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ARC SUPPRESSOR WITH MAGNETIC FEATURE

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6 Claims. (Cl. 200—147)

The invention relates to electric switches or circuit breakers and more particularly to knife switches.

The primary object of the invention is to provide an improved construction for suppressing the arc formed upon the breaking of the circuit.

Another object of the invention is to produce a magnetic suppressing action without the use of coils or other auxiliary devices connected into the main circuit.

A further object is to obtain rapid suppression of the arc by the combined action of closely spaced insulated barrier plates and a magnetic device designed to retain the arc between the plates and diffuse the same to effect quick suppression thereof.

These and other objects are attained by providing the novel features of construction hereinafter more fully described and illustrated in the accompanying drawings, wherein

Figure 1 is a side elevation of a switch;

Figure 2 is a transverse section on the line 2—2 of Figure 1;

Figure 3 is a sectional elevation on the line 3—3 of Figure 2;

Figure 4 is a cross section on the line 4—4 of Figure 2;

Figure 5 is a sectional elevation through a modified construction of switch;

Figure 6 is a sectional plan view thereof on the line 6—6 of Figure 5;

Figure 7 is a cross section on the line 7—7 of Figure 5.

This device comprises the use of closely spaced suppressor or barrier plates A of insulating material with the added feature of a magnetic yoke or blow-out B so arranged as to include interlacing the magnetic circuit with some part of the electrical circuit. The trade term "blow out" is applied to the magnet B but it is to be understood that the arc is actually blown or directed in such a way that it is normally ruptured while retained between the plates rather than blown out of the space therebetween. In the preferred form as shown in Figure 1 the magnetic yoke B is in a substantially U-form, the yoke passing on the outside of the suppressor plates and enclosing same, insulation being provided on the back part by means of an added insulating part C so that no bare parts are exposed to contact with live current-carrying parts or with the arc. The knife blade 10 is hingedly supported by the bracket 11 on the base 12 and the free end 13 of the blade passes between the barrier plates A. 14 is a bifurcated spring contact for engaging the free end of the blade. As shown in Figure 4 the contact is substantially U-shaped having laterally spaced legs 15 return bent toward each other as at 16 to form contact pairs 17 for clamping the switch blade therebetween. The yoke B is so disposed that when an arc is drawn in the mid-portion of the area D enclosed by the barrier plates, this arc will almost immediately by the continued opening of the blade of the switch be caused to pass through or interlace the magnetic yoke B thereby constituting the fractional turn about such yoke and causing the magnetic yoke to be self-excited by its relationship to the path of the current or of the arc.

I find when this is done that the tendency of the magnetic field so excited is to lengthen the path of the current in the yoke by blowing the arc away from the contacts which have broken circuit. As distinguished from blowing the arc towards such contacts this has two effects: first, to prevent the arc from leaving the area enclosed by the arc suppressor plates A unless it so leaves by the most distant or remote opening; and second to increase the length of the arc in a shorter period of time than could be accomplished by the actual mechanical movement of the moving knife blade 10 which is in itself limited in speed by inertia and friction and impelling means.

According to my invention where the barriers are closely spaced on either side of the arcing zone, they provide surfaces upon which the metallic conducting vapors of the arc are deposited out and rendered relatively non-conducting, thereby greatly reducing the conductivity of the vapor within the zone of the arc. This is especially true where the arc is formed between copper contacts. My invention differs radically from the method of lessening the conductivity of an arc by de-ionizing the air or gas within its area. By reason of my combination of the closely spaced suppressors with the magnetic feature, the arc is not only prevented from receding from the zone of the suppressors but is actually impelled to pass through such zone in an elongated path. As evidencing the useful effect of the barrier plates A, I find that a definite color, which in the case of copper contacts is red, is set up upon the face of the barrier plates. This coloration is produced by the condensation of materials from the arc, which materials while in the arc had contributed to its conductivity and had therefore served to prolong the duration of such arc both in respect to time and space occupied. However, it has been proven by tests that, whereas this material when in the arc contributed to the conductivity,

the deposition of the same material upon the barrier surfaces is non-conducting to such a degree as to answer all tests which would be applied to an insulator. For instance, not only the deposit formed after a single flash of the arc but accumulated deposits formed by 6000 such flashes in succession superimposed upon each other will withstand an alternating current electrical voltage between points one-half inch apart upon the surface of such material of 5000 volts to 7000 volts before flashing, whereas such flashing would occur between similar points suspended in air at approximately 3000 volts.

