Sept. 28, 1948. C. E. BAZLEY 2,450,268

CIRCUIT BREAKER

Filed Aug. 30, 1945

Fig. 1.

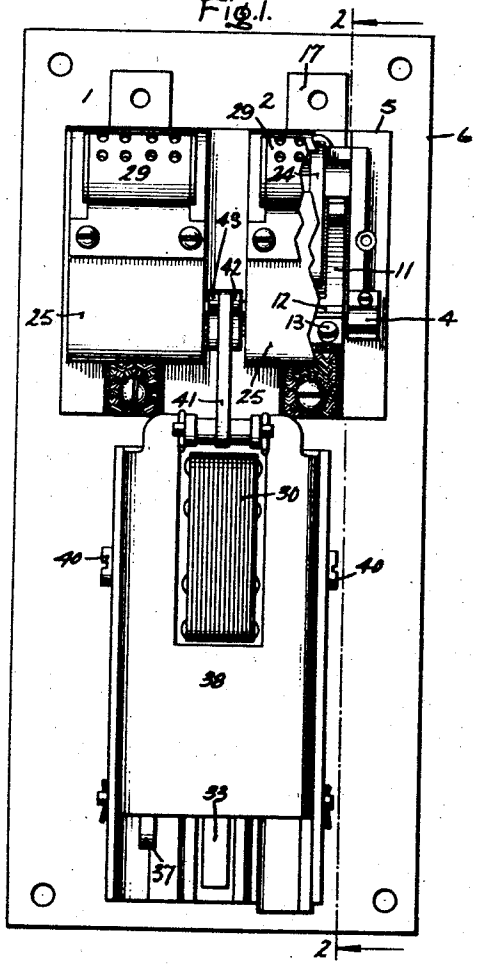


Fig. 2.

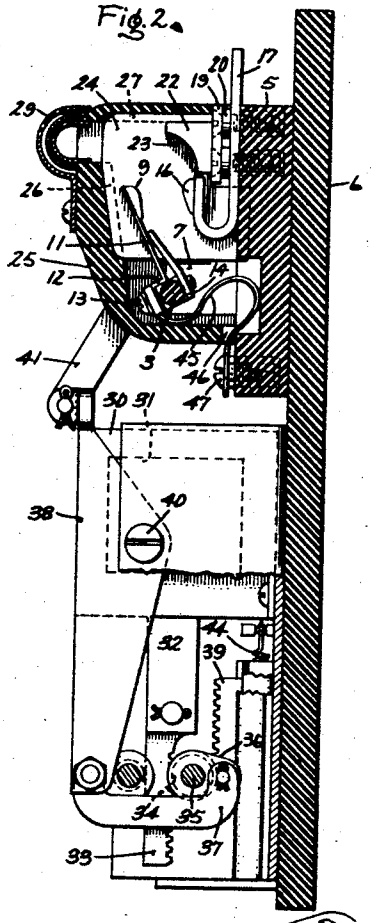


Fig. 3.

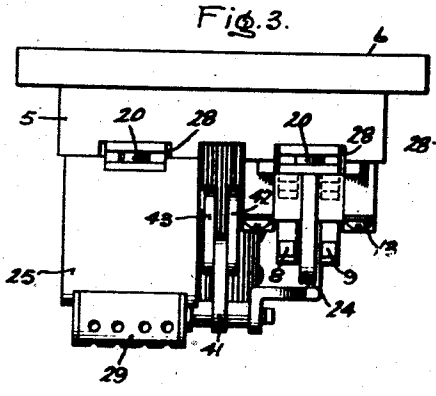
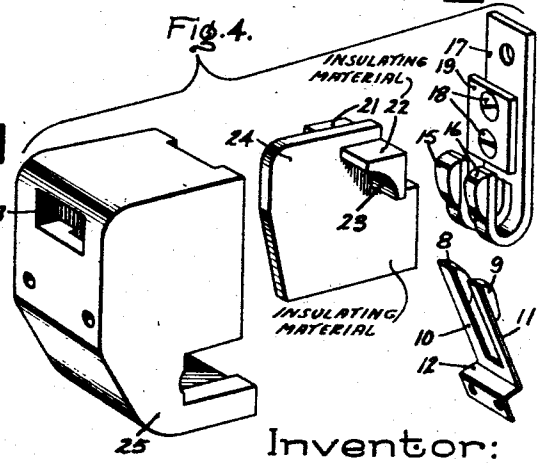


Fig. 4.



