

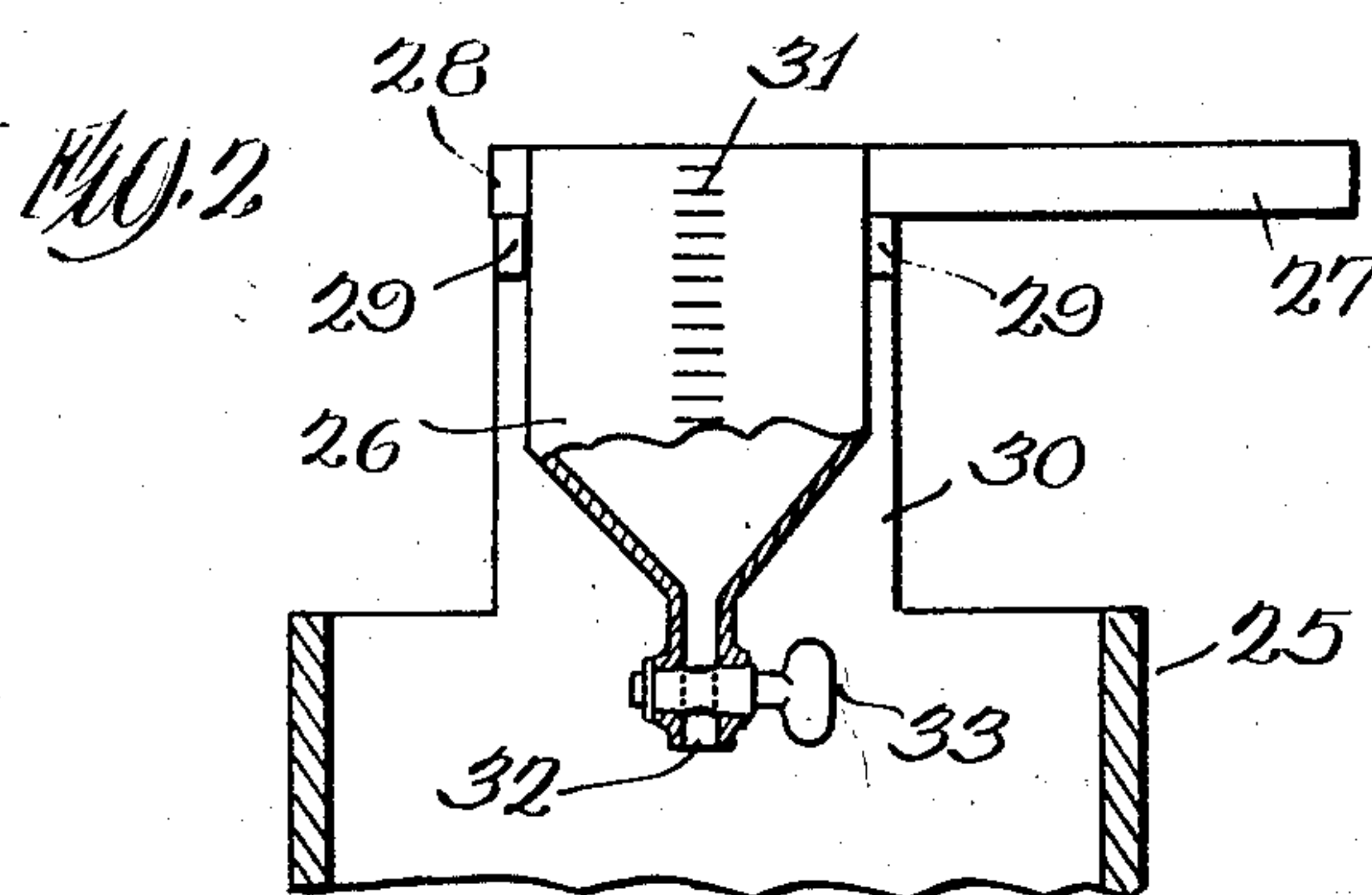
