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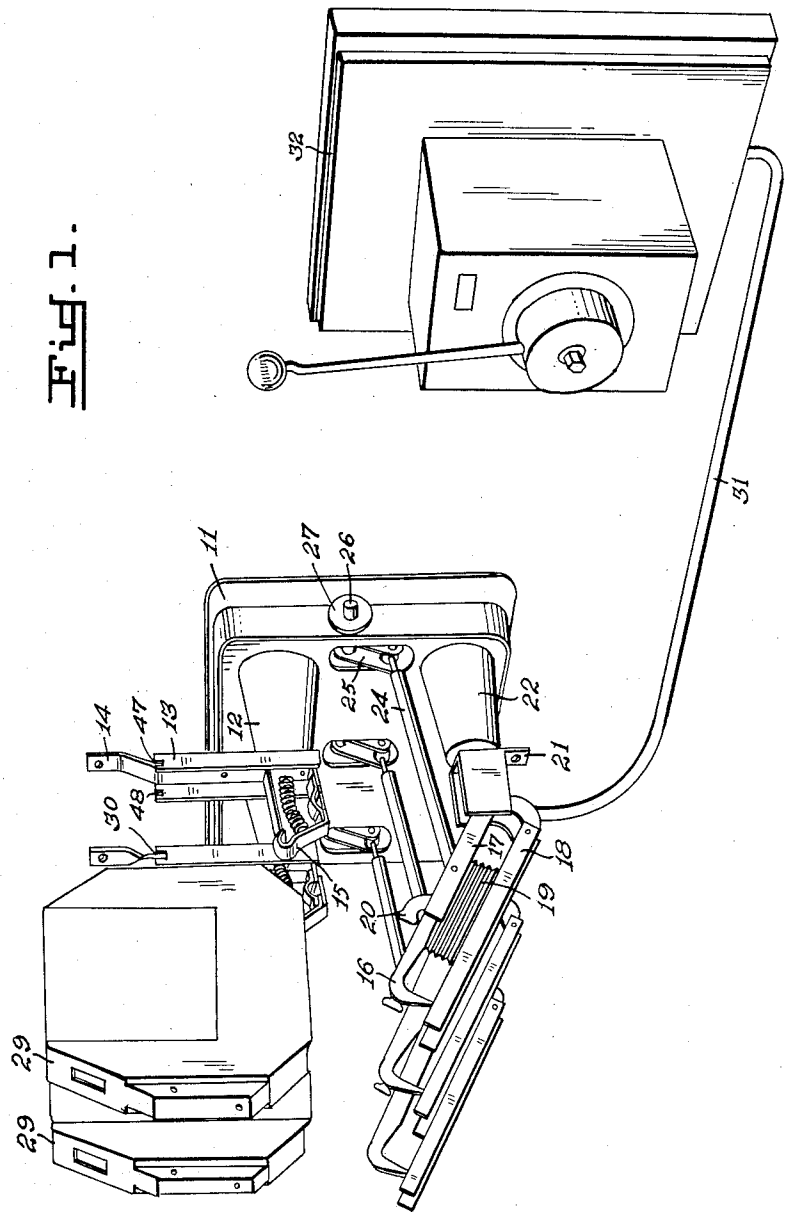
Feb. 24, 1959 A. LATOUR ET AL 2,875,305

CIRCUIT-BREAKERS HAVING MAGNETIC BLOW-OUT

Filed July 16, 1956 2 Sheets-Sheet 1

Fig. 1.



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2 Sheets-Sheet 2

Fig. 2.

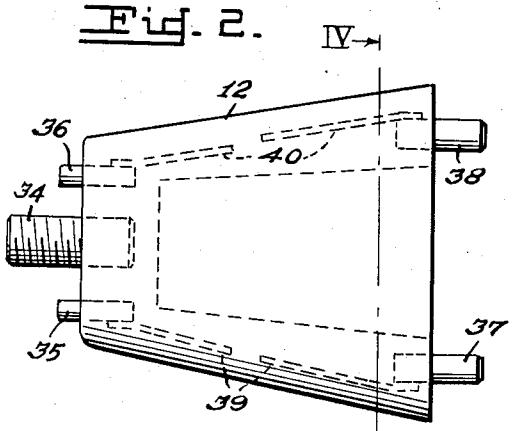


Fig. 3.

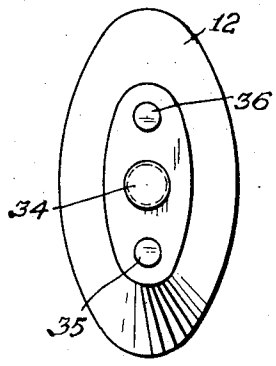


Fig. 4.

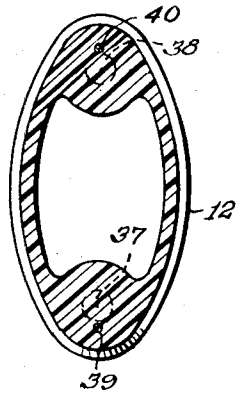


Fig. 5.

