Sept. 24, 1935. O. S. JENNINGS 2,015,561

SWITCH MECHANISM

Original Filed Dec. 13, 1922

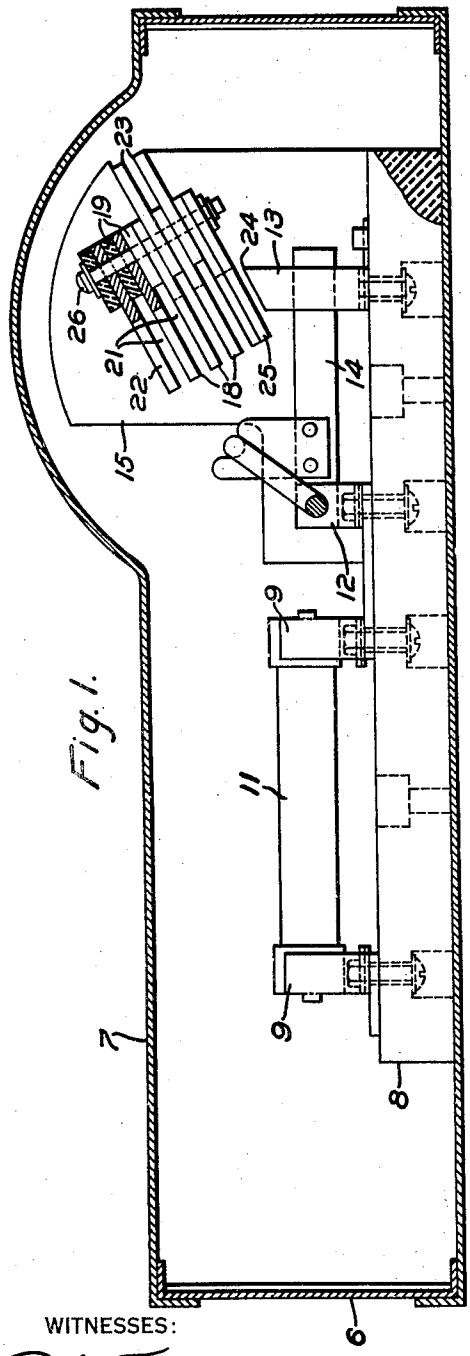


Fig. 1.

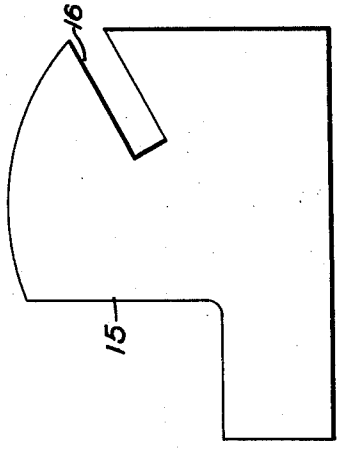


Fig. 3.



Fig. 4.



Fig. 5.

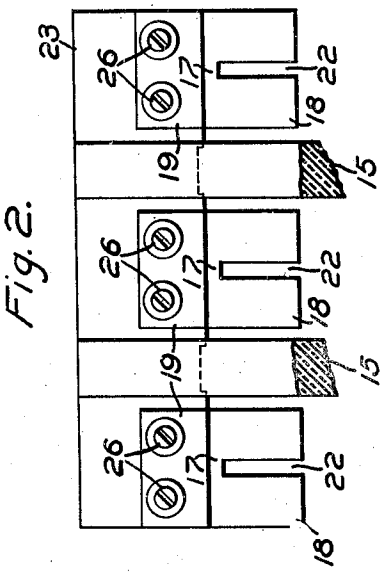


Fig. 2.

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SWITCH MECHANISM

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Continuation of application Serial No. 606,565, December 13, 1922. This application December 16, 1931, Serial No. 581,320

16 Claims. (Cl. 200—144)

My invention relates to switch mechanisms and particularly to switches of the knife-blade type and to enclosed switches.

