April 7, 1931.

L. T. JONES

1,799,689

CIRCUIT BREAKER

Filed Oct. 7, 1929

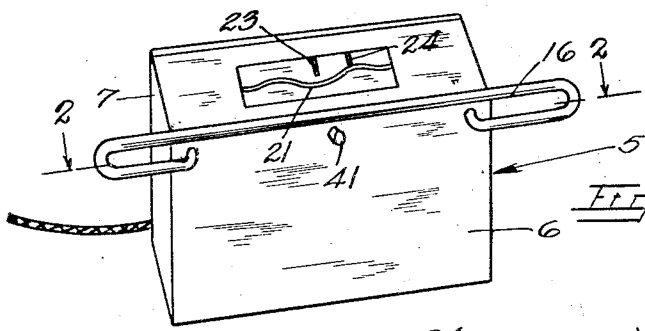

Fig. 1

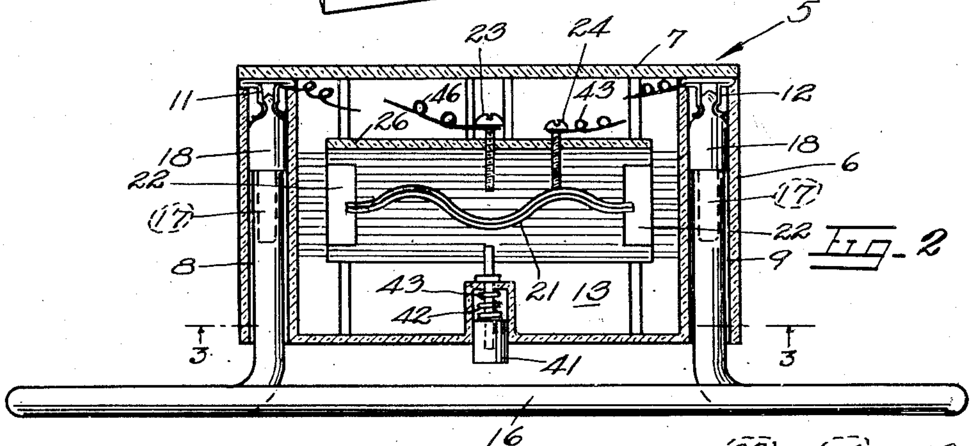

Fig. 2

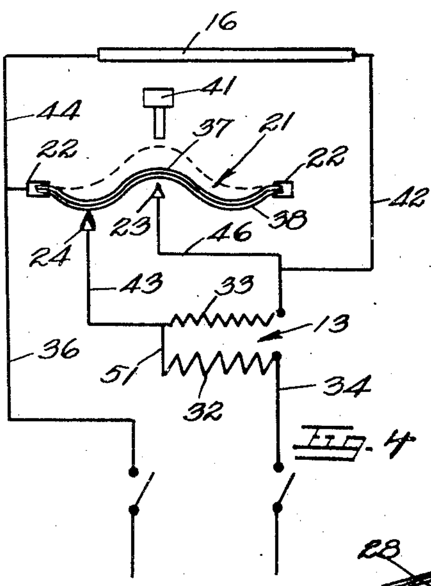

Fig. 4

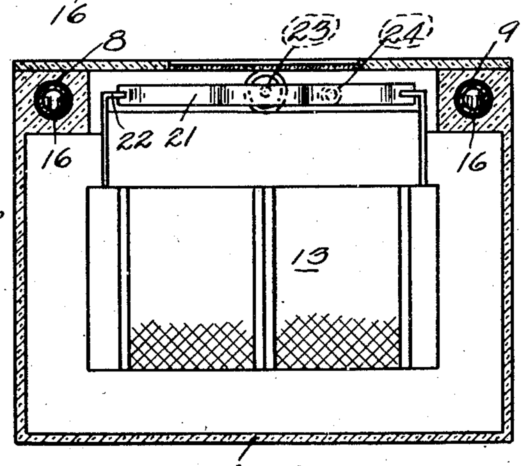

Fig. 3

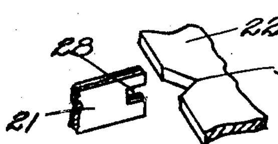

Fig. 5

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CIRCUIT BREAKER

Application filed October 7, 1929. Serial No. 397,889.

The invention forming the subject matter of this application relates to automatic circuit breakers and more particularly to an electric thermostatic circuit breaker adapted for use in connection with luminescent tubes.

Luminescent tubes at present used in electrically lighted signs are normally operated at voltages that are quite in excess of the usual voltages provided for industrial and residential purposes, the voltages being normally between 5,000 and 25,000 volts. This voltage is acquired by means of suitable transformers.

As luminescent tubes containing such gases as neon, argon, helium, or the like are now coming into use for interior decorative purposes and it is apparent that perfect protection from electrical shock by contact with the terminals of a tube that has failed to operate, or which is operating at an unduly high voltage is of vital importance.

Since the breaking of the secondary or high potential circuit enhances rather than removes the hazard, it is the primary object of this invention to provide a circuit breaker that is actuated by the excess voltage in the secondary circuit, as caused by a defective tube, to cause a permanent break in the primary circuit.