While my invention in its broader aspects may be embodied in constructions utilizing barrier plates of any insulating material, I have found that certain types of materials are far superior to others and I have also found that there is a marked difference between certain materials that are ordinarily considered equally insulating and equally arc resistant.

Thus my preferred materials are compositions compressed to ordinary commercial densities and containing asbestos together with Portland cement, magnesite cement or lime or unglazed porcelain. Of lesser value for use in my improved construction are fibre, bakelite, impregnated materials and compositions of asbestos and China-wood oil or other oils adapted to harden and set. These last materials where use in my combination do not result in as effective a deposition or condensation from the arc. Thus in practicing my invention care should be taken to select insulating materials which when used for the closely spaced barrier plates in conjunction with the magnetic arrangement will cause condensation of particles from the arc. The preferred materials above mentioned are the best for this purpose but it is to be understood that the invention is not limited to the specific materials.

It is also to be noted that the air gap portion of the magnetic circuit shall be at the zone of the arc, and the closed portion C, if any portion be closed, is remote from such relation to the circuit and is in the general direction toward which it is desired to impel the arc. The pole pieces E of the magnetic yoke are so located as to include a portion of the circuit containing the arc and to concentrate the magnetic field at the arc zone, therefore not only exciting the magnet by such relation but rendering it certain that the arc will be retained within the area of such device or expelled in the most useful direction.

In the modified construction illustrated in Figures 5, 6 and 7 the invention is shown as applied to a contactor type of switch. However, in order to preserve the important feature of my invention which involves the maintenance of the barrier plates closely adjacent, I have modified the arrangement of the contactor arms so that they move edgewise through the space between the barrier plates and utilize the edge of the blade for striking the fixed contact. Thus, as shown in the drawings, the contactor blade 20 is formed with a twisted portion 21 so that the outer end 22 of the blade lies in a plane transverse to the plane of the inner or supporting end 23. The fixed contact 24 has the contacting surface 25 of greater width than the edge of the contactor with which it engages. As shown, the fixed contact has the downwardly extending flange 26 secured to the upwardly extending flange 27 of the conducting bar 28 by a bolt 29. Thus it will be seen that the edge of the contactor is arranged to strike against the flat face 25 of the fixed contact.

The baffle plates A are closely spaced as in the preceding structure, there being merely sufficient mechanical clearance between the baffles and the sides of the contactor 22. To accommodate the enlarged width of the fixed contact the lower portion of the baffle is formed by the insulating side plates 31 are arranged outside of the fixed contact in order to enclose the same. Thus, while the space surrounding the fixed contact is of enlarged width, the space between the active portions of the baffles is maintained small in order to have the full effect of the magnetic blow out feature.

It is to be noted that in the usual types of contactor switches, a flat face of enlarged width is caused to move into engagement with the fixed contact, whereas in my improved design the contactor is moved edgewise, thereby permitting the close spacing of the baffle plates between which it operates.

The contactor 20 is, as shown, carried by an insulating support 32 which in turn is hinged at 33 on an insulating base 34. The inner end 23 of the blade is pivotally connected to the support by a pin 35 engaging a socket 36. 37 is a spring bearing on the top surface of the portion 23 for maintaining the contactor in resilient engagement with the fixed contact. A flexible lead 38 extends between the inner end 23 of the contactor and a terminal 39 on the insulating base. The contactor may be operated in any suitable manner, either manually or magnetically in the manner well understood in the art.

The magnetic yoke B is arranged in the same manner as shown in the construction first described and it is either arranged to overlie the baffle plates or to be molded thereinto.

What I claim as my invention is:

1. A switch comprising a pair of insulating plates, a stationary contact, a second contact movable between said plates into engagement with said stationary contact, said plates being spaced apart a distance slightly greater than the thickness of the movable contact, and a U-shaped magnet embracing the space between said plates, said magnet having poles of relatively small cross-sectional area adjacent an edge of each of said plates and a closed end adjacent an opposite edge of each plate, said stationary contact being so disposed with respect to said magnet that the arc formed between the contacts is diffused by said poles in the direction of said closed end.

2. A switch comprising a pair of insulating plates, a stationary contact, a second contact movable between said plates into engagement with said stationary contact, said plates being spaced apart a distance slightly greater than the thickness of the movable contact, and a U-shaped magnet embracing the space between said plates, said magnet having poles of relatively small cross-sectional area adjacent an edge of each of said plates and a closed end adjacent an opposite edge of each plate, the width of said magnet being substantially less than the width of said plates, said stationary contact being so disposed with respect to said poles that the arc formed between the contacts is diffused in the direction of said closed end and thereby retained between said plates.

