Jan. 13, 1925.

1,523,166

C. E. BENNETT

CURRENT INTERRUPTER

Original Filed June 24, 1919

2 Sheets-Sheet 1

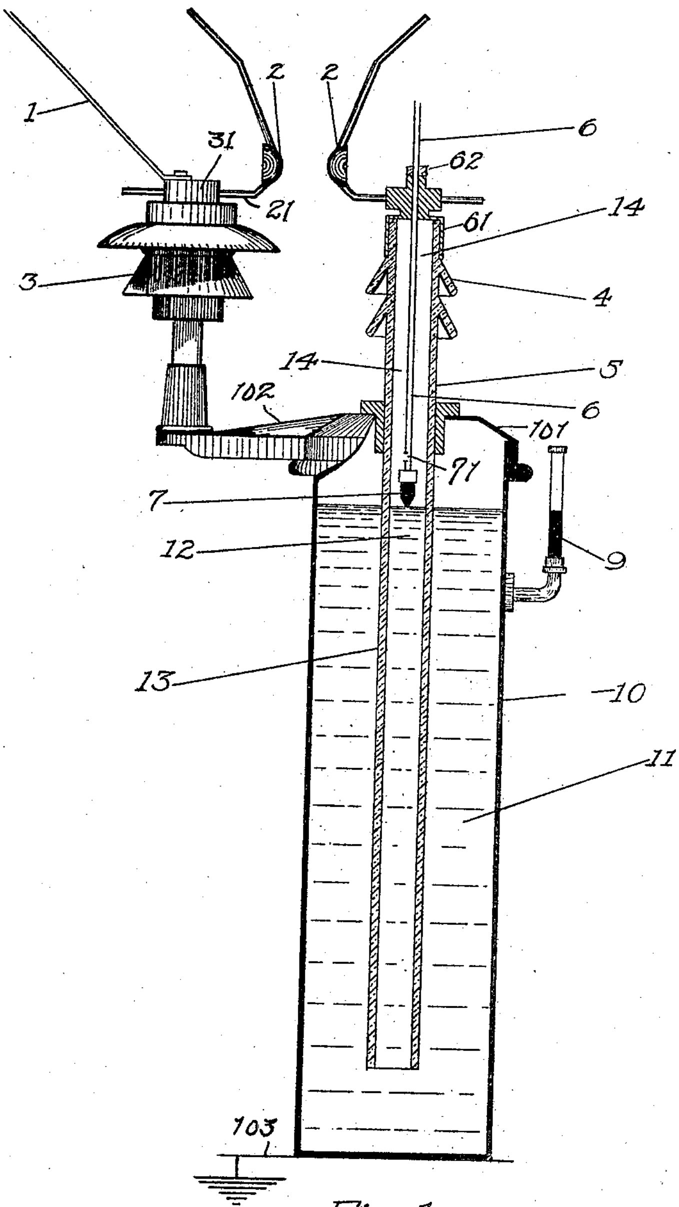

Fig 1

INVENTOR.
CHARLES E. BENNETT
BY
Howson and Howson
his ATTORNEYS

Jan. 13, 1925.

