Sept. 5, 1933. B. P. BAKER 1,925,858

ARC EXTINGUISHER STRUCTURE

Original Filed Jan. 23, 1929

Fig. 1.

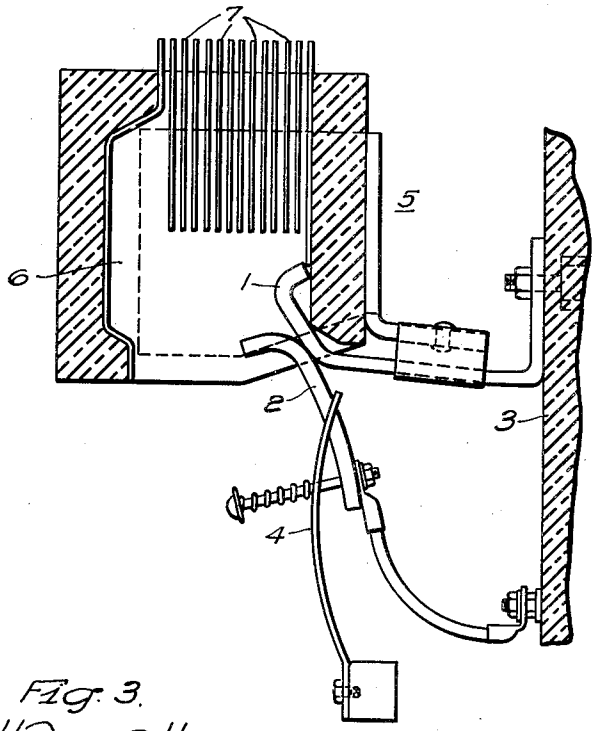


Fig. 2.

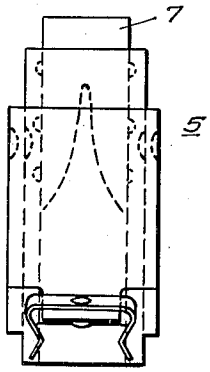


Fig. 3.

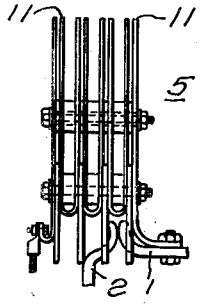


Fig. 4.

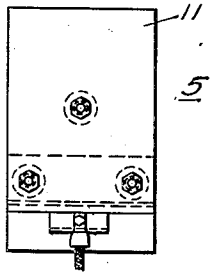


Fig. 5.

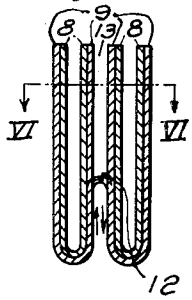
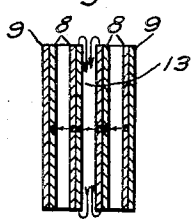


Fig. 6.



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UNITED STATES PATENT OFFICE

1,925,858

ARC EXTINGUISHER STRUCTURE

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Application January 23, 1929, Serial No. 334,442
Renewed September 30, 1930

6 Claims. (Cl. 200—144)

My invention relates to electrical circuit interrupters and particularly to arc-extinguishing devices therefor.

One object of my invention is to provide a plurality of grids or plates for arc-deionizing structures, each plate comprising a conducting material for the current and a magnetic material for strengthing the flux thereabout.

The structure disclosed in application, Serial No. 251,867, filed February 4, 1928, by Slepian, Baker and Todd and the patent to Todd, No. 1,888,707, issued Nov. 22, 1932, and assigned to the Westinghouse Electric & Manufacturing Company, are examples of circuit interrupters having means comprising spaced metallic plates for deionizing the arc established upon the opening of a pair of cooperating contact members. While some of these plates were constructed from materials having high conducting properties, others were made of magnetic materials having a lesser degree of conductivity. The plates so constructed provides satisfactory operation in the service for which they were intended and, while one had the advantage of providing a good conducting path for the arcs, the other, although it lacked this advantage, avoided the necessity of requiring a separate magnetic structure to provide a strong magnetic field for moving the arcs.

