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2,098,692

HIGH VOLTAGE SWITCHING DEVICE

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Fig. 1

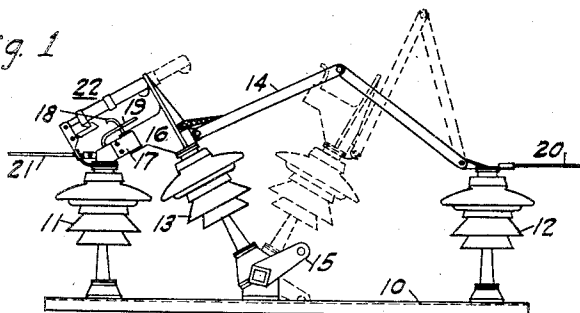


Fig. 2

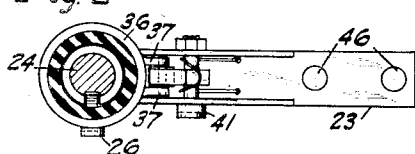


Fig. 5

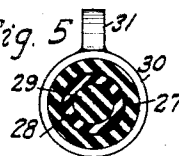


Fig. 3

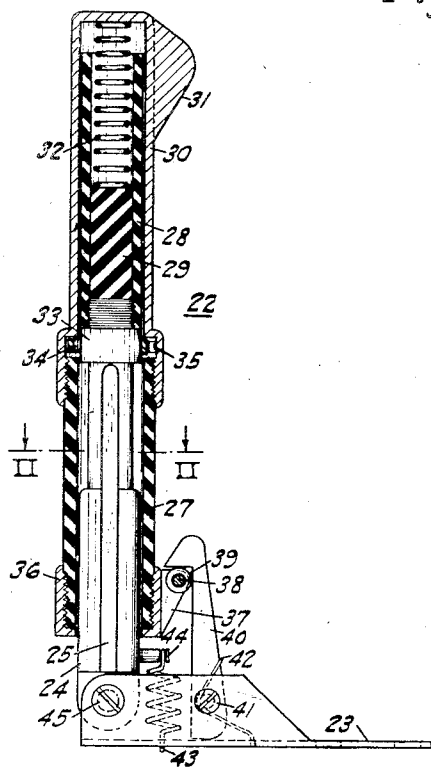
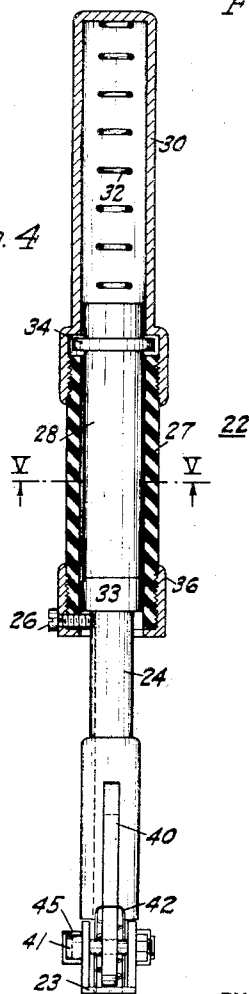


Fig. 4



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HIGH VOLTAGE SWITCHING DEVICE

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5 Claims. (Cl. 200—146)

This invention relates generally to switching equipment for use in connection with electrical circuits, and particularly to those devices known as high tension air-break switches.

5 The present invention is an improvement upon the construction shown in our United States Patent 1,963,413, dated June 19, 1934, for Arc suppressing air break switch.

Among the objects of the present invention 10 may be noted (a) the provision of means for transferring an open-air circuit interrupting arc to a restricted path within a tubular insulator, and subsequently elongating the arc therein; (b) the provision of means for confining the arc 15 during the stretching process within an annular space bounded by insulating material; (c) the provision of gas evolving insulating material for bounding the arc space to assist in arc extinguishment; (d) the provision of an arc sup- 20 pressor so combined with a conventional air-break switch that the operation of the latter in the conventional manner automatically effects the proper functioning of the arc suppressor; (e) the provision of an effective and inexpensive 25 arc suppressor and switching device which is simple in operation and construction.

With the above and other objects in view which appear as the description proceeds, our invention comprises the elements and combina- 30 tions of elements, features of construction and arrangement of parts which will be exemplified in the structures herein described, and the scope of the invention will be indicated in the appended claims.

35 In the description of the embodiment of the invention here presented, specific language will be used for the purpose of facilitating an understanding of its construction and operation, but it will be understood that various changes in 40 the specific construction may be made without departing from the principles of the invention.

In the drawing:

Fig. 1 is a side elevational view of the switching device.

45 Fig. 2 is a sectional view of the arc suppressor embodied in the switching device, taken along the plane indicated by the line II—II in Fig. 3.

Fig. 3 is a side elevational view of the suppressor, shown in section.