1,523,166

C. E. BENNETT

CURRENT INTERRUPTER

Original Filed June 24, 1919

2 Sheets-Sheet 2

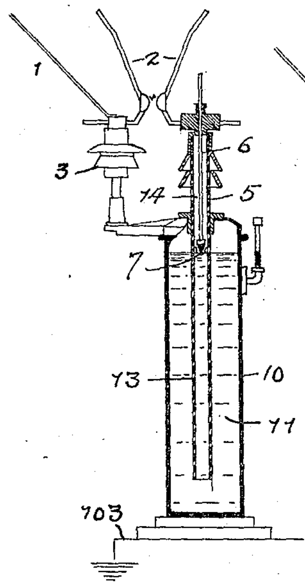

Fig.2

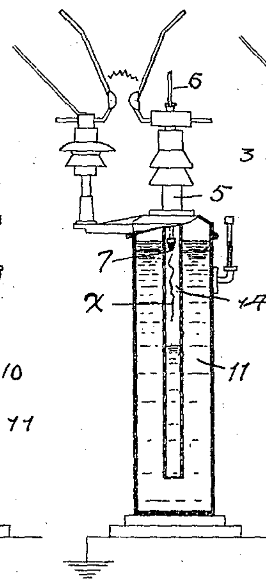

Fig.3

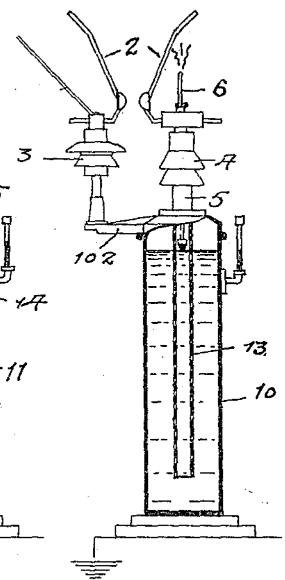

Fig.4

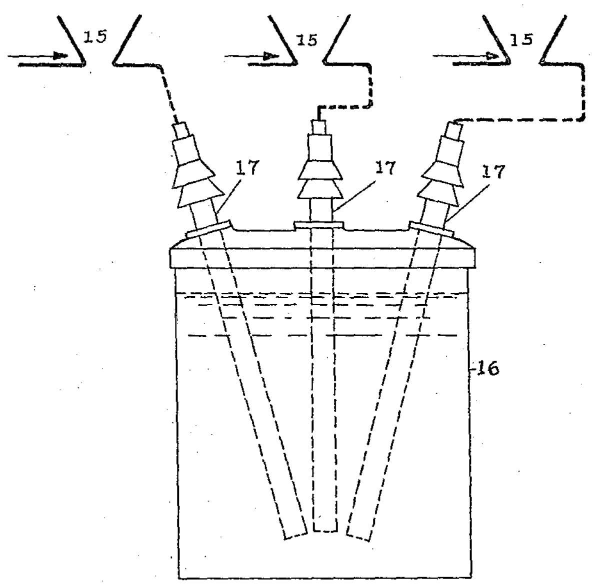

Fig. 5

INVENTOR.

CHARLES E. BENNETT

BY

Howson and Howson

his ATTORNEYS.

Patented Jan. 13, 1925. **1,523,166**

UNITED STATES PATENT OFFICE.

CHARLES E. BENNETT, OF ATLANTA, GEORGIA, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO BALT MANUFACTURING COMPANY, OF ATLANTA, GEORGIA, A CORPORATION OF GEORGIA.

CURRENT INTERRUPTER.

Application filed June 24, 1919, Serial No. 306,383. Renewed December 11, 1923.

To all whom it may concern:

Be it known that I, CHARLES E. BENNETT, a citizen of the United States of America, residing in the city of Atlanta, county of Fulton, and State of Georgia, have invented certain new and useful Improvements in Current Interrupters, of which the following is a specification.

My invention relates to automatic current interrupters, and particularly to a device of the general type shown in my co-pending applications Ser. Nos. 207,771 and 247,826, filed respectively on December 18, 1917, and August 1, 1918, the object of my present invention being to improve the construction and operation of the device in certain features hereinafter described or shown in the accompanying drawings, in which

Fig. 1 is a vertical section through an apparatus in which my invention is embodied in one form;

Figs. 2, 3 and 4 are similar views drawn to a smaller scale and illustrating the operation of the apparatus; and

Fig. 5 is a side elevation of a modified construction.

The apparatus here illustrated comprises certain main features of resemblance to that shown in my co-pending applications above referred to, but differing therefrom in certain particulars hereinafter pointed out. A suitable container or tank 10 is partially filled by a body of liquid 11—12 constituting a low resistance electrolyte of suitable capacity which may be varied to suit the needs of the particular installation. Passing through a bushing in the head of the tank or container is a tube of insulating material, the lower portion 13 of which dips into the electrolyte and extends downward therein to a point adjacent the bottom of the tank, while the upper portion 5 of the tube projects above the tank and is provided with skirts 4 after the fashion of a post insulator. Enclosing the upper end of the tubing is a metal cap 61, through which passes a conductor 6 in the form of a pipe, at the lower end of which is mounted an electrode 7, the pipe being adjustable through its lock nut 62, to bring the electrode 7 into contact with the electrolyte which rises in the tube. The pipe 6 is open at its upper end while a hole 71 in its wall establishes communication between the interior of the pipe and the expansion chamber 14 which lies above the electrolyte in the tube 13. The head 101 of the tank carries an arm 102 which supports the pin insulator 3. A lead 1 from the power line is secured to the insulator cap 31, through which passes the adjustable base rod 21 of one branch of the combined sphere and horn gap 22, the other branch of which is secured to the cap 61 of the insulating tube 5—13.

