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W. E. PAUL

CIRCUIT INTERRUPTER

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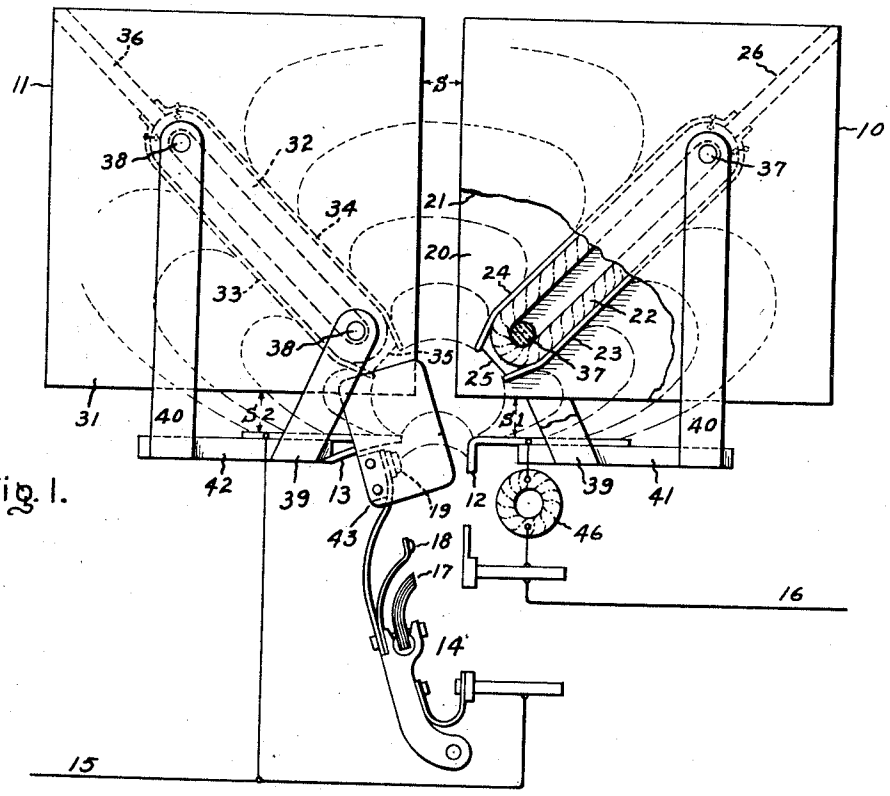


Fig. 1.

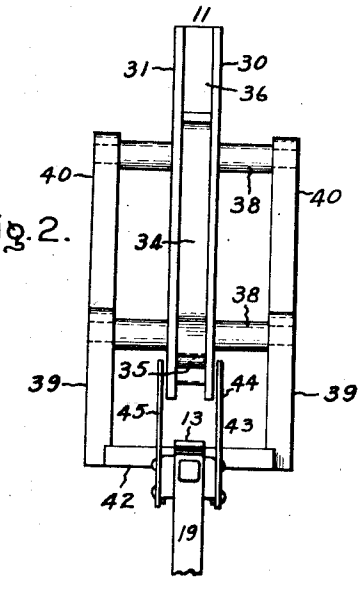


Fig. 2.

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UNITED STATES PATENT OFFICE.

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CIRCUIT INTERRUPTER.

Application filed July 23, 1926. Serial No. 124,506.

This invention relates to circuit interrupters, particularly those having magnetic blowouts for rupturing the arc occurring upon the interruption of the circuit, and the principal object of the invention is to provide an improved form of magnetic arc blowout suitable for high voltage service.

In such service, one of the principal difficulties encountered is the restriking of the arc through the conducting deposits formed in the magnetic blowout arc chute by the gases and vapors produced at the arcing terminals. It has been proposed heretofore to overcome the tendency of the arc to restrike by constructing the blowout chute so as to provide a circuitous leakage path for the arc. Such an arrangement is described and broadly claimed in the Case Patent No. 1,227,385, dated May 22, 1917. The present invention, in certain of its aspects, is an improvement upon the Case arrangement that enables the magnetic blowout to be applied to high voltage circuits and at the same time effectively insures a rapid attenuation of the high voltage arc to the breaking point.

These results are obtained in accordance with my pressent invention by constructing the magnetic blowout of a plurality of non-contiguous arc chutes, each of which is provided with a blowout coil arranged to be inserted in the arc circuit as the arc lengthens. In the preferred form of the invention, a pair of rectangular arc chutes are disposed above the arcing terminals from which the arc emanates in non-contiguous spaced relation with each other, as well as with the terminals, thereby forming a restricted path for the arc with gaps therein between the arc chutes and also between each arc chute and the corresponding arcing terminal. In order to mechanically subdivide the arc and also provide a magnetic blowout field therefor, a blowout coil, preferably of elongated form, is located in each of the rectangular arc chutes with the coil extending diagonally therethrough and substantially radially from the arcing space between the terminals. In this way, the restricted path provided by the arc chutes and the magnetic blowout action produced by the blowout coils serve to rapidly dissipate each of the several portions into which the arc is subdivided by the blowout coils. Furthermore, the gaps existing between the arc chutes and the arcing terminals, as well as the gap between the arc chutes, effectively prevent the establishment of a continuous conducting path between the arcing terminals through metal vapor or other conducting material deposited upon the walls of the arc chutes. The gaps preferably are greater than the striking distance of the voltage of the several corresponding portions of the arc.

