Nov. 4, 1930. C. A. MARTIN 1,780,202

CIRCUIT BREAKING DEVICE

Filed Nov. 26, 1928

Fig. 1

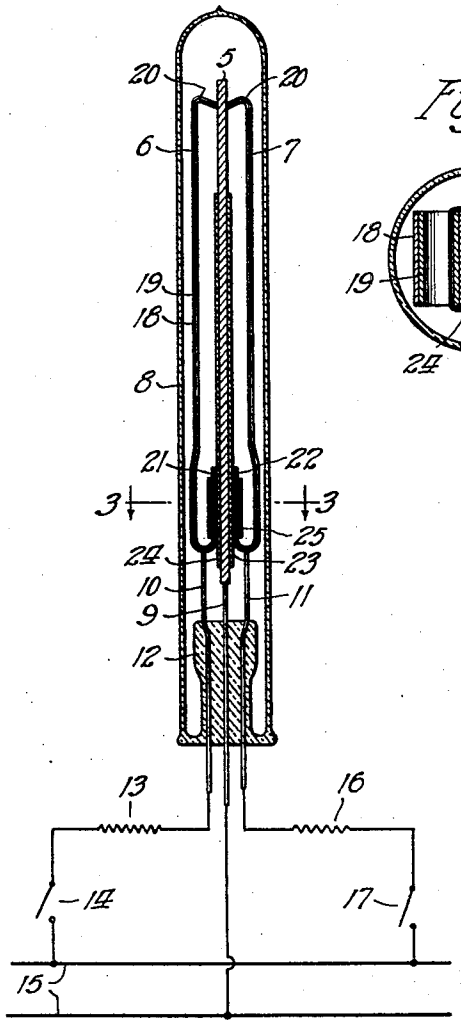


Fig. 3

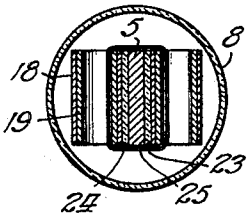
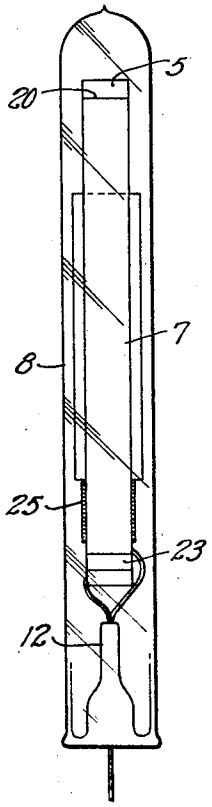


Fig. 2



Inventor
Charles A. Martin

By Jabel & Banning Attys.

Patented Nov. 4, 1930

1,780,202

UNITED STATES PATENT OFFICE

CHARLES A. MARTIN, OF CHICAGO, ILLINOIS

CIRCUIT-BREAKING DEVICE

Application filed November 26, 1928. Serial No. 321,904.

My invention relates to circuit controlling or breaking devices and more particularly to a device of this character which is adapted to be inserted in an electric circuit to open or close the circuit in response to the changes in the temperature of said device.

One of the objects of this invention is to provide a thermostatic circuit controlling device adapted to be inserted in an electric circuit for securing rapid contact or separation of electrical contacts by magnetic means operating in conjunction with heat responsive means to bring about contact or separation of the electrical contacts controlling an electric circuit.

It is also a purpose of this invention to provide in a device of this character means for enclosing the contacts and the associated magnetic means and heat responsive means in an atmosphere that will prevent oxidization of the contacts due to the making or breaking of an electric current carrying circuit.

More particularly my invention consists of the provision of a magnet and a bimetallic thermostatic element which are adapted to be connected in an electric circuit in such manner that at normal working temperatures the circuit is completed through the bimetallic element and the magnet and upon a rise in the temperature above a predetermined value, the bimetallic element is adapted to move away from the magnet at its contacting point due to the unequal expansion of the component metals making up the element.

The magnetic attraction of the magnet in a device of this character holds the contacts securely together until the force exerted by the unequal expansion of the metals in the bimetallic element create a great enough force to overcome the magnetic attraction whereupon the contacts snap apart. Since the magnetic attraction between the magnet and the bimetallic element increases rapidly as the two are brought closer together and has its maximum when the contacts are in engagement, it is obvious that a very rapid separation or closing of the contacts is obtained by these elements.

