Dec. 20, 1949 R. E. FRINK 2,491,964

AIR BLAST CIRCUIT INTERRUPTER

Filed Aug. 22, 1946

Fig. 1.

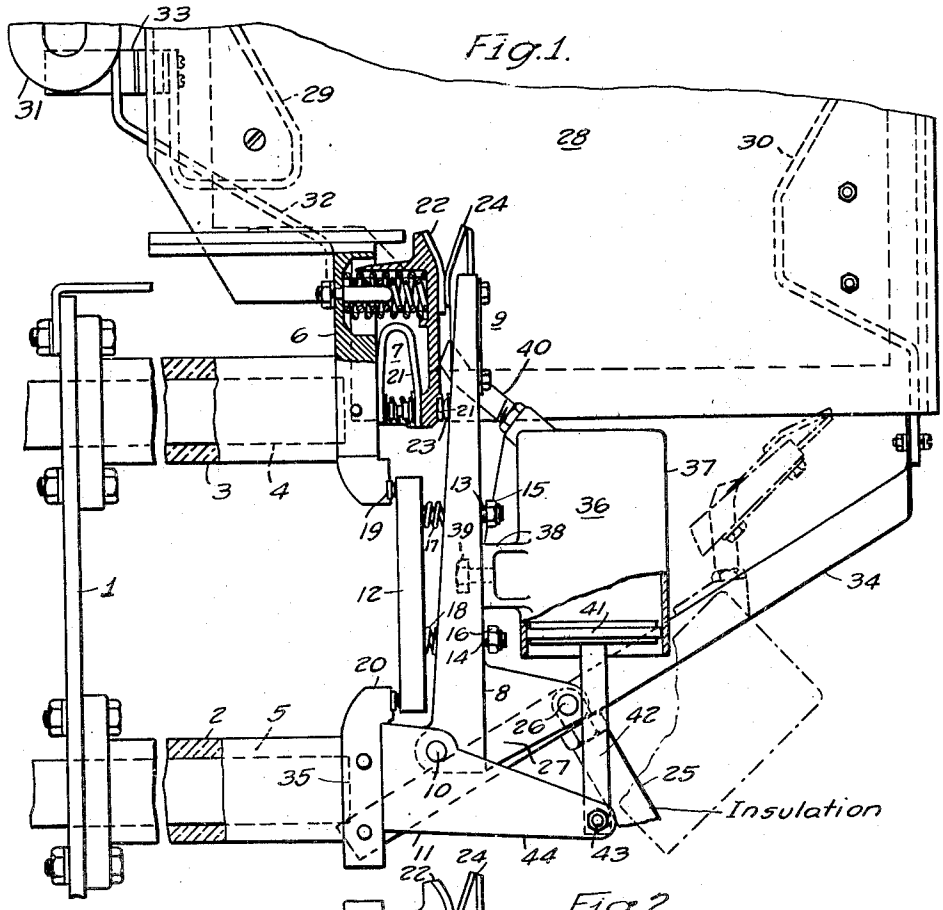
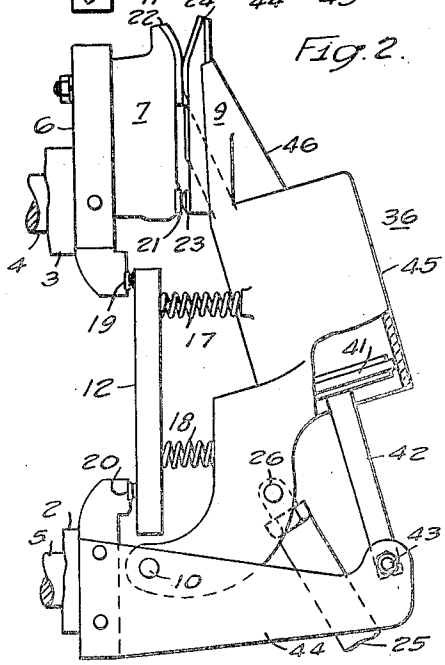


Fig. 2.



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AIR BLAST CIRCUIT INTERRUPTER

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3 Claims. (Cl. 200—148)

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This invention relates to circuit interrupters in general, and more particularly to arc-extinguishing structures therefor.