Inventor:
Carl E. Bazley.
by Chandler W. Hoff
His Attorney.

Patented Sept. 28, 1948

2,450,268

UNITED STATES PATENT OFFICE

2,450,268

CIRCUIT BREAKER

Carl E. Bazley, Schenectady, N. Y., assignor to General Electric Company, a corporation of New York

Application August 30, 1945, Serial No. 613,462

1 Claim. (Cl. 200—144)

1

My invention relates to circuit breakers, more particularly to electromagnetically operated circuit breakers of the type known as contactors, and has for its object a simple, reliable and low cost arc extinguisher means for direct current contactors.

In carrying out my invention in one form I provide an enclosure made of electrically insulating material for the switch contacts, one wall of which is mounted adjacent the stationary contact and provided with a curved surface for deflecting an arc formed between the contacts to obtain rapid cooling and extinguishment of the arc while at the same time offering the least possible interference with the movement of the arc and without elongation or compression of the arc. This curved surface, which is preferably arcuate, begins at a point immediately adjacent the stationary contact surface and extends away from the stationary contact and in the direction of movement of the movable contact, thereby to deflect the arc substantially at right angles. It moreover extends crosswise of the arc chute enclosure in a direction at right angles to the plane of movement of the movable contact.

For a more complete understanding of my invention, reference should be had to the accompanying drawing, Fig. 1 of which is a front elevational view of a contactor embodying my invention; Fig. 2 is a sectional view taken along the line 2—2 of Fig. 1 looking in the direction of the arrows; Fig. 3 is a plane view of the device shown in Fig. 1, while Fig. 4 is an exploded view of the parts forming the contact enclosure and the guiding means for the arc.

Referring to the drawing, I have shown my invention in one form as embodied in a two-circuit or two-pole contactor having a separate enclosure means for each pole. The separate switching means and enclosure means 1 and 2 for the two poles are identical in construction and therefore only one will be described in detail, this one being the switch means and enclosure 2.

In the form shown, the movable contacts are pivoted and are mounted on the ends of arms secured to an operating shaft 3 mounted at its opposite ends on bearings, one of which, 4, is shown in the drawing, the bearings being mounted on supports or pedestals secured to a supporting plate member 5 made of molded electrically insulating material, which member 5 is in turn secured to a panel support 6. The pedestal bearing support 7 for the bearing for the left-hand end of the shaft 3, as seen in Fig. 1, is shown in Fig. 2. By means of the pedestals, the shaft is

2

mounted in spaced parallel relation with the plate support 5.

As shown in Fig. 4, for the purpose of increasing the current carrying capacity of the circuit breaker and rate of cooling of the arc, two electrically connected movable contacts 8 and 9 are provided for each pole, these two contacts being mounted on the ends of flexible, electrically conducting, spring arms 10 and 11 which are electrically joined together by a base connecting portion 12 arranged to be secured by suitable screws 13 to an intermediate portion of the shaft 3 having a square cross section. On the opposite face of the square portion of the shaft is secured by the screws 13 a member 14 having two relatively rigid arms which extend along the right-hand side or below the two switch arms 10 and 11, as seen in the drawing, and engage the switch arms at intermediate points as indicated in Fig. 2. These rigid arms assure forcible separation of the contacts in case the contacts should become welded together.

Also, the rigid arms create a substantial initial contact pressure by reason of the fact that the spring arms 10 and 11 are biased by their own resiliency against the rigid arms.

As shown in Fig. 4, the movable contacts 8 and 9 of each pole cooperate respectively with stationary contacts 15 and 16 on the ends of spaced apart U-shaped arms, the opposite ends of the arms being integrally secured to an electrically conducting supporting member 17 which in turn is secured by screws 18 to the supporting block 5. Also secured by the screws 18 against the outer or left-hand side of the support 17 is a rectangular positioning base or plate 19, the purpose of which will be described hereinafter.