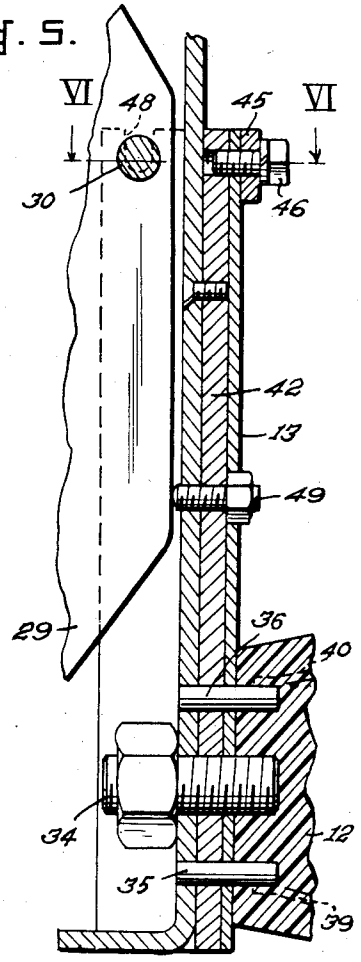


Fig. 6.

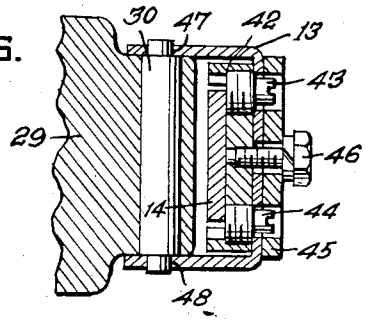
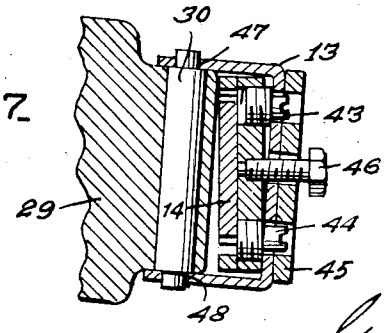


Fig. 7.



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2,875,305

CIRCUIT-BREAKERS HAVING MAGNETIC BLOW-OUT

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Application July 16, 1956, Serial No. 598,126

Claims priority, application France July 27, 1955

8 Claims. (Cl. 200—147)

This invention relates to circuit-breakers, and more particularly to circuit-breakers with magnetic-blow-out-arrangements which include arc extinction chambers built up of piles of refractory plates.

The several improvements which constitute the objects of the present invention may be applied separately to circuit-breakers, but are preferably applied in combination, in order to obtain on one hand circuit-breakers of a more aesthetic aspect and on the other hand presenting new technical advantages as will be disclosed hereafter.

Heretofore the circuit-breakers were so constituted as to comprise as a whole the circuit-breaker proper, the control device, and the latching device, this latter term covering the device which after closing of the breaker keeps the breaker closed and at the same time the tripping (or opening) spring tensioned.

According to a first improvement the control device is separated from the circuit-breaker proper, so that they can be placed at some distance therefrom according to the local possibilities or necessities, and are connected with the circuit-breaker by a flexible cable for remote control, said cable being held under mechanical tension (pull) so long as the circuit-breaker is in closed position. In other words, the pull of the cable maintains the circuit-breaker closed and the tripping spring tensioned.

This solution presents various advantages. In the first place the use of the cable eliminates any mechanical reaction on the mounting means of the circuit breaker and the control device, the reaction to the force transmitted by the cable being absorbed by its own sheath, wherein it moves. As a consequence the frame which in the conventional circuit-breakers renders the same integral with its control device (and therefore has to be very rigid), may now be built lighter and less expensive.

On the other hand the circuit-breaker and the control device are rendered independent from each other, whereby the choice of the locations for mounting the circuit-breaker and the control device is considerably facilitated. Moreover a great mobility is conferred onto the control device, regardless of the position of the circuit-breaker (closed, open or in movement between these positions). As a consequence of this mobility, the control device may for instance be mounted directly on the door of a switching cubicle, thus providing a ready accessibility to the control device as well as to the circuit-breaker.

A further advantage of this disposition is that the control device is always accessible, regardless of whether the circuit-breaker is under tension or not, which of course is not the case with the designs hitherto used where the circuit-breaker had to be earthed before access could be had to the control. Thus inspection and maintenance of the two devices are greatly facilitated and simplified.

A further advantage of this solution is on one hand, that the design of the circuit-breaker is simplified and that its shape can be rendered more aesthetic, and on

the other hand, that quantity manufacture is facilitated, because one single type of the novel circuit-breaker may replace the various types necessary for the conventional circuit-breakers according to whether the control device is to be affixed in front, in the back, at the top or at the base of the circuit-breaker.

