Feb. 16 , 1926. 1,572,990

O. A. COLBY

THERMAL SWITCH

Filed May 10, 1922

Fig. 1.

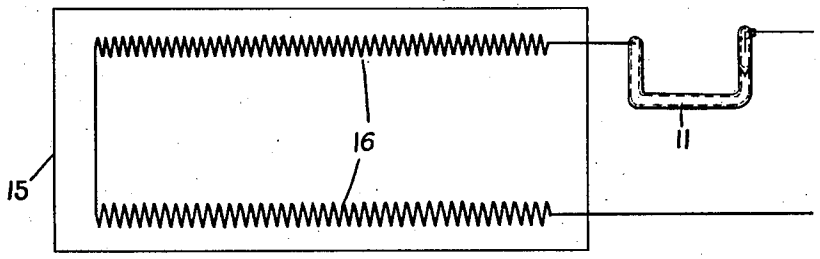


Fig. 2.

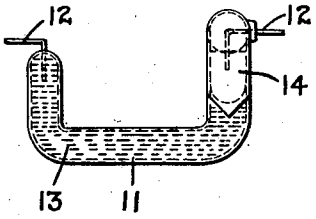


Fig. 3.

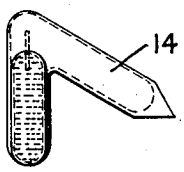


Fig. 4.

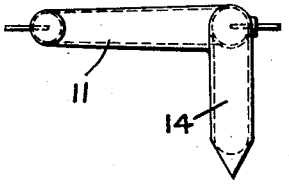


Fig. 5.

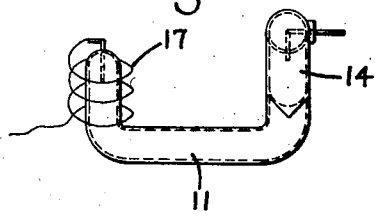
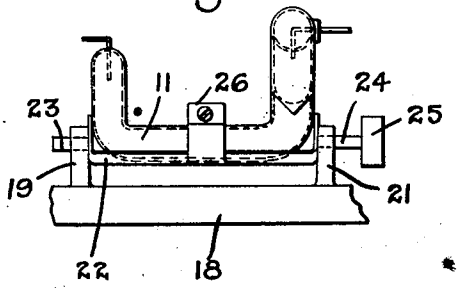


Fig. 6.



WITNESSES:

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1,572,990

UNITED STATES PATENT OFFICE.

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THERMAL SWITCH.

Application filed May 10, 1922. Serial No. 559,724.

To all whom it may concern:

Be it known that I, ORA A. COLBY, a citizen of the United States, and a resident of Irwin, in the county of Westmoreland and State of Pennsylvania, have invented a new and useful Improvement in Thermal Switches, of which the following is a specification.

My invention relates to circuit interrupters and particularly to fluid circuit interrupters and it has for its object to provide a relatively simple and rugged circuit-interrupting device that shall be effective to interrupt an electric circuit either manually or automatically.

In practising my invention, I provide a closed evacuated tube of insulating material having a main portion of substantially U-shape and an integral lateral extension connected to the main portion at one end thereof. Electric circuit terminals extend into the main portion of the tube, at the ends thereof, and operatively engage a column of conducting fluid which fills substantially all of the main portion of the tube. An auxiliary heating coil may be mounted on one portion adjacent the end thereof to aid in volatilizing the conducting fluid at that point and thereby cause the circuit through the device to be interrupted. The tube may be mounted in a support having a turning movement to permit of manually interrupting the circuit or of reclosing the circuit after it has been interrupted either automatically or manually.

In the single sheet of the drawing,

Figure 1 is a diagrammatic representation of an electrically heated device with which is associated a fluid circuit-interrupting means embodying my invention;

Fig. 2 is a view, in side elevation, of a device embodying my invention;

Figs. 3 and 4 are end and top plan views, respectively, of the device illustrated in Fig. 2;

Fig. 5 is a view, in side elevation, of a modification of the device embodying my invention; and

Fig. 6 is a view, in side elevation, of a device embodying my invention in a suitable mounting means.

Referring more particularly to Figs. 2, 3 and 4, a fluid circuit interrupter comprises a closed evacuated tube 11 of any suitable insulating material, such as glass or quartz, and bent to substantially U-shape. At each of the ends of the tubes there is provided an electric circuit terminal 12 which extends through the wall of the tube at the end thereof and operatively engages a column 13 of a suitable conducting fluid, such as mercury. The tube also comprises an integral lateral tubular extension 14 connected to the main portion of U-shape at one of its ends and extending laterally and downwardly therefrom. The device is intended to be mounted in substantially the position illustrated in Fig. 2 of the drawing; that is, the connecting or intermediate portion of the tube is at the bottom.

Fig. 1 illustrates, diagrammatically, the device operatively associated with an electrically heated apparatus 15, represented generally as a rectangle, and here intended to represent a furnace or any other electrically heated apparatus. A resistance or heating element 16 is associated with the device 15 and the circuit-interrupting device is so located relatively to the electrically heated device that one end thereof, namely, that opposite to the one at which the lateral extension is located, is under the thermal influence of the electrically heated device. If desired, or necessary, the circuit-interrupting device may be so located as to extend partly into the electrically heated device to obtain a more direct transmission of heat from the electrically heated device to the circuit interrupter.

