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CIRCUIT INTERRUPTER

Filed July 28, 1926

Fig. 1.

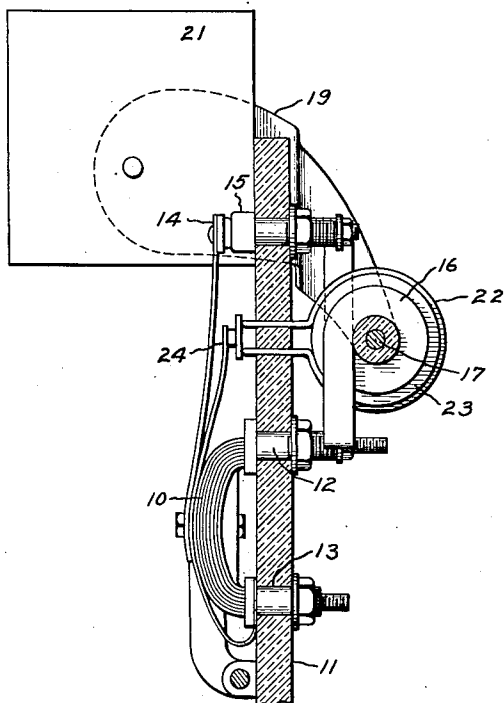
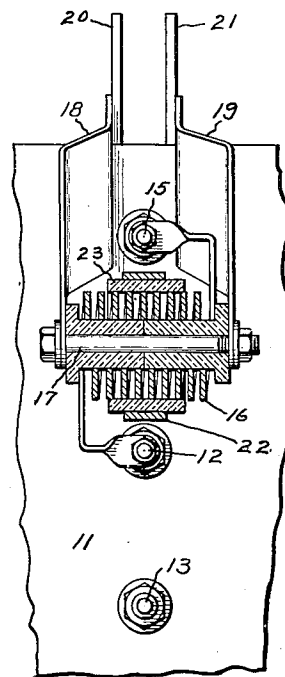


Fig. 2.



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UNITED STATES PATENT OFFICE

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CIRCUIT INTERRUPTER

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This invention relates to circuit interrupters, particularly those having magnetic blowout coils arranged to be connected in the arc circuit for rupturing the arc occurring upon interruption of the circuit.

In an interrupter of the above type it is common practice to arrange the blowout coil so that it is connected in shunt with the main circuit while the interrupter is closed, thereby eliminating a loss of energy in the coil during the normal operating conditions and permitting a coil of relatively small cross section to be used. With such an arrangement the blowout magnet is so connected that it is energized by the current in the arc circuit immediately upon the opening operation of the interrupter. This ordinarily is accomplished by providing the circuit interrupter with an auxiliary arcing contact through which the blowout coil is connected in the circuit after the main current carrying contact is opened. Moreover, the auxiliary arcing contact arrangement is intended to localize the arcing at the auxiliary contact which is subjected to the action of the blowout coil. However, due to the inherent reactance of the blowout coil it frequently happens that a sufficient voltage is impressed upon the main current carrying contacts to cause considerable arcing upon the opening thereof. This results in burning and pitting of the main contact due to the fact that the arcing is not confined to the auxiliary contact.

The principal object of my present invention is to overcome the above difficulty by counteracting or substantially neutralizing the reactance of the blowout coil when it is initially inserted in the arc circuit.

In accordance with the preferred form of the invention, this may be accomplished by providing a closed circuit or winding in inductive relation with the blowout coil so as to effectively counteract or neutralize the reactance thereof. The closed circuit then is arranged to be opened after the main current carrying contact of the interrupter is opened, thereby permitting the blowout coil to supply its full value of blowout flux for dissipating the arc occurring at the auxiliary arcing contact.

The accompanying drawing illustrates a preferred form of the invention embodied in a circuit interrupter having a main and an auxiliary arcing contact suitable for heavy duty power service. Fig. 1 is a side view of the interrupter with certain parts in section, and Fig. 2 is a back view of the interrupter showing more in detail the arrangement of the closed circuit in inductive relation with the blowout coil.

Referring to Fig. 1, it will be seen that the circuit interrupter comprises a main current carrying contact 10, which is pivotally mounted upon the base 11 so as to bridge the main circuit contact terminals 12 and 13. The interrupter also is provided with the auxiliary arcing contact 14, which is arranged to engage with the cooperating arcing terminal 15, before closure of the main contact 10, as well as to disengage the contact 15 after the opening of the main contact.

The blowout coil 16 is connected between the main circuit terminal 12 and the arcing contact 15 so as to be inserted in the arc circuit upon the opening operation of the interrupter. The blowout coil 16, in accordance with the usual practice, is wound about and suitably insulated from the core 17 of magnetic material, from the ends of which the blowout flux conducting plates 18 and 19 extend on the outside of the restricting arc chute formed by the walls 20 and 21. The arcing contact 14 and terminal 15 are enclosed within the restricted arc chute so that the arc drawn therebetween is subjected to the strong blowout action of the flux passing between the plates 18 and 19 through the arc chute.