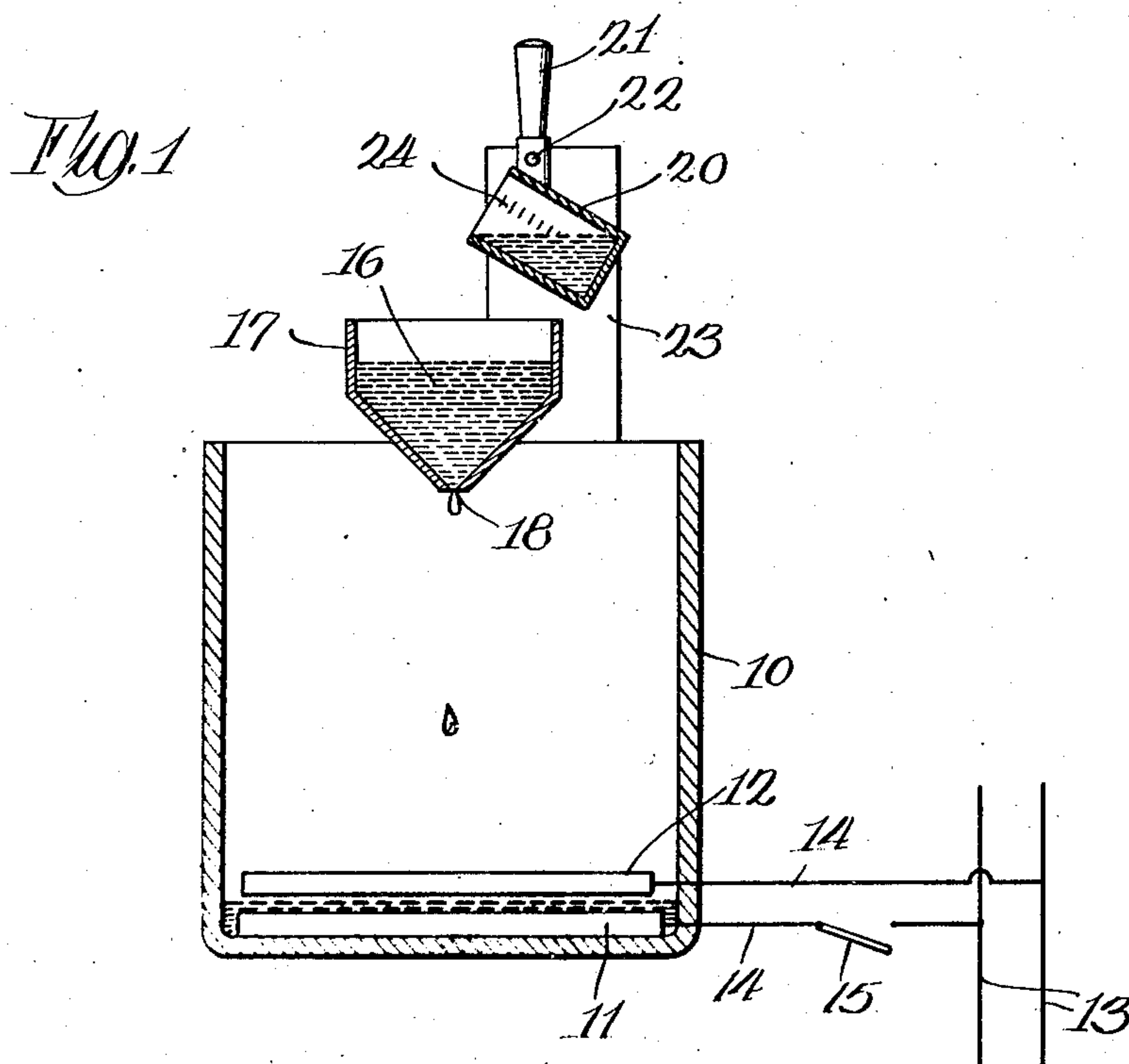
Sept. 4, 1928.