Another object of the invention is to provide means whereby the circuit breaker may be manually actuated to close the break in the secondary circuit when the defective tube has been replaced so that the new tube may be easily and readily placed in service. It is desirable that said means be of such a simple nature that in localities where the manufacturers service is not readily available, the ordinary layman should be able to replace the tube and reset the device even though he may not possess any technical knowledge of electricity.

A further object of this invention is to provide a circuit breaker of the character set forth that will be superior in the point of simplicity, inexpensiveness of construction, positiveness of operation, and facility and convenience in use and general efficiency.

With the foregoing and other objects in view, which will be made manifest in the following detailed description and specifically pointed out in the appended claims, reference is had to the accompanying drawings for the illustrative embodiment of the invention, wherein:

Fig. 1 is a perspective view of a complete luminescent tube installation, and illustrating the circuit breaker of my invention.

Fig. 2 is a top plan sectional view taken on the line 2—2 of Fig. 1.

Fig. 3 is front sectional view taken on the line 3—3 of Fig. 2 and with the luminescent tube removed.

Fig. 4 is a wiring diagram showing the electric thermostatic circuit breaker of my invention as connected.

Fig. 5 is a detail perspective view showing the manner in which the ends of the circuit breaker are hingedly secured to a supporting structure.

Referring to the accompanying drawings wherein similar reference characters designate similar parts throughout, the various figures described above adequately illustrate my invention, and the following detailed description is commensurate with the above mentioned drawings in enabling an artisan to construct and assemble the constituent parts of the same.

The device involves in its general adaptation a receptacle designated as an entirety by the reference numeral 5. Said receptacle comprises a rectangular hollow box like body 6 having a removable side plate 7. Sockets 8 and 9 are formed in the body of the receptacle 5 at the corners thereof and extend through said receptacle and are terminated at one end thereof by the plate 7. Disposed within the sockets 8 and 9 and positioned at the closed ends thereof, are resilient contacts 11 and 12 formed of a strip of sheet metal bent to substantially a T shape.

Numeral 13 indicates a transformer which is postioned within the hollow receptacle 5 and connected to the contacts 11 and 12 and a source of electricity, it being preferable that the respective sizes of the interior of the box and the transformer be such as to provide a substantially snug fit so as to prevent the transformer from moving about in said box.

A tube filled with gas such as neon at reduced pressure, is indicated at 16 and is formed in the usual manner, of glass tubing bent to any desired shape or configuration. Said tube is provided at its opposite ends with electrodes 17 connected to exposed jack plug terminals 18 secured to the said tube at the ends thereof. It will now be seen that by inserting the ends of the tube 16 in the sockets 8 and 9, the jack plugs 17 will be engaged by the resilient contacts 11 and 12, thereby connecting the electrodes 17 with the transformer 13, which is connected to a source of electricity, causing a discharge from each electrode and thereby illuminating the gas in the tube.

Viewing Fig. 2 of the drawings, it will be seen that the size of the sockets 8 and 9 are such as to provide a relatively snug fit with ends of tube 16 and in this manner the said tube is held substantially rigid with respect to the receptacle 5.

Means are provided for automatically breaking the circuit to the tube 16 when the tube becomes defective in any manner. Said means comprises a circuit breaker comprising a curved strip of bimetallic sheet metal 21 commonly known as thermostatic metal. The thermostatic strip 21 is hingedly mounted at its opposite ends in terminal supports 22 which are attached to the core of transformer 13. A terminal 23 and a contact 24, consists of screw threaded contact screws which extend through threaded openings in a plate 26 of insulating material and also attached to the transformer 13. Normally the terminal 23 is adjusted so that the end thereof is spaced from the strip 21 and the contact 24 is adjusted so as to contact with said strip as is clearly shown in Fig. 2.

In Fig. 5 of the drawings there is shown the preferable method of hinging the strip 21 to the terminal supports 22. This consists in forming a slot 28 in each end of the strip 21 which slot fits loosely in a corresponding V notch 31 formed in each of the terminals 22. The purpose of this construction will be hereinafter set forth.

Viewing Fig. 4 the transformer 13 consists of a primary winding 32 and a secondary winding 33. The winding 32 is connected to a wire 34 leading to a source of alternating current supply. A second wire 36 connects with one of the two terminals 22 which are in electrical contact with and support the themostatic strip 21.

The thermostatic strip 21 is composed of a thin strip of brass 37 and a similar strip of invar metal 38 welded to form a single piece in such a manner as to have one face of brass and the opposite face of invar metal. The coefficients of linear expansion of these two metals are different and it is well known that a change in temperature of the strip 21 will cause a change in its curvature. This change in curvature will cause the strip to move suddenly to a new position as indicated by the dotted line position in Fig. 4. The compound curvature of the strip 21 in combination with the slots provided in its ends and the notches in the terminals 22, causes it to remain in its new position even after its temperature has returned to normal. In moving from the solid line position to the dotted line position the strip 21 is not stressed beyond its elastic limit and therefore suffers no permanent change in shape. Consequently, it may be returned to its original position. Means are provided for returning the strip 21 to its original position said means comprising a button 41 slidably mounted in a socket 42 formed in one side of the casing 6 so as to extend transversely of the strip 21. A coil compression spring 43 normally holds the button 41 in extended position as clearly shown in Fig. 2. The motion of the button 41 is limited to that sufficient to return the strip to its original solid line position.