This application is a continuation of my copending application Serial No. 606,565, filed Dec. 13, 1922.

In my Patent No. 1,630,389, issued May 31, 1927, I have shown an enclosed multi-pole switch having an arc-extinguishing barrier therein through which the free end of the switch blade passes in moving to open position and which consists of a barrier made of insulating material disposed above the contact break jaw of the switch and provided with an enlarged portion having slots registering with the contact jaws and through which the blades operate. The switch jaws are separated by vertically disposed barriers which prevent the arc from flashing over from one jaw to another.

It has been found that, where the thickness of the barrier is made sufficient to properly cool and extinguish the arc, fine particles of the switch blade that have become fused and separated from the blade are deposited upon the walls and, after long continued usage, the walls of the slot become entirely coated, with the result that the metal serves as a conductor and, consequently, the arc is carried outside of the barrier. This condition greatly reduces the arc rupturing capacity of the switch.

One object of my invention is to provide an arc-extinguishing barrier for knife-blade switches wherein a maximum of cooling surface is presented to the arc when the blade is withdrawn from the break jaw and wherein the deposit of metallic vapor is, in no way, detrimental to the operation of the switch or barrier.

Another object of my invention is to provide a barrier, having the above characteristics, wherein a composite structure is built up of alternate plates of metal and insulating material in such manner that air spaces are provided between portions of the metal plates into which the arc gases incident to the opening of the switch are permitted to expand and therefore are cooled by the extensive surfaces of the plates.

Another object of my invention is to provide an arc-quenching barrier that is inexpensive to manufacture and which is efficient and durable.

Another object of my invention is to provide an arc-extinguishing barrier that is capable of extinguishing an arc within a minimum of time, thereby preventing undue fusion of the break jaws and the switch blade.

A further object of my invention is to provide an arc extinguishing structure which by the use of plates of magnetic material effectively moves the arc in the structure and holds it there during its extinguishment.

These and other objects, that will be made apparent throughout the further description of the invention, are attained by means of the apparatus hereinafter described, and illustrated in the accompanying drawing, wherein:

Figure 1 is a longitudinal section through the switch mechanism, showing the fuse, switch and barriers in elevation;

Fig. 2 is a plan view of the improved barrier construction;

Fig. 3 is an elevational view of a barrier mounted between the contact-jaw members, and

Figs. 4 and 5 are elevational illustrations showing barrier plates arranged in modified positions viewed in the direction of the space between the plates through which the blade passes.

Referring to the drawing, the apparatus includes a metal housing 6 having a metal cover 7 for enclosing the switch mechanism which comprises an insulating base 8, fuse receptacles 9 for receiving a cartridge fuse 11 and switch pivot jaws 12 and contact break jaws 13. The switches of the type illustrated in the copending application referred to above are of the three-pole, knife-blade type and are well known in the art. Switch blades 14 are pivoted to the switch jaws 12 and movable into and out of engagement with the break jaw members 13.

Insulating barriers 15 are secured to the base and disposed between the break jaw members 13 to prevent the arc incident to the separation of the switch blade from the break jaw from flashing from one switch blade to another. The barriers are provided with angularly-disposed slots 16 into which the arc-extinguishing barrier, to be hereinafter described, is inserted in such manner that it is supported by the barriers 15.

The arc-extinguishing barrier comprises three groups 17 of metal plates 18 that are arranged in superimposed relation and separated by insulating strips 19 made of bakelite, micarta, asbestos fibre or any preferred insulating material. The strips are of substantially the same thickness as the plates and serve to support the plates in such manner that an air space 21 is provided between each plate. The plates of each group are provided with slots 22 and the plates are so disposed that the slots 22 are in alinement. The groups of plates are so arranged upon the strips 19 that the slots 22 in the plates 18 are alined with the break jaw members. Consequently, the

free ends of the switch blades 14 pass through the slots 22 in moving to open position.