1,683,070

M. W. HANKS

LIQUID CONDUCTOR HEATER AND METHOD OF OPERATING SAME

Filed June 27, 1924



Inventor:
 Marshall W. Hanks
 By Rector, Hibben, Davis & Macauley
 Attys.

Patented Sept. 4, 1928.

1,683,070

UNITED STATES PATENT OFFICE.

MARSHALL W. HANKS, OF MADISON, WISCONSIN.

LIQUID-CONDUCTOR HEATER AND METHOD OF OPERATING SAME.

Application filed June 27, 1924. Serial No. 722,670.

This invention relates to liquid conductor heaters and is particularly applicable to that type of electrical apparatus disclosed in my prior Patents, No. 1,175,442, granted March 14, 1916 and No. 1,184,178, granted May 23, 1916.

In starting electrical apparatus in which a liquid is employed as the conductor to complete the electrical circuit between two or more electrodes, an objectionable feature is the high starting current which may cause fuses to blow out or the lights to wink, particularly when the apparatus is operated on the usual lighting circuit in the home. This high starting current is due to the fact that the internal resistance of the liquid, when it first establishes a connection between the electrodes, is low as compared with its resistance during the subsequent operation of the apparatus after bubbles have formed in the liquid. The liquid most commonly used is water but any other liquid having suitable resistance characteristics may be employed.

The principal purpose of the present invention is to restrict the starting current in liquid conductor heaters by causing a gradual engagement of the liquid and the electrodes after an electric potential has been impressed on the electrodes, thus causing only a small portion of the electrodes to become active at the start and causing only a relatively small current to flow. As an increased quantity of liquid is added, the tendency of the current to increase is overcome by the bubble structure which is formed in the liquid by the current passing through it so that an approximately normal starting current is maintained at a value which is considerably less than that which prevails when the entire charge of liquid is poured in at one time at the commencement of operation. After all of the liquid has been introduced into the receptacle containing the electrodes, it continues to boil until it has all evaporated, whereupon the current ceases to flow. The rate of introducing the liquid governs the rate of current rise and the amount of liquid introduced into the receptacle governs the duration of time through which the heater operates. The prior patents above referred to disclosed liquid conductor heaters in which there is introduced into the receptacle a measured quantity of liquid just sufficient to effect the cooking of eggs or the warming of milk in a

nursing bottle, for example, for predetermined periods of time. The present invention is applicable to heaters of that type as well as to various other forms of liquid conductor heaters.

The nature of the invention will be understood from the following specification taken with the accompanying drawings in which Figure 1 shows a vertical section through a simplified form of liquid conductor heater adapted to be operated by the improved method of the present invention, and Figure 2 shows a modified form of construction.

In the embodiment of the invention shown in the drawings, the heating vessel 10 is provided in the lower part thereof with suitable electrodes 11 and 12 which are spaced apart vertically and connected in an electrical circuit comprising line conductors 13 and branch conductors 14 including a switch 15. The electrodes may be located in any desired position but are here shown extending horizontally. The electrodes 11 and 12 are adapted to be connected by a liquid 16 which is introduced into the heating vessel 10 from a feeding receptacle 17 which is provided in the lower wall thereof with one or more restricted openings 18 of such size that the flow of liquid through the opening or openings is restricted to a predetermined rate so that the quantity of the liquid conductor in contact with and connecting the electrodes 11 and 12 at starting is such as to maintain the starting current at a predetermined minimum. As the water or other liquid 16 continues to flow into the heating vessel 10, the area of contact of the liquid with the upper electrode 12 increases so that there is a tendency for the current to increase but this tendency is overcome by the formation of bubbles in the liquid due to the passage of current therethrough. After all of the liquid has been introduced into the vessel 10, it continues to boil with a resulting heating effect until it has all evaporated whereupon the operation of the apparatus is automatically arrested.