The interruption of low currents with a magnetic type circuit breaker without unduly long arcing time has always been a problem. This is largely a question of getting the arc off from the arcing contacts and onto the arcing horns. It is generally known that this can be accomplished by blowing a puff of air across the contacts, and when this is done, speedy interruption results.

A general purpose of my invention is to provide an improved pneumatic mechanism which will accomplish the above, and which will be simple and economical to manufacture.

A more specific object of my invention is to improvise an improved circuit interrupter of the air break type in which a pivotally mounted switch arm carrying a pneumatic cylinder is rotated during the opening operation, and a piston movable within the pneumatic cylinder is operable to force a jet of air across the coacting arcing contacts to assist in extinguishing the arc drawn thereat.

Another object is to provide an improved circuit interrupter of the air break type in which a puff of compressed air is more effectively directed across the separating contact structure during the opening operation. Preferably, the puff of air is created by pneumatic means including a pneumatic cylinder secured to and movable with the pivotally mounted switch arm.

Further objects and advantages will readily become apparent upon a reading of the following specification, taken in conjunction with the drawing, in which:

Figure 1 is a side elevational view, partially in section, of an air-break circuit breaker embodying my invention and shown in the closed circuit position; and

Fig. 2 is a modified type of circuit interrupter embodying my invention, and also shown in the closed circuit position.

Referring to the drawing, and more particularly to Figure 1 thereof, the reference numeral 1 designates a base which mounts insulator bushings 2, 3, interiorly through which extend terminal studs 4, 5. The terminal stud 4 is preferably integrally formed with a conducting portion 6 which supports a relatively stationary contact assembly generally designated by the reference numeral 7.

A pivotally mounted switch arm 8 carries the movable contact structure generally designated

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by the reference numeral 9 and has its lower end pivotally mounted at the fixed pivot 10 which is supported by a conducting portion 11 of the lower terminal stud 5. A main bridging contact 12 is carried by means of two studs 13, 14 which pass through the switch arm 8 and have nuts 15 and 16 threadedly secured thereto. Preferably, compression springs 17, 18 are provided, disposed between the bridging contact 12 and the inner face of the switch arm 8 to bias the main bridging contact 12 outwardly. The extremities of the bridging contact 12 make engagement with fixed main contacts 19, 20 which are electrically connected respectively with terminal studs 4, 5.

The relatively stationary contact assembly 7 comprises a relatively stationary transfer contact 21 and a relatively stationary arcing contact 22. The transfer contact 21, in the closed circuit position of the interrupter as shown in Fig. 1, makes engagement with a movable transfer contact 23 carried by the switch arm 8. Coacting with the stationary arcing contact 22 is a movable arcing contact 24 carried at the outer free extremity of the switch arm 8.

From the foregoing description, it will be apparent that in the closed circuit position of the interrupter shown in Fig. 1, the electrical circuit therethrough includes terminal stud 4, conducting portion 6, main contact 19, bridging contact 12, fixed main contact 20, to the lower terminal stud 5. During the opening operation, an operating rod 25 composed of insulating material and pivotally connected at 26 to a bracket 27 of the switch arm 8 is moved downwardly by suitable mechanism (not shown), to cause clockwise opening rotative motion of the switch arm 8. The contact opening sequence is as follows. First, the bridging contact 12 separates from the fixed main contacts 19 and 20, not being subjected thereby to any arcing whatsoever. Since the transfer contacts 21, 23 are electrically in parallel with the main contacts, the transfer contacts permit the current to pass therethrough. Further opening movement causes separation of the transfer contacts 21, 23 to force the current to pass through the arcing contacts 22, 24. Finally, the arcing contacts 22, 24 separate to draw an arc therebetween.

It will be noted that a loop circuit is formed including the terminal studs 4, 5 and the switch arm 8. In any loop circuit, the forces are such as to expand the loop. Consequently, the arc which is drawn at the arcing contacts 22, 24, is bowed upwardly into the arc-extinguishing struc-

ture generally designated by the reference numeral 28. The arc-extinguishing structure 28 may assume any desired form, but preferably it is of the type set forth in United States patent application Serial No. 514,362 filed December 15, 1943, now U. S. Patent 2,442,199, issued May 25, 1948, to Robert C. Dickinson and Russell E. Frink, and assigned to the assignee of the instant application.