A gauge 9 let into the tank 10 indicates the liquid level in the tank. The electrolyte 11—12 is grounded in any suitable way, as by a connection 103 to the tank, where the latter is of metal.

The operation of the apparatus is as follows: Assuming an arc to have been established at the horn gap 2—2 by excessive voltage, such as accompanies a stroke of lightning, the normal line voltage maintains the arc and grounds the power current through 6, 7, 12, 11 and 103. This arc is automatically broken and normal conditions reestablished, as shown in Figs. 2, 3 and 4 and explained as follows: The area of contact between the electrode 7 and electrolyte 12 in the tube 13 is small, since the electrode is adjusted merely to touch, or only slightly dip into, the electrolyte. The heating effect of the current is therefore concentrated at this point and not only is the air within the chamber 14 rapidly heated, but the electrolyte in contact with the electrode 7 is immediately vaporized and expanded. If the electrolyte is water, steam is formed. The resultant pressure in the chamber 14 forces downward the electrolyte in the tube 13 with the result that the arc X (Fig. 3) is rapidly lengthened downward until it breaks and the ground connection is thereby interrupted. The expanded air and evaporated electrolyte thereupon partially condense in the chamber 14 and partially escape through the pipe 6, whereupon the electrolyte from the tank promptly rises again in the tube 13 and reestablishes contact with the electrode 7. Normal conditions are thus reinstated. Another important characteristic of the present apparatus is the condenser action obtained. It will be noted that the electrolyte within the tube 13 is separated by the insulating wall of the latter from the surrounding electrolyte in the tank 10. The current enters the electrolyte in the upper portion of the tube and must overcome the resistance of the electrolyte in the tube on its path to ground. There is a consequent drop in voltage due to this resistance before the current enters the electrolyte in the tank at the lower end of the tube. In other words, the electrolyte in the upper portion of the tube carries current at a higher voltage than that of the electrolyte in the tank surrounding the tube, and the voltage differential drops progressively as the lower end of the tube is approached. The condenser action is therefore most marked in the upper reaches of the tube, and is practically nil at its lower end. However, the condenser action is much greater than is the case of the usual condenser since the electrolyte within the tube—which forms one plate of the condenser—is being constantly drained to ground of its current through the resistance of the electrolyte in the lower portion of the tube and in the tank.

On the downward displacement of the electrolyte in the tube by the trapped vapor, the condenser action is doubtless modified and is believed to be increased since the voltage at the point at which the current enters the vapor is doubtless much greater than that of the electrolyte in the tank by reason of the greater current drop, incident to the increased resistance interposed by the vapor. This fact, however, is not usually of importance since the high frequency charge is ordinarily drained through the arrester before the downward displacement of the electrolyte within the tube occurs, and it is not until the flow of the normal line current becomes effective to vaporize the electrolyte in the tube that the latter is forced downward by the trapped vapor. Consequently during the discharge of the high frequency current, the condenser action is that incident to the full electrolyte plate at its normal level, and separated from the electrolyte in the tank by the full length of the submerged portion of the insulating tube. If, however, the high frequency current should persist, as for instance, by reason of a succession of lightning discharges, which may last for as much as a second, or a resonance condition of even greater duration on the line, the condenser effect is still attained although the water leg within the tube may be driven downward. This is due to the fact that the water vapor which has replaced the electrolyte is still at a much higher voltage than the surrounding electrolyte of the tank.

In Fig. 5 I have shown three interrupters 17 for the corresponding gaps 15 of the usual three line wires, associated with a single tank 16. In other respects the construction and operation are identical with that just described.