It is a purpose of this invention to provide a device of this character in which the elements are so arranged as to obtain the maximum utility of the magnetic attraction by reducing the reluctance of the magnetic path between the opposite poles of the magnet. To accomplish this purpose with small elements which may be readily utilized in small spaces and to obtain a long life for the device, I preferably utilize a bimetallic element which consists of a strip of magnetic metal and a strip of non-magnetic metal having a greater coefficient of expansion than the magnetic element and so associate them with the magnet as to bring the magnetic metal into close relation with the opposite poles of the magnet to thereby reduce the gaps in the magnetic circuit to a minimum.

It is also a purpose of this invention to provide a device of this character wherein the magnet and the thermostatic element are supported in proper relation within a sealed vessel by means of the lead in conductors which serve to connect the circuit controlling device in an electric circuit.

It is also a purpose of this invention to provide a device of this character which may be readily sealed in a closed vessel and wherein the magnet may be utilized for controlling a plurality of electric circuits by combining therewith a plurality of thermostatic elements.

Other objects and advantages of the invention will appear as the description proceeds in connection with the accompanying drawing wherein the preferred form of my invention is illustrated. It is obvious, however, that various modifications may be made in the detailed structure without departing from the spirit of the invention and it is to be distinctly understood that I intend to avail myself of all such modifications as fall within the scope of the claims.

In the drawings:

Fig. 1 is a sectional view of my circuit breaking device showing the same applied to a plurality of electric circuits;

Fig. 2 is a side view of the device; and

Fig. 3 is a section on the line 3—3 of Fig. 1.

Referring now in detail to the drawings, my invention consists essentially of the elon-

gated bar magnet 5 and the bimetallic elements 6 and 7 secured to opposite sides of the magnet 5 in a manner which will presently be described. This structure is then enclosed by means of the glass tube 8 in a non-oxidizing atmosphere which is preferably hydrogen gas although other gases having similar characteristics may be used.

As shown in Fig. 1, the circuit making and breaking structure, consisting of the magnet 5 and thermostatic elements 6 and 7, is supported by means of the wires 9, 10, and 11 which connect to the magnet 5, thermostatic element 6, and element 7 respectively. These wires extend through the stem or press 12 of the tube and form terminals at the exterior of the tube for connecting the device in an electric circuit.

As shown the magnet 5 and thermostatic element 6 are connected in series with a heating resistance 13 and controlling switch 14 across a source of electric current indicated generally by the numeral 15. Similarly the magnet 5 and element 7 are connected in series with the heating resistance 16 and circuit controlling switch 17 across the same source of current.

The bimetallic elements 6 and 7 are substantially duplicates both in their construction and in the manner of securing them to the magnet 5. These elements consist of the metallic strip 18 which is preferably of a magnetic metal such for instance as iron and a strip 19 consisting of a non-magnetic metal such for instance as brass having a greater coefficient of expansion than the magnetic metal 18. At the upper end of the magnet 5 these elements are turned in as at 20 to make contact directly with this end of the magnet. It will be noted that these turned in portions bring the outer magnetic metal strips of the elements directly into contact with the magnet when the circuits are closed in the normal position of the device. At the lower end of the magnet as shown in Fig. 1, the bimetallic elements are turned in toward the magnet and then extended upwardly substantially parallel thereto as indicated by the portions 21 and 22. A pair of strips of insulation 23 and 24 are placed between the magnet and the bimetallic elements to insulate them so far as the flow of current between the magnet and the elements at this point is concerned. The elements are then secured in place by means of a cord 25 wound therearound along the rebent portions 21 and 22. This serves to firmly mount the elements in position on the magnet and forms a very compact structure.

It will be noted from the preceding description that the magnetic circuit between the opposite ends or poles of the magnet is substantially closed by means of the magnetic strips 18 which normally contact with the magnet at the upper end thereof and which at the lower end thereof are separated from the magnet only by the thin strips of insulation 23 and 24. This makes the reluctance of the magnetic circuit very low and serves to prolong the life of the magnet as well as to obtain a maximum of magnetic attraction at the upper end of the magnet for drawing the thermostatic elements into engagement therewith.