For the purpose of guiding an arc formed between the contacts so as to facilitate its cooling and extinguishment, I provide blocks 21 and 22 adjacent the outer or upper ends of the stationary contacts, these blocks having each an arcuate curved surface perpendicular to the plane of movement of the movable contact as indicated by the curved surface 23 on the block 22.

Preferably, as shown in Fig. 4, the two blocks 21 and 22 are secured on opposite sides of a partition wall member 24 which is removably inserted between the contacts of each pair, the partition wall 24 and the blocks 21 and 22 being molded integrally from a heat refractory electrically insulating material having good heat conductivity, preferably an inorganic compound, such as a cold molded mixture of asbestos and Portland cement.

As shown in Fig. 2, the plate 24 is inserted from

left to right between the arms 10 and 11 and between the corresponding two arms supporting the stationary contacts, thereby to isolate from each other the two arcs formed upon separation of the two pairs of contacts. The right-hand edge of the plate 24 extends into a groove provided for it in the block 5, while a portion at the top of the right-hand edge is cut away flush with the right-hand walls of the members 21 and 22 which engage the member 19. The plate 19 serves accurately to position the blocks 21 and 22 so that the arcuate arc deflected surfaces 23 are immediately adjacent the upper ends or extremities of the stationary contacts. A molded cover member 25 fits over the two pairs of contacts for each pole and the shaft 3 onto the plate 5, thus forming two arc chambers separated by the partition wall 25. The cover, as well as the plate 5, is made from the heat refractory electrically insulating material referred to above. Grooves 26 and 27 are formed in the inner walls of the cover to receive the left-hand and top edges of the plate 24, thereby to secure the plate in position, while the lower end of the plate terminates above the shaft 3.

It will be observed that the arcuate curved surface 23 on the block 22 forming part of the wall of the arc chamber begins at its right-hand or lower end, as seen in Fig. 2, at a point adjacent the upper or outer end of the stationary contact 16, but somewhat below or to the right of its contact face to reduce burning of the block 22 by the arc. The arcuate surface extends upward away from the upper end of the contact 16 and toward the left-hand in the direction of the movement of the movable contact. Also, the curved surface 23 extends transversely at right angles with the plane of movement of the contact 9, across the arc chamber space between the plate 24 and the adjacent side wall of the cover 25. The surface 23 is at all points arcuate in some plane parallel with the plane of movement of the movable contact 9. Its radius of curvature in a typical contactor, as shown in the drawing, was substantially equal to the length of the contact 9 or 16.

Preferably the cover member 25 is provided with an elongated aperture 28 for the escape of air and other gases heated or formed by the arc. This opening 28 is provided with a muffle 29 extending over it consisting of three substantially semi-cylindrical plates secured together at their ends by end plates. These members are each provided with one or more rows of apertures extending lengthwise of the opening 28, the apertures in the respective members, however, being in staggered relation with each other.

For the operation of the contactor I have shown shockproof electromagnetic operating means such as described and claimed in copending applicaton of Chester I. Hall filed October 22, 1945, Serial No. 623,650, assigned to the same assignee as this application.

This mechanism comprises a rectangular magnet frame 30 provided with a coil 31 and a plunger armature 32. On the lower end of the armature is a rack 33 which engages with a pinion 34 on a shaft 35. Also secured to the shaft 35 is a crank 36, the end of which is connected by a link 37 to the lower end of a pivoted operating arm 38. A second weight counterbalancing rack 39, provided with guides for slidable movement, is connected to the pinion 34 whereby the operating parts and armature are balanced about the axis of the shaft 35. The upper end of the operating lever 38, which lever is mounted on a pivot 40, is connected by a link 41 to a crank arm 42 secured

on the left-hand end of the shaft 3. As shown, a second crank arm 43 is provided which is secured on the end of the operating shaft for the mechanism 1, this shaft being in alignment with the shaft 3. The crank arms 42 and 43 are made of electrically insulating material and the link 41 is positioned between them and secured to them by a pivot pin.