50 Fig. 4 is a front view of the arc suppressor, shown partly in section.

Fig. 5 is another sectional view of the arc suppressor, taken along the plane V—V in Fig. 4.

Referring first in detail to the arc suppressor, 55 as illustrated by Figs. 2, 3, 4, and 5, a rod-like

supporting member 24 is pivotally mounted at the lower end thereof, by means of the sup- pressor pivot 45, on the mounting channel 23. The latter is provided with the holes 46, through which suitable fasteners may be passed in order 5 to rigidly mount the device on the top of an insulator, as shown in Fig. 1. To the upper end portion of the member 24, and extending co- axially upwardly therefrom, is secured, by means of cooperating threads, the cylindrical element 10 of insulating material 28. A suitable material for the latter is hard fiber.

An elongated metal cap 30 is loosely fitted over the element 28, and is provided with screw threads at the lower end portion engaging co- 15 operating threads on the fiber tube 27. The elements 30 and 27 provide a housing for the element 28 and the member 24, being disposed in substantial coaxial relation therewith. A lower tube ring 36 is threaded on the lower end por- 20 tion of the tube 27. The housing, including the hollow cap member 30 and the hollow tubular insulator 27, is arranged for reciprocatory movement with respect to the member 24 and the 25 element 28, and is guided and limited in its re- ciprocations by means of the guide screw 26, extending laterally through the lower ring 36 into the longitudinally extending slot 25 of the member 24.

A compression spring 32, one end of which 30 abuts the inner surface of the top of the cap 30, and the other end of which abuts the filler of insulating material 29 within the element 28, is continuously urging the housing outwardly away from the mounting channel 23. For pre- 35 venting such movement of the housing until de- sired, a latch member 40 removably connects the lower tube ring 36 to the mounting chan- nel 23. The ring 36 is provided with a pair of integral, laterally extending spaced ears 37, 40 between which is mounted the latch roller pin 38, and the latch roller 39. The upper end por- tion of the latch member 40 is arranged to hook over the roller 39, and the lower end is pivotally mounted on the mounting channel 23 45 by means of the latch member pivot 41. A latch spring 42 continuously biases the latch member 40 in a direction to maintain the latched posi- tion.

It should be noticed that the supporting mem- 50 ber 24, together with all the elements supported thereby, may be rotated in a counterclockwise direction, as viewed in Fig. 3, about the pivot 45. Such movement is normally prevented by the alignment spring 43, one end of which is attached 55

to the mounting channel 23, and the other to the pin 44, the latter being rigidly secured to the supporting member 24.

It will also be seen that the above mentioned counter-clockwise movement will release the housing from the latch member 40, and permit it to move upwardly away from the mounting channel 23 under the influence of the actuating spring 32. The latter movement telescopes the tubular insulator 27 with respect to the insulating element 28. The position of the various members after this movement is illustrated by Fig. 4.

Referring again to Fig. 3, the upper end of the supporting member 24 is provided with an enlarged portion 33, of slightly less diameter than the internal diameter of the tube 27. A ring 34, of slightly larger diameter than that of the portion 33 of the supporting member 24, is supported at the upper end of the tube 27, and arranged to move therewith. In the closed position, illustrated by Fig. 3, the ring 34 is urged to engagement with the portion 33 by means of the movable contact spring 35, so that the metal cap 30 is electrically connected through the spring 35 and the ring 34 to the supporting member 24.

With this arrangement, a voltage impressed upon the suppressor between the triangularly shaped lateral extension 31 of the cap 30, and the mounting channel 23, will result in a flow of current through the cap 30, the contact spring 35, the movable contact 34, the stationary contact 33, the supporting member 24, and the pivot 45 to the mounting channel 23.

Under such a condition, if the extension 31 is urged in a counter-clockwise direction to release the housing from the latch member 40, a circuit interrupting arc will be formed between the stationary arc suppressing contact 33 and the movable arc suppressing contact 34, as the latter moves with the housing away from the former. This arc is therefore elongated within the annular space between the inner surface of the tube 27 and the outer surface of the element 28. The arc is thus elongated in a space in which the cross-sectional area may be changed without changing the degree of proximity of the arc with the insulating material bounding the arc space. We have found this arrangement to be an unexpectedly effective arc extinguishing structure; for example, under test, substantially zero power factor 60 cycle alternating currents at 8000 volts have been broken with only $1\frac{1}{2}$ inches of arc elongation in a device having a one-inch diameter and an annular space of approximately one thirty-second of one inch. This is about six times as effective as the conventional expulsion fuse tube now in general use. For best results, the arrangement should be such that the spring 32 will quickly actuate the device to the open position. The gases resulting from the action of the arc upon the element 28 and the tube 29 are highly conducting in character, and are therefore vented from the open end of the tube 29 in a direction away from the live parts.