For relatively high voltage service where the gaps become large enough to permit the arc stream to escape from the restricted path formed by the non-contiguous arc chutes, I provide, in accordance with my invention, an auxiliary arc chute for temporarily closing the gaps between the arc chutes, as well as between the arcing terminals, and thereby effectively confine the arc stream to the path provided by the arc chutes. However, while the arc is being extinguished, the auxiliary arc chute is removed so that the restricted arc path is broken at the gaps between the arc chutes, to thereby insure against the possibility of restriking the arc.

The accompanying drawing illustrates the invention embodied in a preferred form of magnetic arc blowout for a circuit interrupter suitable for interrupting high voltage power circuits.

Fig. 1 is a side elevation illustrating the construction of my improved magnetic arc blowout and its relation with the circuit interrupter, and Fig. 2 is an end view showing more in detail the construction of the auxiliary movable arc chute employed in the blowout arrangement illustrated in Fig. 1.

Referring to Fig. 1, the magnetic arc blowout in the preferred form shown comprises a pair of arc chutes 10 and 11, which are disposed in spaced relation above the terminals 12 and 13, between which an arc is sprung upon the opening operation of the circuit interrupter 14 which controls the interruption of the circuit including the high voltage supply lines 15 and 16. While the detailed construction of the circuit interrupter or other device whereby an arc is sprung between the arcing terminals 12 and 13 is immaterial as far as the broader aspects of my present invention are concerned, it will be noted that the circuit interrupter 14 is of the usual type having a

main current carrying contact 17 and the primary and secondary arcing contacts 18 and 19, although other suitable forms of circuit interrupters may be employed if desired.

The arc chute 10 is composed of parallel walls 20 and 21 of arc resisting material, such as asbestos board and the like, preferably in rectangular form as shown, within which the blowout coil 22, provided with the arcing terminals 23 and 24, is enclosed so as to form the barrier extending diagonally of the arc chute. The members 25 and 26 of arc resisting material are interposed between the opposite ends of the arcing terminals 23 and 24 so as to complete the barrier structure. The arc chute 11 is of substantially the same construction with the arc resisting walls 30 and 31 enclosing the blowout coil 32, which is surrounded by the arcing terminals 33 and 34 and the insulating members 35 and 36.

In conformance with my invention the arc chutes 10 and 11 are separated from each other by a gap S which is sufficiently greater than the striking distance of the voltage of the arc drawn between the arcing terminals 24 and 34 to effectively prevent restriking of the arc in case the walls of the respective arc chutes should receive a conducting coating from the metallic vapors of the arc. Likewise, each of the arc chutes 10 and 11 is separated from the corresponding arcing terminals 12 and 13 by the gaps S^1, S^2, which are sufficient to prevent restriking of the arc between the terminals 12 and 23 or 13 and 33 under similar conditions.

The arc chutes 10 and 11 may be supported in spaced relation with each other and with the main arcing terminals 11 and 12 by means of the insulating rods 37 and 38 and the spacing members 39 and 40 by which the rods are supported from the insulating base 41 and 42 for the main arcing terminals 12 and 13. The supporting arrangement of the arc chute 10 is shown more in detail in the end view illustrated in Fig. 2, although it will be understood that other suitable means for rigidly holding the arc chutes in operative relation with each other and with the arcing terminals may be employed if desired.

In case the gaps S, S^1, and S^2 become too large in extremely high voltage service, so as to fail to confine the arc to the restricted path provided by the arc chutes, the auxiliary movable arc chute 43 formed by the parallel plates 44 and 45 may be provided for temporarily closing the several gaps between the arc chutes and the main arcing terminals during the initial stages of rupturing the arc. As shown, the auxiliary movable arc chute is mounted upon the secondary arcing member 19 of the interrupter 14 so as to straddle the ends of the arcing terminals 12 and 13, as well as the lower adjacent corners of the arc chutes 10 and 11.

