the flutes or convolutions inclined upwardly to coincide with the surface of a marginal cone having its outer edge engaging the bottom

of the vessel 58. The lowermost edges of the flutes or convolutions 61^b which are thus formed in the electrode plate extend horizontally parallel to the lower electrode 59. This form of construction of the upper electrode is adapted to permit a more ready escape of bubbles from the region between the electrodes than would occur if both electrodes were flat. In this construction, the vessels are preferably made up of inner metallic portions having outer and inner coverings of insulating enamel or the like and the metal portions of these vessels are adapted to be connected in an electric circuit in the manner heretofore described.

In Fig. 10 there is illustrated the adaptation of the present invention to apparatus intended primarily for the making of coffee and this improvement embodies many of the advantages of the construction which is described and claimed in my co-pending application Serial No. 431,713, filed February 27, 1930. This apparatus comprises a series of vessels nested one within the other, including an upper vessel 65 adapted to contain water, a second vessel 66 which contains the vessel 65 and is spaced downwardly and outwardly therefrom, a third vessel 67 which contains and supports the vessel 66 and which is adapted to contain coffee grounds, and a lower vessel 68 which is adapted to support the vessel 67 and which receives the liquid coffee. The upper vessel 65 is adapted to contain a body of water 69, when the apparatus is initially started in operation, and its bottom wall 65^a is preferably constructed in the form of an inverted cone having an aperture 65^b at its center through which the water may flow downwardly. This bottom wall 65^a may itself serve as an electrode or it may be provided on its under side with a separate electrode plate 70 which contacts directly with the metallic body portion of the vessel 65. The vessel 65 may be provided adjacent its upper edge with an outwardly extending annular enlargement 65^c which rests upon a bead 66^d formed around the edge of the next lower vessel 66, this outwardly projecting portion 65^c terminating at its upper edge in an annular bead 65^d, or the bottom 65^a of the vessel 65 may rest directly on the annular ledge 66^b formed around the bottom of the vessel 66. At one side of the vessel 65, the annular enlargement 65^c is connected with a handle 71 which is of the form illustrated in Fig. 1, being provided with a metallic terminal 72 which is adapted to engage the plug attached to conductors leading from a source of electric current. The second vessel 66 may be provided with an enlargement 66^c, adjacent the bead 66^d, which rests upon the annular bead 67^d formed around the upper edge of the vessel 67, or the bottom of the vessel 66 may rest directly on the coffee grounds in the vessel 67 and thus pack the grounds through which the water passes. The bottom of the vessel 66 is provided with a portion 66^a which is constructed in the form of an inverted cone similar in form to the bottom wall 65^a of the vessel 65. The portion 66^a is offset downwardly from an annular ledge 66^b which is united with the outer cylindrical wall of the vessel 66 and, between the parts 66^a and 66^b there is provided a substantially cylindrical circular portion 66^e having a series of small apertures 66^f formed therein. The metallic portion of the part 66^a of the bottom wall may itself serve as an electrode but in the construction shown in Fig. 10 there is provided a separate cone-shaped elec-

trode plate 73 which is attached to the upper side of the part 66^a. The annular enlargement 66^c of the vessel 66 is provided with a projecting handle 74, similar to the handle 23 shown in Fig. 1, and having a terminal 75 which may be connected in an electric circuit. When this circuit is completed, current may flow to the electrode plate 73 through the wall of the vessel 66 and then upwardly to the cone-shaped electrode plate 70 through a portion of the water 69 which will have flowed downwardly into the space between the electrodes through the aperture 65^b.

The water which is heated by the passage of current between the electrodes 70 and 73 flows outwardly through the small hole 66^f and drips downwardly through the coffee grounds 77 which are contained in the depressed bottom 67^a of the vessel 67. The central portion of this bottom wall is provided with a series of perforations 67^b and the liquid coffee which is formed by the passage of the hot water through the coffee grounds drips downwardly through these apertures 67^b into the bottom vessel 68. The vessel 68 is adapted to rest upon a table or other support 78 and it is provided around its upper edge with an annular flange 68^d which forms a seat for the vessel 67. With this novel arrangement, a small quantity of cold water, for example, a single cupful, may be poured into the upper vessel 65 and, the terminals 72 and 75 having previously been connected in a circuit, this water, upon flowing downwardly through the hole 65^b in the upper vessel, will cause a current to flow between the electrodes 70 and 73, with the result that the water between the electrodes is heated and flows outwardly through the apertures 66^f and thence downwardly through the coffee grounds, thus producing a single cupful of liquid coffee in a short interval of time. It will be apparent that this improvement may be applied to coffee making apparatus of varying capacity and that the vessels 65 and 66, and their electrodes, may be constructed and mounted in any of the ways heretofore illustrated in connection with the other forms of the invention.