In order to reduce the size of this device sufficiently to make it a practical circuit controlling device for small currents that can be inserted in small spaces, it is necessary to use a very small magnet, and I have found that to obtain a long life for the magnet, it is better to construct it in the elongated bar form shown in the drawing. This enables me to use comparatively long bimetallic strips so that the change in temperature necessary to cause them to separate from the magnet a sufficient distance to break the circuit is not too great. Also, the elongated magnet has a longer life than a short heavy magnet would have with the same amount of material and this, of course, is essential in a device of this character.

The provision of the hydrogen gas filling prevents any oxidization or forming of carbon on the contact points due to the arcing of the current across the gap when the circuit is open. In this manner substantially clean and bright contacts are maintained at all times which not only makes a good electrical contact, but also maintains the magnetic reluctance of the path between the poles of the magnet substantially the same so that a substantially constant attraction of the thermostatic elements is obtained from the magnet. This would not be the case if the contacts were permitted to oxidize by sparking since that would soon build up a carbon layer between them and this would greatly reduce the magnetic attraction thus slowing down the opening or closing of the contacts.

From the above description it is thought that the construction and advantages of this invention will be clear to those skilled in this art, and having thus described my invention what I desire to secure by Letters Patent of the United States is:

1. A thermostatic control device for electric circuits, comprising a thermostatic make and break switch including a bimetallic element and a magnet, a sealed receptacle in which said switch is enclosed and conductors extending from said element and said magnet to the exterior of said receptacle for connecting said switch in an electric circuit.

2. A thermostatic control device adapted to be inserted in an electric circuit for opening and closing the circuit in response to changes in temperatures of said device, comprising a sealed vessel having lead in conductors extending through the wall thereof, a

magnet in said vessel, a thermally responsive means composed in part of magnetic material associated with said magnet and normally held in contact therewith by magnetic attraction but adapted to separate therefrom when the temperature of said device exceeds a certain value, said magnet and means being electrically connected with said conductors.

3. A circuit controlling device comprising a closed vessel having a non-oxidizing gaseous filling, a magnet therein, a bimetallic thermostatic element therein composed in part of magnetic material whereby it is attracted by said magnet, and lead in conductors extending through said vessel and secured to said element and magnet respectively.

4. A circuit controlling device comprising an elongated bar magnet, a bimetallic thermostatic element composed of a magnetic metal and a non-magnetic metal, said magnet and element being secured to but insulated from each other adjacent one end and having contacting faces at the other end thereof, whereby the magnetic circuit between the ends of said magnet is substantially closed by means of said magnetic metal, and means for connecting said element and magnet in an electric circuit.

5. A circuit controlling device comprising an elongated bar magnet, an elongated bimetallic thermostatic element composed of a magnetic and a non-magnetic metal and having one end thereof insulatingly mounted on said magnet adjacent one end thereof with the magnetic metal between the magnet and the non-magnetic metal at the said end, said element and magnet having contacting faces at their free ends normally in contact but adapted to separate upon a rise in temperature of said device above a predetermined value.

6. A circuit controlling device comprising an elongated magnet, a bimetallic thermostatic element composed of a magnetic metal and a non-magnetic metal having a greater co-efficient of expansion than said magnetic metal, one end of said element being insulatingly secured to one end of said magnet with the magnetic metal between the magnet and the non-magnetic metal, said element being bent to extend toward the other end of said magnet whereby the non-magnetic metal lies between the magnet and the magnetic metal intermediate the ends thereof, the free ends of said element and magnet having cooperating contact faces and means for connecting said magnet and element in an electric circuit.

7. A thermostatic control device for electric circuits, comprising a thermostatic make and break switch including a bimetallic element and a magnet, a sealed receptacle in which said switch is enclosed and conductors extending from said element and said magnet to the exterior of said receptacle for connecting said switch in an electric circuit, said conductors supporting said switch in spaced relation to said receptacle.

8. A circuit controlling device comprising a closed vessel having a non-oxidizing gaseous filling, an elongated bar magnet therein, a bimetallic thermostatic element therein composed in part of magnetic material whereby it is attracted by said magnet, said magnetic material in said element extending substantially from one pole of said magnet to the opposite pole thereof to complete the magnetic circuit therefor, and lead in conductors extending through said vessel and secured to said element and magnet respectively.

In witness whereof, I hereunto subscribe my name this 14th day of November, A. D. 1928.

CHARLES A. MARTIN.