In the closing of the switch when the coil 31 is energized, the plunger armature 32 is moved from its deenergized position shown in Fig. 2 to its raised position whereby the crank 36 is turned clockwise substantially 180 degrees to its opposite dead center position with respect to the link 37. This movement of the crank 36 turns the arm 38 clockwise about its pivot 40 whereby the link 41 is moved to turn the operating shaft 3 on which the movable contacts are mounted, whereby the switch is closed. The turning movement of the shaft 3 is somewhat greater than just necessary to produce engagement between the contacts whereby after engagement of the contacts the spring contact arms 10 and 11 are bent and the movable contacts thereby caused to roll downward on the stationary contacts whereby the circuit is maintained closed through different engaging portions of the contacts than the portions through which the circuit is first closed. It will be noted that the stationary and movable contacts are of curved cross-sectional configuration with upper portions of their engaging surfaces extending toward each other. Thus the contacts first engage each other at their upper tips during the closing of the switch. Thereafter, the movable contacts roll downward on the stationary contacts as the spring arm 11 is stressed to give a wiping action. During the opening of the switch upon deenergization of the coil 31, which is effected by the spring 44 connected to the rack 39, the reverse action takes place, so that the contacts are always separated at their upper extremities.

Upon separation of the fixed and movable contacts any arc between them is drawn at the extreme upper ends of the contact surfaces. The configuration of the contacts and the resilient mounting of the movable contacts ensures an upward rolling disengagement such that the contacts finally separate at their upper extremities. As soon as the arc elongates, it flows naturally and freely onto the curved deflecting surface 23 of the associated block 21 and 22, by reason of the close proximity of the deflecting surface to the upper extremity of the tip of the stationary contact. The surface 23 turns or deflects the arc and causes the arc to take a path substantially at right angles to its initial path. This deflecting or guiding action of the curved surface brings the arc into intimate thermal relation with the block 22, whereby the heat of the arc is transmitted very rapidly to the block 22 and also to the side walls formed by the partition member 24 and the cover member 25. This results in a very rapid cooling and extinguishment of the arc. At the same time, curved surface 23 offers the least possible interference with the movement of the arc and provides for a free movement of the arc with a minimum of turbulence of the gasses surrounding the contacts.

By reason of the fact that the crank 36 is in a dead center position in the open and closed positions of its switch, the crank serves to secure the mechanism against false operation as a result of the heavy shock. Moreover, the weight-bal-

ancing rack 39 further makes the moving parts free from the effects of shocks.

As shown, the electrically conducting support 17 projects upward outside the cover 27 and serves as an electric connection for connecting the circuit breaker in an electric circuit. A second electric connection for the movable contact is provided by means of a flexible electric conductor 45 having one end electrically connected to the base connecting portion 12, as by means of the screws 13 and its other end extending through a notch 46 at the lower edge of the cover 25 and connected to the connector screw 47.

While I have shown a particular embodiment of my invention it will be understood of course that I do not wish to be limited thereto since many modifications may be made and I therefore contemplate by the appended claim to cover any such modifications as fall within the true spirit and scope of my invention.

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

A circuit breaker comprising a supporting member made of electrically insulating material, a pair of fixed contact members electrically connected together and mounted upon said supporting member in a spaced relation, a pair of movable contact members electrically connected together and pivotally mounted in spaced relation for cooperation with said fixed contact members respectively, said movable contact members being supported upon resilient cantilever spring fingers and said fixed and movable contact members having engaging surfaces curved to provide

rolling engagement and reverse rolling disengagement of said fixed and movable contact members and to effect final disengagement of said contact members always at a predetermined extremity thereof, a partition wall of electrically insulating material positioned between the cooperating pairs of fixed and movable contact members, a pair of arc deflecting members of electrically insulating material supported on opposite sides of said partition wall and each having a concave arcuate surface extending from said extremity of the associated fixed contact member away from said fixed contact member and in the direction of movement of said movable contact members, and a cover made of electrically insulating material mounted upon said supporting member and enclosing said contact members and said partition wall thereby to form separate arc extinguishing enclosures for said pairs of cooperating contact members.

CARL E. BAZLEY.

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