In Fig. 4 the secondary 33 of the transformer 13 is connecter to the terminals of the luminescent tube 16, by a wire 42 which connects to one end of said tube, and to the other end of said tube through a wire 43 which connects with the contact 24 which in turn connects with the strip 21 and through a wire 44 connecting the terminal 22 with the end of said tube. A spark gap to the thermostatic metal is placed in parallel with the luminescent tube by means of the wire 43 which connects to the contact 24 and a second wire 46 which connects to the terminal 23 spaced from the strip 21. The transformer shown in the drawings is of the type known as the auto transformer, having one end of the primary and secondary windings connected as by a wire 51. Should both ends of the secondary be free a second terminal similar to the terminal 23 is provided for connecting to the other end of said secondary winding.

The luminescent tube 16 is filled with gas at or near its best conducting state. The length of spark formed by the strip 21 and the terminal 23 is adjusted so that the operating voltage of the tube is not sufficient to bridge the gap. Should the voltage operating the tube become excessive either because of increasing vacuum within the tube or because of breakage of the tube a spark will occur between the strip 21 and the terminal 23 and the heat thus given the thermostatic strip, will cause it to move to the dotted line position shown in Fig. 4 breaking the primary circuit at 24.

It is of vital importance that the strip 21 have a compound curvature such as that illustrated. Should the strip have a simple curve and if it is longer than the distance between the supporting terminals 22 the strip in moving will pass from a convex inward to a convex outward position. As the temperature returns to normal, the strip, unless it be a very long one, will return to its original position automatically, unless it be free to alter its angular position of contact with the terminals 22. It will thus fail to accomplish its purpose of providing a permanent break in the primary circuit unless such provision for angular displacement at the ends be made.

When the thermostatic strip 21 possesses a compound curvature and is properly hinged at the ends it may be caused by rise in temperature to pass suddenly and permanently from the full line position in Fig. 4 to the dotted line position. It is carefully adjusted so that atmospheric temperatures will not cause it to move and when once moved it will not return to its original position although the temperature returns to normal.

In the drawings the spark gap terminal 23 is positioned so that the heat will be applied at a point where the metal whose expansion coefficient is the greater lies on the convex side of the center curve in the thermostatic strip 21. When the heat is applied at this point the strip will move faster than when the heat is applied at a point where the opposite curvature exists. This has been proven by careful experiment.

From the foregoing it is thought that the construction, use, and many advantages of the herein described circuit breaker will be adequately understood. It will be further understood that certain material alterations in the construction may be effected without having a deleterious effect upon the efficiency of the device. The minor details of construction will at all times of course be performed within the scope and spirit of the sub-joined claims.

Claims:

1. In an automatic circuit breaker, in combination, a stationary contact member, a movable contact member normally contacting with said stationary contact, comprising a strip of thermostatic metal hingedly mounted at its ends, and a spark terminal spaced from said movable contact member and forming a spark gap therebetween.

2. In an automatic circuit breaker, in combination, a stationary contact member, a movable thermostatic contact member, comprising a strip formed of two strips of metal having different coefficients of linear expansion, means for hinging said strip at the ends thereof, and a spark terminal spaced from said strip and positioned so as to form a spark gap between said terminal and the strip of metal.

3. In an automatic circuit breaker, in combination, a stationary contact member, a movable thermostatic contact member, comprising a strip formed of two strips of metal having different coefficients of linear expansion, said strip being formed with a compound curvature, means for hinging said strip at the ends thereof, and a spark terminal spaced from said strip and positioned so as to form a spark gap between said terminal and the strip of metal.

4. In an automatic circuit breaker, in combination, a stationary contact member, a movable thermostatic contact member, comprising a strip formed of two strips of metal having different coefficients of linear expansion, said strip being formed with a compound curvature, means for hinging said strip at the ends thereof, and a spark terminal spaced from said strip and positioned so as to form a spark gap between said terminal and the strip of metal, and at a point where said strip of metal is concave with respect to the metal portion having the lower coefficient of expansion.

5. In an automatic circuit breaker, in combination, a stationary contact member, a movable thermostatic contact member comprising a strip formed of two strips of metal having different coefficients of linear expansion and formed with a compound curvature, said strip being formed at each end with a slot for engaging corresponding V notches formed in terminal members provided for hingedly supporting said ends, a spark terminal spaced from said strip and positioned so as to form a spark gap between said terminal and the strip of metal, whereby a spark from said terminal will cause said thermostatic strip to move from said stationary contact, and manually operated means for engaging said strip and reengaging said contacts.

In testimony whereof I have affixed my signature.

LLOYD T. JONES.