The arc which is bowed upwardly into the arc-extinguishing structure 28 has its terminal ends transferred to the arcing horns 29, 30. The transfer of the left-hand terminal of the arc from the relatively stationary arcing contact 22 to the arcing horn 29 cuts into series circuit the blowout coil 31. The energization of the blowout coil 31 creates a transverse magnetic field in the arc-extinguishing structure 28 to thereby effect upward movement of the arc to consequently effect the extinction of the same. The blowout coil 31 has a strap connection 32 to the conducting portion 6 of terminal stud 4. The blowout coil 31 also has a strap connection 33 to the arcing horn 29. Thus, when the arc is disposed within the arc-extinguishing structure 28, the electrical circuit includes terminal stud 4, conducting portion 6, strap 32, blowout coil 31, strap 33, arcing horn 29, the arc (not shown) disposed in the extinguishing structure 28, arcing horn 30, conducting strap 34, to the conducting portion 35 of the lower terminal stud 5.

During the interruption of high amperage currents, the interrupting ability of the extinguishing structure 28 is sufficient to effect rapid transfer of the arc to the arc horns 29, and 30 and speedy interruption of the high-amperage arc drawn therein, it being noted that at this time there is an intense transverse magnetic field set up by the blowout coil 31. The same rapid interrupting ability is obtained during the interruption of moderate currents. However, during the interruption of low-amperage currents, the tendency of the current loop to cause the arc to expand and transfer to the arcing horns is practically nil, since this force is proportional to the square of the current. The result is that the arc remains across the arcing contacts until enough thermal currents have been produced to accomplish the transfer. Also, after the transfer is accomplished the transverse magnetic field set up by blowout coil 31 is relatively weak, and interruption is sluggish. The total effect may be arcing times of the order of thirty cycles or more for some values of low-amperage currents.

To facilitate the interruption of such low-amperage current arcs, I have provided pneumatic means generally designated by the reference numeral 36 and including a pneumatic cylinder 37, having lug portions 38 through which extend bolts 39, thereby securing the pneumatic cylinder 37 to the switch arm 8. Preferably the pneumatic cylinder 37 is of a lightweight metal, such as aluminum, to minimize the mass of moving material. A relatively short nozzle 40 permits communication from the upper end of the pneumatic cylinder 37 to the region immediately adjacent to the movable arcing contact 24, the latter moving with the free end of the switch arm 8.

Positioned within the cylinder 37 is a piston 41 secured to the upper end of a piston rod 42, the lower end of which is pivotally mounted at 43 between a pair of outwardly jutting brackets 44 projecting from the conducting portion 35 of the lower terminal stud 5. Since the lower end of the piston rod 42 is pivotally connected to a fixed pivot 43, clockwise rotation of the switch arm 8 about the pivot 10, as caused by the operating rod 25, will effect upward movement of the piston 41 within the pneumatic cylinder 37 to force a jet of compressed air upwardly through the nozzle 40 and across the arcing surface of the movable arcing contact 24. This puff of compressed air provides the desired assistance during the interruption of low-amperage currents to facilitate upward movement of the arc drawn between the contacts 22, 24 upwardly into the extinguishing structure 28. Also, the blast of air through the nozzle 40 will tend to effect interruption of the arc drawn between the arcing contacts.

It will be noted that, by having the operating cylinder 37 move with the switch arm 8, a pneumatic means is provided, being very economical in space. Also, it is to be noted that the fixed relation of the air blast to the contacts always permits the jet of compressed air to be effectively directed against the drawn arc throughout the entire opening operation, regardless of the disposition of the movable arcing contact 24 and the switch arm 8. Furthermore, by having a relatively short nozzle 40, there is provided an unimpeded gas-blast passage to hinder the passage of compressed gas as little as possible.