In order to counteract or neutralize the reactance of the blowout coil 16 and thereby vary the impedance of the coil under certain conditions in accordance with the preferred form of the invention, a winding 22 of relatively low resistance is formed about the blowout coil 16 so as to constitute a closed circuit in inductive relation with the blowout coil 16. A suitable insulating ring 23 serves to insulate the auxiliary winding 22 from the voltage impressed upon the blowout coil 16. The continuity of the closed cir-

cuit formed by the low resistance winding 22 is controlled by the switch member 24 which is associated with the movable contact 10 of the circuit interrupter to be operated consecutively therewith. The switch 24 is thus arranged to be opened after the opening of the main interrupter contact 10 and before the opening of the auxiliary arcing contact 14 of the interrupter. In this way the closed circuit formed by the winding 22 is effective to counteract or neutralize the reactance of the blowout coil 16 and thereby control the impedance of the coil when the main current carrying contact 10 of the interrupter is opened. However, upon the opening of switch 24 the neutralizing action of the winding 22 is discontinued thereby permitting the blowout coil 16 to magnetize the magnetic blowout flux path to full value preparatory to the opening of the arcing contact 14.

From the foregoing it will be apparent that with the circuit interrupter in the closed position in which it is shown the blowout coil 16 is effectively short circuited by the main current carrying contact 10 of the interrupter thereby eliminating any loss of energy in the blowout coil. Upon the initial opening movement of the interrupter, the main current carrying contact 10 disengages the line terminals 12 and 13 thereby shunting all of the current in the circuit through arcing terminal 14 to energize the blowout coil 16. Due to the fact that the circuit including the winding 22 is closed by the switch 24, the reactance of the blowout coil is practically negligible so that the current readily flows through the blowout coil and the arcing contact 14. Consequently, there is practically no reactive voltage set up in coil 16 across the arc chute.

It may be noted that due to the very low voltage induced in the closed circuit formed by the winding 22 there is practically no sparking when the switch 24 opens. When the arcing contact 14 disengages the arcing terminal 15 the arc drawn therebetween is quickly and effectively extinguished by the magnetic blowout field set up by the coil 16.

As the opening and closing mechanism of the circuit interrupter is not of the essence of my present invention and may be of any suitable form, these have been omitted from the drawing and description for the sake of clarity.

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

1. The combination with a magnetic arc blowout coil, of means for energizing the coil and establishing the arc means for varying the impedance of said coil, and circuit controlling means whereby said varying means is rendered inoperative after the blowout coil is energized and before the arc is established.

2. The combination with a magnetic arc blowout coil, of means for varying the im-

pedance of said coil, circuit-controlling means whereby said coil is energized and said varying means is temporarily brought into action and thereafter rendered inoperative while the blowout coil is energized.

3. The combination of a magnetic blowout coil having a winding inductively related therewith for controlling the impedance of the blowout coil, and circuit-controlling means for consecutively controlling the energization of said coil and winding.

4. The combination of a magnetic arc blowout coil having a winding inductively related therewith for neutralizing the reactance of the blowout coil, and circuit-controlling means for consecutively energizing said coil and deenergizing said winding.

5. The combination of a magnetic arc blowout coil, a closed circuit inductively related to the blowout coil for counteracting the reactance thereof, and means for consecutively energizing said coil, opening said circuit, and establishing an arc under the magnetic influence of said coil.

6. In combination, a magnetic arc blowout coil, means for connecting the blowout coil to be energized in accordance with the current in the arc circuit to set up a blowout flux transverse the arc path, and electrical means controlled by said first means for temporarily reducing the reactance of the coil while the coil is being energized.

7. In combination, a circuit-controlling switch, a magnetic blowout coil connected to be energized in accordance with the current in the arc occurring upon the opening of the switch, and electrical means controlled by said switch for temporarily preventing the building up of a reactive voltage across the terminals of the blowout coil when the switch is opened.

8. The combination of a circuit interrupting device having three circuit controlling elements operable in sequence, a magnetic arc blowout coil connected to be inserted in the arc circuit upon operation of the first element, electrical means controlled by the second element for temporarily substantially neutralizing the reactance of said coil when the coil is inserted in the arc circuit, and means controlled by the third element for establishing an arc under the magnetic influence of said arc blowout coil.

9. The combination of a circuit interrupter having a movable switch member, a magnetic arc blowout connected to be short circuited by said member when the member is in the closed position and inserted in the arc circuit when the member is operated to the open position, and electrical means for preventing the building up of a reactive voltage across the terminals of the blowout coil when the coil is initially inserted in the arc circuit.

10. The combination of a circuit, an interrupting device for establishing an arc there-

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in and having a magnetic arc blowout coil connected to be inserted in the arc circuit before establishment of the arc, a closed circuit inductively related with the blowout coil for counteracting the reactance thereof, and switch mechanism under the control of the device for opening said closed circuit after the insertion of said blowout coil in the arc circuit and before the establishment of the arc therein.

11. The combination of a circuit interrupter having a movable switch member, a magnetic arc blowout coil connected to be short circuited by said switch member when the member is in the closed position and inserted in the arc circuit when the member is operated to the open position, a closed circuit inductively related with said blowout coil for counteracting the reactance thereof when the blowout coil is initially inserted in the arc circuit, and means responsive to predetermined movement of said switch member toward the open position for opening said circuit.

12. The combination of a circuit interrupter having a main current carrying contact and a secondary arcing contact, arranged to be operated in sequence upon the opening of the interrupter, a blowout coil connected in circuit with said arcing contact to be energized in accordance with the current in the arc produced upon the opening thereof, a short circuited winding for substantially neutralizing the reactance of said coil when the main contact is opened, and switch mechanism for open circuiting said winding before the arcing contact is opened.

In witness whereof I have hereunto set my hand this 26th day of July 1926.

WILLIAM E. PAUL.