In Fig. 11, there is shown a further modification of the invention adapted for use as a sterilizer. The construction is the same as that shown in Fig. 1, except that openings are provided for admitting steam from the outer vessel to the inner vessel which serves as the sterilizing chamber. As illustrated, the sterilizer comprises an outer vessel 80 and an inner telescoping vessel 81 which is supported thereby, for example, by providing the inner vessel with an annular portion 81^b which rests upon the upper edge of the outer vessel. A cover 82 rests on the inner vessel and thus closes the upper end of the sterilizing chamber 83 in which the objects to be sterilized are placed. The two vessels 80 and 81 are formed of suitable metal, such as stainless steel, and are provided on their inner and outer sides with insulating coatings, the metallic portions of these vessels being connected to the terminals of an electric circuit through handles 84 and a plug 85, as in the form shown in Fig. 1. The insulating coatings are removed from opposed portions of the bottom walls of the vessels and the exposed metal portions of the vessels may serve as electrodes or they may contact directly with separate parallel electrode plates 86 and 87. The outer vessel 80 is adapted to contain a body of water or other vaporizable fluid 88 which establishes a connection between the electrodes 86 and 87 and is heated and vaporized by the passage of current

therethrough. To admit the steam or vapor thus produced to the sterilizing chamber 83, a series of holes 81^c may be provided in the bottom 81^a of the inner vessel around the electrode 87 or a series of holes 81^d may be provided in the annular wall of this vessel above the level of the water 88.

Although several forms of the invention have been shown and described by way of illustration, it will be understood that it may be constructed in various other embodiments within the scope of the appended claims.

I claim:

1. The combination in a liquid conductor heater, of a pair of vessels nested one within the other and having metallic portions spaced apart to serve as electrodes, one of said vessels being adapted to contain a liquid conductor for connecting said electrodes, means for connecting said vessel in an electric circuit, and means for preventing the operation of said connecting means when said vessels are not in proper nested relation to each other.

2. The combination in a liquid conductor heater, of a pair of vessels nested one within the other and having metallic portions spaced apart to serve as electrodes, one of said vessels being adapted to contain a liquid conductor for connecting said electrodes, a pair of conducting members extending normally in parallel relation and each connected to one of said vessels, and means engaging said conducting members when they are in said parallel relationship for connecting them to the terminals of an electric circuit.

3. The combination in a liquid conductor heater, of a pair of vessels nested one within the other and having metallic portions spaced apart to serve as electrodes, one of said vessels being adapted to contain a liquid conductor for connecting said electrodes, a pair of insulating handles each carried by one of said vessels and adapted to extend in parallel relationship one above the other, conducting members attached to said vessels and extending through said handles, and means engaging said conducting members for connecting them to the terminals of an electric circuit.

4. The combination in a liquid conductor heater, of a pair of vessels nested one within the other and having metallic portions spaced apart to serve as electrodes, one of said vessels being adapted to contain a liquid conductor for connecting said electrodes, a pair of conducting members each secured to one of said vessels and

extending outwardly therefrom in normal parallel relationship, insulating members enclosing said conducting members and having registering sockets at their outer ends, and an insulating plug engaging said sockets and having means for connecting said conducting members to the terminals of an electric circuit.

5. The combination in coffee making apparatus, of a vessel adapted to contain liquid coffee, a second vessel supported by said first named vessel and having a perforated bottom adapted to support coffee grounds, a third vessel nested within said second named vessel and having a metallic portion adapted to serve as an electrode with perforations therethrough adjacent said electrode portion, a fourth vessel nested within said third named vessel and having a metallic portion adapted to serve as an electrode spaced from said electrode portion of said third named vessel, said fourth vessel being adapted to contain water and having a perforation through which said water flows to the space between said first named and second named electrode portions, and means for connecting said third named vessel and said fourth named vessel to the opposite terminals of an electric circuit.

6. The combination in coffee making apparatus, of a plurality of vessels nested one within the other, two of said vessels being of metal insulated from each other and provided with means for connecting them to the terminals of an electric circuit, said insulated vessels being provided with exposed metal parts serving as spaced electrodes, one of said vessels being adapted to contain water and to admit said water gradually to the space between said electrodes, another of said vessels being adapted to contain coffee grounds and to receive the heated water from said electrodes.

7. The combination in coffee making apparatus, of a plurality of vessels nested one within the other, two of said vessels being of metal insulated from each other and provided with means for connecting them to the terminals of an electric circuit, said insulated vessels being provided with exposed metal parts serving as spaced electrodes, one of said vessels being adapted to contain water and to admit said water gradually to the space between said electrodes, another of said vessels being adapted to contain coffee grounds and to receive the heated water from said electrodes, another vessel being adapted to collect the liquid coffee formed by the passage of said heated coffee through said coffee grounds.

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