With the magnetic arc blowout arrangement as above described, the opening of the main contact 17 and the primary arcing contact 18 leaves the secondary arcing contact 19 in conducting engagement with the arcing terminal 12, thereby causing the current in the high voltage circuit, including the supply lines 15 and 16, to flow through the series blowout coil 46. Thus, as the arc is drawn between the arcing terminal 12 and the secondary switch contact 19, the blowout action of the coil 46 quickly drives the arc upward into the restricted path provided by the arc chutes 10 and 11. At the same time, the auxiliary arc chute 43 effectively confines the arc and directs it into contact with the arcing terminals 12 and 13, as well as with the lower ends of the arcing terminals 23, 24, 33 and 34, as indicated by the broken line in Fig. 1. This results in the barrier formed by the blowout coil in each of the arc chutes mechanically subdividing the arc into three parts and simultaneously inserting the blowout coils in the arc circuit. The blowout flux set up by the coils then effectively attenuates and dissipates the arc, as illustrated by the broken lines.

As the arc is being expanded until finally broken, the auxiliary arc chute 43 is removed by the continued movement of secondary contact 19 from its initial position sufficiently to insure that the gaps S, S^1, S^2 are opened so as to thereby prevent restriking of the arc across any one of the gaps.

While I have illustrated and described my invention embodied in the preferred form, it will be understood that the arrangement shown may be considerably varied without departing from the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A magnetic arc blowout for interrupting an electric circuit comprising a pair of arcing terminals, a plurality of arc chutes arranged to jointly form a restricted path for the arc from said terminals and each having a blowout coil therein arranged to be inserted in the arc circuit to subdivide the arc as the arc lengthens, said arc chutes being separated from said terminals and from each other with a gap greater than the striking distance of the voltage of the arc therebetween.

2. A magnetic arc blowout for interrupting an electric circuit comprising a pair of terminals for the ends of the arc, a plurality of arc chutes disposed in alignment above said terminals to jointly form a restricted path for the arc therebetween with a gap in the restricted path between the arc chutes

and between each arc chute and the corresponding terminal, each of said arc chutes having a blow-out coil located therein and arranged to be connected in the arc circuit as the arc lengthens for setting up a blowout flux to drive the arc along said restricted path.

3. A magnetic arc blowout for interrupting an electric circuit comprising a pair of terminals for the ends of the arc, a pair of chutes supported in non-contiguous alignment to jointly form a restricted path for the arc from said terminals, said arc chutes being disposed with their edges separated from said terminals and from each other by a gap greater than the striking distance of the voltage of the arc therebetween and each chute having a magnetic blowout coil arranged to be inserted in the arc circuit to set up a flux across said restricted path.

4. A magnetic arc blowout for interrupting an electric circuit comprising a pair of terminals for the ends of the arc, a pair of cooperating arc chutes having a gap between the adjacent edges thereof and disposed in spaced relation with said terminals to receive the arc therebetween, and each having a blowout coil therein arranged to be inserted in the arc circuit as the arc lengthens for jointly setting up a blowout flux for the portion of the arc between the blowout coils and separately setting up a blowout flux for the respective portions of the arc between each blowout coil and the corresponding terminal.

5. In a high voltage magnetic arc blowout for interrupting an electric circuit, the combination of a plurality of arc chutes grouped in spaced relation to form a restricted path for the arc with a gap between the adjacent edges of the chutes and a plurality of blowout coils each provided with arcing terminals to be included in the arc circuit as the arc lengthens and each forming a barrier in a corresponding one of the arc chutes for mechanically subdividing and magnetically attenuating the arc therein.

6. In a high voltage magnetic arc blowout for interrupting an electric circuit, the combination of a pair of substantially rectangular arc chutes disposed in spaced relation to form a restricted path for the arc with a gap between the adjacent edges of the chutes, and a plurality of blowout coils each provided with arcing terminals to be included in the arc circuit as the arc lengthens and forming therewith a barrier extending diagonally through a corresponding arc chute for mechanically subdividing and magnetically attenuating the portions of the arc therein.

7. In a high voltage magnetic arc blowout for interrupting an electric circuit, the combination of a pair of terminals spaced apart for receiving the ends of the arc, and a pair of arc chutes composed of parallel walls of arc resisting material and disposed in spaced relation with said terminals to provide a restricted path for the arc therefrom and each having a blowout coil therein provided with arcing terminals to be included in the arc circuit as the arc lengthens and forming therewith a barrier extending substantially radially of the restricted arc path from the arcing space between said terminals.

8. A magnetic arc blowout for interrupting an electric circuit comprising a pair of non-contiguous arc chutes arranged to form a restricted path for the arc and each having a blowout coil therein arranged to be inserted in the arc circuit as the arc lengthens for jointly setting up an arc blowout flux, and an auxiliary movable arc chute for temporarily closing the gap between said arc chutes.

9. In a high voltage magnetic arc blowout for interrupting an electric circuit, the combination of a pair of terminals spaced apart for receiving the ends of the arc, a pair of non-contiguous arc chutes arranged to form a restricted path for the arc from said terminals and each having a blowout coil arranged to be inserted in the arc circuit as the arc lengthens, and an auxiliary movable arc chute for temporarily closing the gap between said arc chute and said terminals.

In witness whereof, I have hereunto set my hand, this 22nd day of July, 1926.

WILLIAM E. PAUL.