It is a further object of my invention to combine the materials having the magnetic and the high conducting qualities found in the above structures to provide a plate that shall have both the high degree of conductivity for the current and the arc and the proper magnetic characteristics which cause the current and arc to be rapidly moved thereon.

With the foregoing objects in mind, my invention will readily be understood by referring to the following specification, taken in connection with the accompanying drawing, in which,

Figure 1 is a view, partly in section and partly in elevation, of a circuit interrupter embodying my invention.

Fig. 2 is an end view in elevation of the structure shown in Fig. 1.

Fig. 3 is a view, in elevation, of a modified type of arc extinguishing device embodying my invention.

Fig. 4 is a side view of the strcture shown in Fig. 3.

Fig. 5 is a sectional view of an embodiment of my invention disclosing the relation of the current path to the magnetic flux in its vicinity.

Fig. 6 is a sectional view taken along the line VI—VI of Fig. 5.

My invention comprises, in general, a stationary contact 1 cooperating with a movable contact 2, the two contacts being respectively supported on a base 3 and an operating arm 4, in a manner well known in the art. Since the particular contactor structure herein shown, including the separable contacts and the operating mechanism, is not a part of the present invention, any other means, well known in the art to be suitable, may be employed in its stead.

The contacts 1 and 2 have associated therewith an arc-deionizing device 5 comprising a refractory insulating chamber 6 containing spaced metallic plates 7. These plates are employed to break up the arc, established upon the separation of the contacts 1 and 2, into a plurality of small arcs that are moved in the spaces between the plates and are thereby deionized and extinguished.

It has been the practice, in certain devices employing deionizing chambers of the same general nature as chamber 6, to provide a magnetic-blowout device to force the arc upwardly into the spaces between the plates and to move it rapidly therein.

In other similar arrangements, the plates 7 have been made entirely of magnetic material so that the employment of blowout devices of the character just described was unnecessary.

When current flows through the structure last described, the magnetic flux between the plates is strengthened by the magnetic material constituting a portion of its path, with the result that the arc is moved rapidly across the surfaces of the plates. While the latter arrangement is an improvement over the former, for certain fields of service, for certain other fields of service it has been found disadvantageous because of the poor current-conducting qualities of the magnetic plates.

According to my present invention, I provide a plurality of plates 7, each of which comprises a middle layer of magnetic material and outer layers of copper. The middle layer being of iron or other material having magnetic properties, while the outer layers are of materials having a high electrical conductivity; such, for example, as copper. A grid of the above-described construction will present a better path of travel for the current and the contact portions of the arc than will the magnetic material, while, at the same time, the thermal properties thereof will

be substantially the same as those of a plate of solid conducting material.

Referring to Fig. 3, the plurality of plates 11 of the deionizing structure 5 are of U-shape and spaced apart to form channels into which the arc is propelled. As the current travels only over the outsides of plates 11, there is no advantage in employing plates that have both surfaces covered with conducting material. I prefer, therefore, to construct each plate 11 of a layer of iron or other magnetic material that has only one of its surfaces covered with a layer of metal having high electrical and thermal conductivity. This plate is bent to form the U-shape grid, the iron surfaces being on the inside thereof, adjacent to each other.

In the case of a grid formed of magnetic material having one or both of its surfaces faced with copper, the copper may be welded to the iron and drawn out, or rolled out, into sheets of the desired thickness, which is a process similar to that used in the manufacture of copper-clad iron wire. An electroplating process may also be employed, if desired, to form a conductive layer upon the iron base. Either process will permit the construction of grids of the type herein disclosed that are no thicker than the plain grids heretofore employed.