It will be noted that in the present arrangement I have eliminated the submerged resistance coil shown in my two co-pending applications above mentioned, since I have found that the apparatus operates with requisite speed when the electrode is so positioned that it merely touches the surface of the electrolyte in the tube 13, and thus causes a rapid evaporation and expansion of the vapors in the chamber 14. On the other hand I have retained the advantage of the construction shown in Serial No. 247,826 wherein the insulating tube in which the arc is formed dips into the electrolyte in the tank, which effectively cools the tube and prevents heat injury thereto while the arc is maintained. The particular construction of the tube 5—13 and of the pipe lead 6 to the electrode as well as the vent of the chamber 14, and the manner of supporting the horn gap terminals, are new in the present arrangement and constitute improvements over my former constructions, but are nevertheless subject to much further modification without departing from what I claim as my invention.

I claim:

1. In a device of the class described, a container, a conducting fluid within the container, an insulating tube dipping into said fluid and open thereto, but substantially closed at its upper end, and an electrode in series circuit relation with the upper portion of the fluid in the tube, said tube affording in its upper closed portion a pressure chamber in which vapor is trapped and depresses the fluid in the tube away from the electrode on discharge through the circuit.

2. In a device of the class described, a container, a conducting fluid within the container, an insulating tube passing through the top of the container and dipping at its lower end into said fluid and open thereto, but substantially closed at its upper end, and an electrode passing down through said tube into current-flow association with the upper portion of the fluid in the tube, said tube affording at its upper closed portion a pressure chamber in which vapor is trapped and depresses the fluid in the tube away from the electrode on discharge through the circuit.

3. In a device of the class described, a container, a conducting fluid within the container, an insulating tube passing through the top of the container and dipping at its lower end into said fluid and open thereto, but substantially closed at its upper end, and an electrode passing down through said tube into current-flow association with the upper portion of the fluid in the tube, said tube affording at its upper closed portion a pressure chamber in which vapor is trapped and depresses the fluid in the tube away from the electrode on discharge through the circuit, together with an air gap terminal mounted on the upper

end of the tube and electrically connected to the electrode.

4. In a device of the class described, a container, a conducting fluid within the container, an insulating tube passing through the top of the container and dipping at its lower end into said fluid and open thereto, but substantially closed at its upper end, and an electrode passing down through said tube into current-flow association with the upper portion of the fluid in the tube, said tube affording at its upper closed portion a pressure chamber in which vapor is trapped and depresses the fluid in the tube away from the electrode on discharge through the circuit, together with an air gap terminal mounted on the upper end of the tube and electrically connected to the electrode, in combination with a bracket mounted on the container, and a secondary gap terminal mounted thereon and cooperating with the gap terminal mounted at the upper end of the tube.

5. In a device of the class described, a container, a conducting fluid within the container, an insulating tube passing through the top of the container and dipping at its lower end into said fluid and open thereto, but substantially closed at its upper end, and an electrode passing down through said tube into current-flow association with the upper portion of the fluid in the tube, said tube affording at its upper closed portion a pressure chamber in which vapor is trapped and depresses the fluid in the tube away from the electrode on discharge through the circuit, together with means for venting the pressure chamber in the tube to prevent building up of excessive pressure therein.

6. In an automatic current interrupter, a reservoir, an electrolyte therein, an insulating tube dipping into the electrolyte and open thereto, and a conductor arranged in current flow association with the electrolyte within the tube to cause the current to pass therethrough and thus to at least partially vaporize the same and draw an arc within the tube on the operation of the arrester, said conductor being a pipe through which the upper portion of the tube is vented, substantially as described.

7. In a protective ground connection, a container, an electrolyte therein, an insulating tube extending into the electrolyte and chilled thereby, a pressure chamber above the level of the electrolyte in the tube, and means for leading current to the electrolyte in the tube to at least partially vaporize the same on discharge through the apparatus and cause vapor to accumulate in the pressure chamber, depress the electrolyte in the tube and draw an arc under vapor pressure in the submerged and chilled area of the tube.

8. A protective device comprising a resistance liquid condenser, means for leading current to one plate of the condenser, and means for trapping vapor generated by the flow of current through said plate to displace its liquid and thereby interpose a vapor resistance to the flow of currents.

9. A protective device comprising a liquid resistance condenser, means for leading current to one plate of the condenser, and means for trapping vapor generated by the flow of current through said plate to displace its liquid and thereby substitute vapor under pressure for at least portion of said liquid plate of the condenser.

In testimony whereof I have signed my name to this specification.

CHARLES E. BENNETT.