It is also to be observed that by the construction which I have provided, that is, by clamping the pneumatic cylinder 37 to the switch arm 8, the incorporation of my invention may be readily had to circuit interrupters of conventional design with little alteration. It has been found that it is possible to locate the pivot 43 for the lower end of the piston rod 42 in such a position that the piston rod 42 practically coincides with the axis of the pneumatic cylinder 37 in all positions.

In the modification of my invention as shown in Fig. 2, the construction is identical to that shown in Fig. 1 and the operation is the same, except that the pneumatic cylinder 45 is made an integral part of the switch arm casting 46. By such a construction, the cylinder 45 may be economically incorporated with the casting for the switch arm 46. The internal construction of the pneumatic cylinder 45 is identical to that set forth in Fig 1 and the operation is the same. The construction of Fig. 2 lends itself to very economical manufacture.

From the foregoing description of two embodiments of my invention, it will be apparent that I have provided an improved circuit interrupter of the air-break type, in which the interruption of low-amperage currents is facilitated by the novel pneumatic means set forth. The construction is readily adaptable to present conventional circuit interrupter designs and is economical in space. It is positive in action, and always insures a blast of gas toward the arcing contacts to facilitate arc transfer and also arc interruption. By having the cylinder incorporated with the switch arm, a single casting need be provided; and, by forming the cylinder of a lightweight material, such as aluminum, the inertia of the moving parts is not materially increased over conventional structures.

The disposition of the nozzle 40 at a fixed distance immediately adjacent to the movable arcing contact 24 insures that the blast of gas will be effectively directed throughout the entire opening operation.

It will be noted that the construction is such that the pneumatic cylinder 37, 45, is at the same potential as the movable switch arm 8 and in

any position of operation does not come close to parts at the opposite potential, or ground, and the insulation strength of a pole unit is in no way altered by the addition of this device.

Although I have shown and described specific structures, it is to be clearly understood that the same were merely for the purpose of illustration and that changes and modifications may readily be made therein, by those skilled in the art, without departing from the spirit and scope of the appended claims.

I claim as my invention:

1. In a circuit interrupter, a relatively stationary arcing contact, a switch arm, means pivotally mounting the switch arm adjacent one end thereof, a coacting movable arcing contact carried at the other end of the switch arm, a relatively short nozzle carried adjacent the said other end of the switch arm and directed toward the arcing surface of the movable arcing contact, a pneumatic cylinder carried by the switch arm and communicating with the relatively short nozzle, a piston positioned within the pneumatic cylinder, a piston rod having one end thereof connected to the piston, and means pivotally mounting the other end of the piston rod to a substantially fixed pivot, the piston being forced through the pneumatic cylinder during the opening operation to send a jet of air through the relatively short nozzle to assist in extinguishing arcing at the contacts.

2. In a circuit interrupter, a relatively stationary arcing contact, a movable switch arm, means pivotally mounting the movable switch arm adjacent one end thereof, a movable arcing contact carried by the movable switch arm adjacent the other end thereof, the movable arcing contact being separable from the relatively stationary arcing contact during the opening operation of the interrupter to establish an arc therebetween, a pneumatic cylinder carried by the movable switch arm, a relatively short nozzle communicating with the pneumatic cylinder

and carried by the said other end of the switch arm, a piston movable within the pneumatic cylinder, a piston rod, means connecting one end of the piston rod to the piston, means pivotally mounting the other end of the piston rod to a substantially fixed pivot, and the arrangement operating during the opening operation of the interruption to force fluid out of the pneumatic cylinder and through the relatively short nozzle against the arc to facilitate the extinction thereof.

3. In a circuit interrupter, a relatively stationary arcing contact, a pneumatic cylinder, means pivotally mounting the cylinder about a substantially fixed pivot, a movable arcing contact carried by the pneumatic cylinder adjacent the outer free end thereof, a relatively short nozzle communicating with the pneumatic cylinder and carried by the outer free end thereof, the movable arcing contact being separable from the stationary arcing contact to establish an arc therebetween during the opening operation of the interrupter, a piston movable within the cylinder, and means pivotally mounting the piston to a substantially fixed pivot so that on swinging opening rotative motion of the cylinder the piston will move within the cylinder to force fluid thereout and through the relatively short nozzle against the arc to facilitate in the extinction of the arc.

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