Fig. 1 illustrates our switching device, in which the above described arc suppressor is embodied. The line conductors 20 and 21 respectively terminate at the top of the insulators 11 and 12, the latter being supported in any suitable manner at the respective ends of the mounting base 10. An intermediate insulator 13, arranged to be rocked to and fro in response to movement of the crank arm 15, is connected at the top to the conductor 20 through the pantograph 14. The arrangement

just described is not new, and of itself, is not the present invention.

A stationary contact 17, secured to the insulator 11, cooperates with the movable contact 16, secured to the rockable insulator 13, to provide the contacts of a main current carrying switch. The stationary contact 17 is provided with an upwardly extending arcing horn 18, and the latter cooperates with the arcing horn 19 of the movable contact 16. The arcing horns just referred to perform their well known function of preventing the burning and consequent pitting of the contacts.

The arc suppressor, constructed as above described, and designated in its entirety in Fig. 1 by the numeral 22, is rigidly secured, in any suitable manner, to the top of the insulator 11 with its mounting channel in electrical contact with the contact 17, and so that it extends upwardly in the direction of movement of the arcing horn 19. As the crank arm 15 is rotated, the contacts 16 and 17 first part, and the circuit interrupting arc is initially drawn between the arcing horns 18 and 19. As the opening movement continues, the arcing horn 19 engages the cap extension 31, and the path of the current is then through the arc suppressor 22, which immediately extinguishes the arc previously existing between the arcing horns 18 and 19. A continued opening movement of the crank arm 15 causes the arcing horn 19 to unlatch the arc suppressor, in which the circuit interrupting arc is extinguished, as before described. The broken lines in Fig. 1 illustrate the position of the members when the switching device is in the open position. An upwardly extending integral portion of the movable contact 16 is provided for engaging the outer end of the arc suppressor 22 as the switching device is closed, thus urging the housing of the arc suppressor to the latched position against the bias of the actuating spring 32.

The advantage of the movable housing will be apparent from the fact that this housing forms a part of the arc extinguishing mechanism, avoiding the necessity for a separate housing. It may also be noted that the failure of the arc suppressor will not render the current carrying switch useless, as the arrangement is such that the latter may always be used in the customary manner.

We claim as our invention:

1. In combination, elements constituting a current carrying switch including a stationary insulator, a movable insulator, and separable contacts carried thereby, an arc suppressor swingably mounted on said stationary insulator, said arc suppressor including a cylindrical element of insulating material and a hollow tubular insulator arranged for telescopic movement with respect to said cylindrical element, separable arc suppressing contacts secured respectively to said element and said tubular insulator, latch means maintaining and resilient means opposing the engagement of said arc suppressing contacts, and means cooperating with said movable insulator for swinging said arc suppressor about its mounting for unlatching said tubular insulator and effecting the disengagement of said arc suppressing contacts.

2. In combination, a stationary insulator, a movable insulator, separable contacts carried thereby, an arc suppressor swingably mounted on said stationary insulator, said arc suppressor comprising a cylindrical element of insulating material and a hollow tubular insulator arranged for telescopic movement with respect to said ele-

ment of insulating material, arc suppressing contacts secured respectively to said element and said hollow insulator, movable means for actuating said movable insulator, means responsive to a movement of said movable means in a direction to engage said separable contacts for engaging said arc suppressing contacts, latch means maintaining said arc suppressing contacts in engagement, resilient means urging the arc suppressing contacts to disengagement and the tubular insulator to the telescoped position with respect to the element of insulating material, and means responsive to a movement of said movable means in a direction to disengage said separable contacts for swinging said arc suppressor about its mounting, whereby said latch means is released.

3. In combination, elements constituting a current carrying switch including a pair of relatively movable insulators and separable contacts carried thereby, an arc suppressor swingably mounted on one of said insulators, said arc suppressor including a cylindrical element of insulating material and a hollow tubular insulator arranged for telescopic movement with respect to said cylindrical element, separable arc suppressing contacts secured respectively to said element and said tubular insulator, latch means maintaining

and resilient means opposing the engagement of said arc suppressing contacts, and means cooperating with the other of said insulators for swinging said arc suppressor about its mounting for unlatching said tubular insulator and disengaging said arc suppressing contacts.

4. In combination, elements constituting a current carrying switch including a pair of relatively movable insulators and separable contacts carried thereby, an arc suppressor swingably mounted on one of said insulators, said arc suppressor including a cylindrical element of gas evolving insulating material and a hollow tubular insulator arranged for telescopic movement with respect to said cylindrical element, separable arc suppressing contacts secured to said element and said tubular insulator respectively, latch means maintaining and resilient means opposing the engagement of said arc suppressing contacts, and means cooperating with the other of said insulators for swinging said arc suppressor about its mounting for unlatching said tubular insulator and disengaging said arc suppressing contacts.

5. The structure recited in claim 4, said hollow tubular insulator having gas evolving material disposed on the inner surface thereof.

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