The plates 7, in Figs. 1 and 2, as employed in the prior application above mentioned, were constructed entirely of iron because of their advantageous magnetic properties. The advantage obtained in the present application in employing copper surfaces in conjunction with the iron middle layer is primarily a thermal one. It was found that, when iron plates were employed, the arcs would, in certain fields of service, evolve metallic vapors because of the excess heating of the metal plates. This was caused by the slowing up of the arc movement and the poor conductivity of the plates. To meet these special conditions and to retain the magnetic effects of the plates, the present invention provides the middle layer of iron having the layers of copper or other good conducting material associated therewith. The thermal properties of a plate of the character just described are practically the same as those of a plate constructed entirely of copper, and, in the present instance, instead of metal vapors being evolved, the heat will be quickly conducted away from the contacting portion of the arc and no vaporization of the metal will take place.

Referring to Figs. 5 and 6, which illustrate the form assumed by the magnetic field tending to deflect the arc into the spaces between the plates shown in Fig. 3, the path of the current is indicated by arrows passing along a conducting layer 9 through an arc 12 and back along the surface of the adjacent conducting layer 9. The current, upon passing downwardly through the conducting layer of one leg of the plate, flows around the U-shape portion thereof and travels upwardly in the conducting layer of the other leg. Such an arrangement provides a magnetic field about the conducting layers in each space 13, that exerts a propelling force upon the arc therein to move it upwardly in the space.

The magnetic material 8 provides a return path for the flux about the conducting layer 9, thereby strengthening the field in the space 13 between the plates and increasing its driving effect on the arc. The magnetic fluxes, due to the currents in the two adjacent plates, will be seen to add their effect in the space between the plates, as shown by the arrows in Fig. 6, thereby producing a strong magnetic field in the spaces. This strengthened field in the space 13 produces a driving force on the arc which rapidly propels it upward across the face of the conducting material 9.

It will thus be seen that I have provided a grid for a deionizing chamber that has, integral therewith, a layer of magnetic material for strengthening the field about the conducting layer, which thereby supplies both the conducting and magnetic medium necessary for the rapid movement and extinction of the arc.

While I have illustrated and described only two embodiments of my invention, it will be apparent to any one skilled in the art that other arrangements than those herein illustrated may be made without departing from the spirit and scope of my invention. I, therefore, do not wish the following claims to be limited except to the degree rendered necessary by the prior art.

I claim as my invention:

1. An arc-deionizing structure including a plurality of U-shape plates having the legs of the U lying in different planes spaced from each other, each plate including a layer of magnetic material and a layer of highly conductive material on the outside of the U.

2. An arc-deionizing structure including a plurality of U-shape members having the larger surfaces of the legs of the U lying in spaced planes, each having an inner layer of magnetic material that has intimately associated therewith an outer surface of a material having a higher conductivity than said magnetic material.

3. An arc deionizing structure including a plurality of plates positioned in spaced planes, each plate including a layer of magnetic material and a layer of material of higher conductivity than said magnetic material, said plates being electrically connected together in pairs.

4. In a circuit interrupter, means for drawing an arc, an arc-deionizing structure including a plurality of plates, each plate including a layer of magnetic material and a layer of material of higher conductivity than said magnetic material, said plates being integrally joined together in pairs along their edges adjacent the arc-drawing means.

5. An arc-deionizing structure including a plurality of plates positioned in spaced planes, each plate including a layer of magnetic material and a layer of material of higher conductivity than said magnetic material, said layers of material of a higher conductivity on said plates being positioned on opposite sides of adjacent plates, and said layers of material of a higher conductivity being electrically connected in pairs with the layers of magnetic material forming the inside surfaces of said pairs.

6. In a circuit interrupter, means for causing an arc, means for extinguishing the arc including means of sheet metal having their larger surfaces in spaced planes substantially perpendicular to the arc, said means of sheet metal being electrically connected in pairs, and the surfaces of each of said pairs which face each other being of magnetic material, and the outer surfaces of each of said pairs being of a material of higher conductivity than said magnetic material.

BENJAMIN P. BAKER.