Certain strips 23 of insulating material are wider than the others and are adapted to be fitted within the slots 16 in the barriers 15 and serve to support the barrier in the position indicated in Fig. 1. In order to protect the innermost plate 18 from the intense heat of the arc immediately adjacent the breaking point 24 of the break jaw members 13, an insulating plate 25, having slots alined with the slots 22, is placed between the innermost plate 18 and the switch break jaw. The metal plates 18 and the insulating strips 19, 23 and 25 are secured together by means of threaded bolts 26, as indicated in Figs. 1 and 2. The metal plates 18 are preferably made of iron or steel because of their cheapness and their high resistance to heat and are plated with copper to prevent oxidation of the iron. Another particularly desirable result is attained when these plates are made of a magnetic material. The effect of the slot then is to so alter the reluctance of the space about the arc path that the arc is almost immediately moved in the plates and held there by the magnetic forces thus set up. This last is especially important because the holding action prevents any possible flashovers to the box or adjacent parts resulting from the arc passing completely through the slots, as sometimes happens when an arc is blown into an arc quenching structure.

It will be apparent from the foregoing that the metal plates are insulated from one another and each group of plates is also insulated from the other. When an arc is drawn between the plate and the break jaw member during the opening movement of the former, it expands laterally between the metal plates and is almost instantly cooled and extinguished by the heat-absorbing surfaces thereof.

It has been found by actual test that, by reason of the cooling action of the plates, due to the extensive cooling presented by the construction herein illustrated, arcs have been extinguished in less than one-hundredth of a second with a relatively large current flowing at high potentials. The arc is extinguished so quickly that repeated severe tests caused no considerable damage to the blades and break jaws.

In Figs. 4 and 5, I have illustrated diagrammatically other arrangements of the plates. In Fig. 4, the plates are disposed at an angle to one another, and in Fig. 5, the plates are indicated as being in staggered relation. It is obvious that the plates may be arranged in a variety of positions for effecting results similar to those incident to the constructions illustrated in Figs. 1 and 2.

While I have described and illustrated several embodiments of my invention, it will be apparent to those skilled in the art that various changes, modifications, substitutions, omissions and additions may be made in the apparatus illustrated without departing from the spirit and scope of my invention, as set forth in the appended claims.

I claim as my invention:

1. In a circuit interrupter, means to establish an arc, arc extinguishing means for said arc comprising a plurality of metal plates having open spaces therebetween, one or more of said plates having openings extending therein from one edge thereof and being of iron for moving said arc in said plates and retaining it therein until extinguished.

2. In a circuit interrupter, a moving contact for establishing an arc, arc extinguishing means for said arc comprising a plurality of metal plates having open spaces therebetween, one or more of said plates having elongated openings extending therein from one edge thereof and said openings being of a width only slightly greater than said contact and said plates being of a ferrous material for retaining said arc therein until extinguished.

3. In combination, means to establish an arc, and arc extinguishing means for said arc comprising a plurality of plates of a ferrous material having ventilating passages therethrough for moving said arc in said arc extinguishing means and opposing motion of said arc out of said arc extinguishing means, said ventilating passages being open at one or more edges of said plates to permit the escape of gas from between said plates.

4. In combination, means to establish an arc, and arc extinguishing means for said arc comprising one or more plates of iron, having narrow, deep slots extending therein from one edge thereof and open spaces therebetween, for moving said arc in said arc extinguishing means and opposing motion of said arc out of said arc extinguishing means.

5. In combination, means to establish an arc, and arc extinguishing means for said arc consisting of a plurality of slotted plates of a ferrous material, having spaces therebetween which are open to permit flow of arc gases out from between said plates in a direction transverse to the arc, for moving said arc in said arc extinguishing means and opposing motion of said arc out of said arc extinguishing means, said slots in all of said plates being aligned.