The liquid 16 is preferably introduced into the feeding vessel 17 from a measuring vessel 20 which may be provided with a handle 21 loosely and detachably pivoted at the point 22 on a support 23 so that the vessel 20 may be removed to measure a quantity of liquid or tilted in order to cause its contents to flow into the feeding receptacle 17. The measuring vessel 20 may preferably be

of glass or other translucent material and provided with vertical graduations 24 so that any desired predetermined amount of liquid may be introduced into the heating receptacle 17. The apparatus thus embodies means for measuring a predetermined quantity of liquid as well as means for causing a predetermined rate of flow of the liquid into the heating vessel 10.

10 If desired, the measuring vessel and the feeding vessel may be combined, in one unit, and although there are various ways of doing this, there is shown in Fig. 2 by way of illustration, one form of apparatus comprising a heating vessel 25 containing the electrodes and adapted to have the liquid fed thereto from a feeding and measuring vessel 26 having a handle 27 and a projection 28 capable of being detachably supported on lugs 29 carried by a supporting member 30. The vessel 26 has graduations 31 thereon to indicate the quantity of liquid contained therein and the liquid is discharged gradually into the heating vessel 25 through a restricted outlet 32 controlled by an adjustable valve 33. The valve 33 may be closed while the vessel 26 is being filled with liquid and may be adjusted thereafter to secure the desired rate of flow of the liquid into the heating vessel.

Although one method of operation has been described and two forms of apparatus have been disclosed by way of illustration, it will be understood that the invention may be practiced in various ways without departing from the scope of the appended claims.

I claim:

1. The method of operating liquid conductor heaters in which electrodes are adapted to be connected by a liquid conductor in a vessel, which consists in impressing an electrical potential on said electrodes, restricting the starting current by effecting a gradual application of the liquid to the electrodes, retaining said liquid in said vessel for heating by said current, and continuing passage of current through said liquid until the circuit is broken by the evaporation of said liquid.

2. The method of operating liquid conductor heaters in which electrodes are adapted to be connected by a liquid conductor, which consists in impressing an electrical potential on said electrodes, then causing the application of the liquid to the electrodes

to take place gradually at a predetermined rate to restrict the starting current, and continuing the passage of the current until the circuit is broken by the evaporation of the liquid.

3. The method of operating liquid conductor heaters in which electrodes are adapted to be connected by a liquid conductor, which consists in impressing an electrical potential on said electrodes, measuring a predetermined quantity of the liquid conductor, then causing the electrodes and the liquid conductor to engage each other gradually with a gradually increasing area of contact, and continuing the passage of current through said liquid until the circuit is broken by the evaporation of said liquid.

4. A liquid conductor heater comprising a heating vessel adapted to hold and retain a liquid conductor, electrodes located in said vessel, an electric circuit for said electrodes, and means for introducing into said vessel at a gradual predetermined rate a measured quantity of liquid conductor adapted to remain in said vessel and establish an electrical connection between said electrodes.

5. A liquid conductor heater comprising a heating vessel adapted to hold and retain a liquid conductor, electrodes mounted in said vessel and spaced apart, an electric circuit connected to said electrodes, means for measuring a predetermined quantity of liquid conductor, and means for effecting a gradual and predetermined rate of flow of said measured liquid conductor into said heating vessel to establish an electrical connection between said spaced electrodes and effect a gradually increasing contact of said liquid with said electrodes until the entire measured quantity of liquid is contained in said vessel.

6. The method of operating a liquid conductor heater in which electrodes are adapted to be connected by a liquid conductor, which consists in impressing an electrical potential on said electrodes, measuring a predetermined quantity of the liquid conductor, then causing said measured quantity of liquid to engage gradually said electrodes, and continuing the passage of current through said liquid until substantially the entire quantity of liquid disappears by evaporation and breaks the circuit.

MARSHALL W. HANKS