If the heating element 16 is energized and if the temperature of the device reaches a predetermined maximum value, a part of the conducting fluid in that end of the tube, thermally influenced by the electrically heated device, is volatilized and causes a portion of the conducting fluid located in the other end of the tube adjacent the lateral extension to be forced out of the tube

of substantially U-shape and into the lateral extension to be trapped there and prevented from returning. It is evident that when a sufficient amount of the conducting fluid is forced over into the lateral extension, the circuit through the device is interrupted.

If the temperature of the electrically heated device is not sufficiently high to cause volatilization of the proper amount of the conducting fluid in one of the legs of the tubular member of U-shape, an auxiliary heating coil 17 may be operatively associated with that leg of the tubular member to generate additional heat and to effect a quicker volatilization of the conducting fluid and a quicker interruption of the circuit therethrough. If desired, the diameter or the area of the cross-section of the column of conducting fluid may be made relatively small at that end of the tube which is to be thermally influenced by the electrically heated device to generate additional heat internally of the circuit-interrupting device and cause the circuit to be interrupted sooner than would be the case if only externally applied heat from the electrically heated device were available to cause the operation of the circuit-interrupting device.

Referring more particularly to Fig. 6, I have there illustrated a suggested form of mounting of the device embodying my invention to permit of either manually interrupting the circuit or of reclosing the circuit after it has been automatically opened, as hereinbefore described. A suitable base member 18 is provided with bearing members 19 and 21 which may be integral therewith or secured thereto and which carry a supporting and clamping member 22 of such form as to co-operate with, and properly support, the tubular member of U-shape and its integral lateral extension, in proper operative position. Short integral shaft extensions 23 and 24 may be provided on the member 22 to be mounted in the bearing members 19 and 21, and an operating button or handle 25 may be secured at the outer end of the shaft extension 24 to permit of manually operating the mechanism. I have illustrated a pair of integral clamping extensions or lugs 26 adapted to extend around the middle portion of the tubular member of U-shape to properly support and hold the same. It is to be understood, of course, that any suitable or desired mechanism may be employed and further differences in design be effected to hold the tube in either of its limiting positions, although this forms no part of my invention and is not therefore further described.

If it is desired to interrupt the circuit manually, the tube may be given a turning movement in its support in a clockwise direction, when viewed as indicated in Fig. 3, whereby a portion of the conducting fluid flows into the integral lateral extension 14 and is trapped there, causing the conducting fluid to be disengaged from either or both of the electric-circuit terminal members 12. If it is desired to again close the circuit, this may be done by moving the tube in a counter-clockwise direction sufficiently to cause the conducting fluid to again flow into the main portion of the tube, substantially as illustrated in Fig. 2 of the drawing, an operation which must be performed not only after the circuit has been manually interrupted but also when it has been automatically interrupted, as hereinbefore described.

The device embodying my invention thus provides a relatively simple, compact and rugged construction of fluid circuit interrupter which is effective to either manually or thermally interrupt the circuit through an electrically heated device with which it is operatively associated or it may be employed to manually interrupt a circuit through an electrically heated apparatus which does not thermally influence the circuit interrupting device. If the temperature of the electrically heated device is not sufficiently high to cause proper automatic operation of the device, a small auxiliary heater may be added to cause operation of the device under a predetermined set of temperature and current conditions.

Various modifications may be made in the device embodying my invention without departing from the spirit and scope thereof and I desire that only such limitations shall be placed thereon as are imposed by the prior art or are specifically set forth in the appended claims.

I claim as my invention:

1. In a fluid circuit interrupter for an electrically heated device, in combination, a closed, evacuated tube of insulating material having a main portion of substantially U-shape and an integral lateral extension connected to one end of said main portion, electric circuit terminals extending into said tube at the ends of the main portion, a conducting fluid filling substantially all of said main portion, and an auxiliary electric heating means connected in series-circuit relation to said circuit interrupter and surrounding an end portion thereof to cause vaporization of the conducting fluid in said end portion by heat generated thereby when added to that of the electrically heated device thermally influencing said end portion surrounded by the auxiliary heating means, to thereby interrupt the circuit.

2. In a fluid circuit interrupter for an electrically heated device, in combination, a closed evacuated tube of insulating material of substantially U-shape supported in a substantially upright position, electric circuit

terminals extending into said tube at the ends thereof, a conducting fluid in said tube substantially filling the same, one end of said tube being thermally influenced by the electrically heated device with which it is operatively associated to vaporize a portion of the conducting fluid in that end of the tube to cause another part of the fluid to be forced out of said tube, and a tubular member integral with said tube of U-shape and extending laterally and downwardly therefrom at one end thereof for receiving and trapping said fluid forced out of said tube.

In testimony whereof, I have hereunto subscribed my name this 28th day of April 1922.

ORA A. COLBY.