6. The combination with a movable switch blade and a contact jaw member therefor, of an arc extinguishing structure comprising a plurality of plates of a ferrous material having ventilating passages therethrough, said plates being U-shaped and having portions on opposite sides of the switch blade and being disposed in a plane substantially transverse to the plane in which the switch blade passes in moving to the open position.

7. The combination with a movable switch blade and a contact jaw therefor, of an arc extinguishing structure comprising a plurality of slotted plates of ferrous material, having ventilating passages therethrough, said slots being aligned and having a width only slightly greater than said switch blade which moves therein when passing from the open to the closed position, said plates being disposed in a plane substantially transverse to the plane in which said arc is drawn.

8. The combination with a movable switch blade, said blade moving when opening and closing in a plane determined by its greater transverse and its longitudinal axes, and a contact jaw therefor, of an arc extinguishing structure comprising a plurality of aligned slotted plates of iron, said aligned slots having a depth several times their width, which said width is only slightly greater than the least transverse width of said switch blade which moves therein, said plurality of plates thereby forming a structure having portions on opposite sides of said switch blade, and having open spaces between said plates which permit the free lateral expansion of the arc gases formed within said structure, said open spaces being unobstructed at the edges of said plates

providing means for carrying said gases away from said structure.

9. The combination with a movable switch blade and a contact jaw member therefor, of an arc-quenching device comprising a plurality of spaced plate structures arranged on opposite sides of the switch blade and disposed in a plane transverse to that in which the switch member moves and between the edges of which the switch blade passes in moving to open position with respect to the contact jaw member.

10. The combination with a movable switch blade and a contact jaw member therefor, of an arc-quenching device comprising two rows of superimposed plate structures that are spaced apart and disposed on opposite sides of the switch blade and between the adjacent edges of which the switch blade passes in moving to open position with respect to the contact jaw member.

11. Switch mechanism comprising a contact-jaw member, a switch-blade member movable into and out of engagement with the contact member and an arc-quenching device disposed above the jaw member comprising a heat-absorbing body having a slot extending inwardly from one face of the body through which the switch-blade member moves to open position and having transverse grooves constituting air spaces opening into the said slot for permitting the escape of arc gases laterally between portions of the said body.

12. Switch mechanism comprising a pair of contact-jaw members spaced apart, a switch-blade member for each jaw member, an arc-quenching device disposed above each jaw member, each comprising a heat-absorbing body having a slot through which the switch-blade member moves to open position, and having transverse grooves constituting air spaces opening into the said slot for permitting the escape of arc gases laterally between portions of the said body and a barrier disposed between the said devices.

13. The combination with a plurality of spaced switch-jaw members, movable switch-blade members therefor and slotted barriers separating the switch-jaw members, of an arc-extinguishing barrier comprising superimposed heat-absorbing plates, certain of which are adapted to engage the slots in the first said barriers and to support the other plates of the barrier.

14. The combination with a knife-blade switch having a contact jaw therefor provided with a recess, of an arc-extinguishing member comprising a plurality of superimposed spaced conductive plate structures disposed on opposite sides of the recess and so positioned as to provide a narrow space between the adjacent edges of the plates between which the switch blade passes when moved to open position.

15. The combination with a knife-blade switch having a contact member therefor, of an arc-extinguishing member comprising a plurality of superimposed spaced conductive plate structures disposed on opposite sides of the path of movement of the blade member when being separated from the contact member.

16. In a circuit interrupter, a contact member movable for drawing an arc, means for extinguishing said arc comprising a plurality of conducting plates positioned substantially transversely to the arc and having aligned slots extending from one edge of the plates toward the center thereof and in which said contact member is moved, said plates being of a ferrous material thereby providing a low reluctance path for the flux resulting from the arc current on at least one side of the arc and a path of high reluctance on another side of the arc for controlling the movement of the arc, and said plates having open spaces therebetween opening into said slots to permit radial expansion of the arc gases into said spaces and into contact with the faces of said plates, said spaces being open at one outer edge of said plates to permit escape of said gases from between said plates in a direction transverse to the arc path.

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