3. A switch comprising a base, a pair of insulating plates mounted on said base, a stationary contact, a knife blade pivoted on said base and movable between said plates into engagement with said contact, said plates being spaced apart a dis-

tance slightly greater than the thickness of the blade, and a U-shaped magnet embracing the space between said plates, said magnet having a closed end, and pole pieces of relatively small cross-sectional area formed at the ends of said magnet, said pole pieces and said closed end being adjacent opposite edges of said plates, said pole pieces being disposed between the pivot of said blade and said closed end, and said contact being disposed between said closed end and said pole pieces.

4. A switch comprising a pair of insulating plates, a stationary contact, a second contact movable between said plates into engagement with said stationary contact, said plates being spaced apart a distance slightly greater than the thickness of the movable contact, and a U-shaped magnet embracing the space between said plates and having a width substantially less than the width of said plates, said magnet being disposed in a plane substantially at right angles to the line of the arc formed between said contacts and substantially centrally of said plates, the magnet having poles of small cross-sectional area at its ends adjacent an edge of each plate and a closed end adjacent an opposite edge of each plate, said stationary contact being contiguous to a portion of said magnet.

5. A switch comprising a pair of insulating plates, a stationary contact, a second contact movable between said plates into engagement with said stationary contact, said plates being spaced apart a distance slightly greater than the thickness of the movable contact, and a U-shaped magnet embracing the space between said plates, said magnet having poles of relatively small cross-sectional area and a closed end, said stationary contact being so disposed with respect to said magnet that the arc formed between the contacts is diffused by said poles in the direction of said closed end and retained between said plates.

6. A switch comprising a pair of insulating plates, a stationary contact intermediate opposite edges of said plates, a second contact movable between said plates into engagement with said stationary contact, said plates being spaced apart a distance slightly greater than the thickness of the movable contact, and a U-shaped magnet embracing the space between said plates, said magnet having poles of relatively small cross-sectional area and a closed end, said stationary contact being so disposed with respect to said magnet that the arc formed between the contacts is diffused by said poles in the direction of said closed end.

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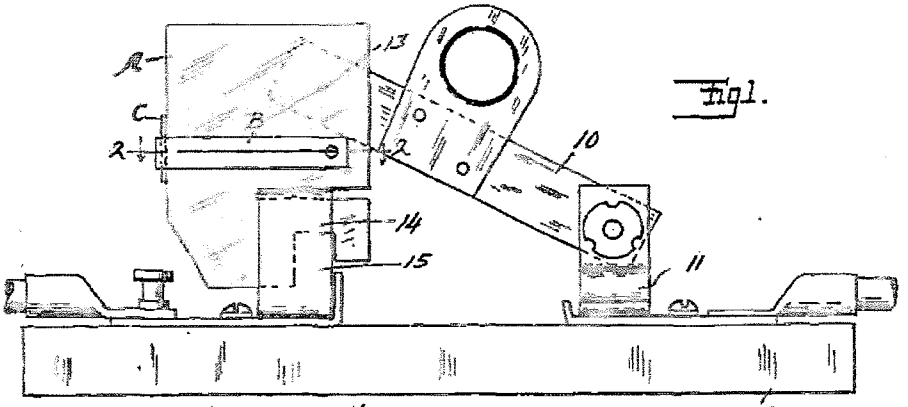

Fig 1.

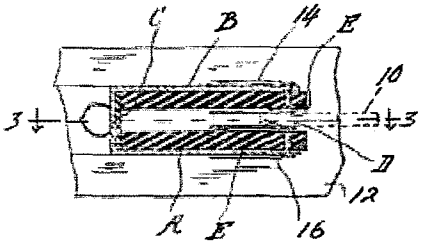

Fig 2.

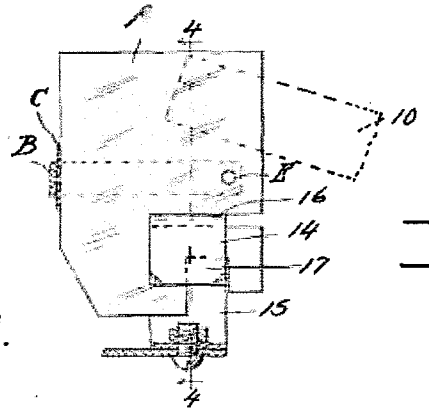

Fig 3.

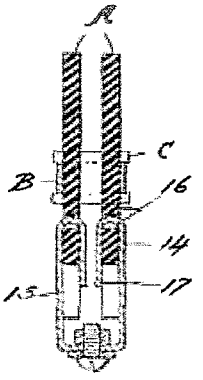

Fig 4.

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