As a rule the arc-extinction chambers (called hereinafter chambers) of such circuit-breakers are supported by cantilever insulators fixed to a vertical frame. In order to reduce the bending stress exerted on the insulators it has always been attempted to distribute the weight of each chamber onto at least two insulators, which generally were the insulators bearing the incoming and outgoing terminals for the connection of the circuit-breakers to the system. Sometimes the chamber is borne by one of these insulators and a special third insulator so that each pole of the circuit-breaker comprises three insulators. Further insulators then formed the actuating rod of the movable contact assembly. Thus designed, the circuit-breakers presented a clumsy, aesthetically poor aspect, not to mention the additional problems of a mechanical and electrical nature raised by the presence of so many insulators intended to isolate the live parts or to transmit mechanical forces.

According to the invention a single cantilever insulator is used to carry the arc-extinction chamber, and in order to meet the increased stress exerted by the weight of the chamber an elliptical cross-section is given the insulator which advantageously will be an insulator molded of a synthetic material and preferably of an epoxyd (ethoxylin) resin. Of course, any other material may be used having the same mechanical and electrical properties. Arc-extinction chambers built up by a plurality of ceramic (or refractory) cooling plates have a considerable weight, and therefore single supporting insulators have not been used up to now for the support of such chambers as the stresses in the conventional round insulators call for dimensions which render the circuit-breaker too cumbersome in width. The elliptical cross-section obviates this drawback.

It is known that circuit-breakers must comply according to their nominal voltage with a given insulation level determined by surge voltage values. The length of the insulators varies according to whether they are tested with positive or negative impulse or surge waves. In order to obtain the optimal, i. e., the shortest insulator length, according to the invention electrodes are placed into the insulator body, are electrically connected to the top or base fixing studs so as to equalize the ionizing effect of the waves of the negative and positive polarity, so that the flash-over voltages of the insulators become almost equal for the two polarities. These electrodes are embedded in the body of the molded insulators. This of course would not be possible with ceramic insulators without creating other inconveniences.

Owing to the fact that the control devices are now removed from the circuit-breaker, it is possible to design the same in such a manner that the actuating rods take a position parallel to the upper or lower generatrix (or edge) of the corresponding insulators when the circuit-breaker is opened or closed, so that the latter offers in both positions a particularly pleasing configuration.

As each arc-extinction chamber is supported by a single insulator, means are provided to secure its correct position with respect to the movable contact assembly, said means allowing the adjustment of the chamber in two planes perpendicular to each other.

In the accompanying drawings:

Fig. 1 is a schematic perspective view of the circuit-breaker according to the invention and of the remote control device placed at a distance with respect to the circuit-breaker.

Fig. 2 is a side view of one insulator for the support of the arc-extinction chamber.

Fig. 3 is a top plan view of the insulator shown in Fig. 2.

Fig. 4 is a cross-section of Fig. 2 seen in the direction of arrows IV, showing the cross section of the insulator by vertical planes perpendicular to the axis being an ellipse, the long axis of which is in a vertical plane.

Fig. 5 is an elevational cross-section of the device for the mounting of the arc-extinction chamber shown fixed to the supporting insulator.

Fig. 6 is a horizontal section taken along line VI—VI of Fig. 5.

Fig. 7 is a view similar to Fig. 6 showing the positioning device of Fig. 5 adjusted so as to direct the vertical median plane of the chamber towards the left hand side when seen by standing in front of the chamber.

Fig. 1 shows in perspective view a circuit-breaker with its control device placed at a distance. In order to facilitate the description the circuit-breaker is shown only with two arc-extinction chambers, the chamber of the third pole being removed. The circuit-breaker comprises a frame **11**, housing the control shaft and bearing the three poles. Each pole is constituted by two supporting insulators **12** and **22**, an arc-extinction chamber **29**, the fixed contact **15** and the movable contact **16**. Insulators **12** and **22** have an elliptical cross-section, the long diameter of the ellipse being vertical. Insulator **12** carries the fixed contact **15**, the input terminal **14** and a positioning device **13** on which is suspended the arc-extinguishing chamber **29**. The device **13**, which will be described hereinafter, supports the chamber and can be adjusted so as to position the chamber correctly in order to allow an unimpeded movement of the movable contact **16**. The latter is borne by an arm **17**, whereon is fixed the auxiliary blade **18** which in a known manner replaces the conductor connecting the arc-extinction chamber to the output terminal. Between the arm **17** and the auxiliary blade **18** is fixed a bellows **19** which during the opening movement of the circuit-breaker directs by means of the nozzle **20** a jet of air onto the breaking arc. The assembly **16, 17, 18, 19, 20** is carried by the insulator **22** to which is also fixed the output terminal **21**. The movable contact is actuated by means of a rod **24** and a crank **25** integral with the control shaft **26** placed in the interior of the frame **11**. The shaft **26** turns in ball or roller bearings placed in flexible sleeves, of which one is shown at **27**, and which by their flexibility allow a correct alignment of the shaft **26** and consequently of the cranks **25**. In Fig. 1 only the right hand side sleeve **27** can be seen, the left one being hidden.

The shaft **26** is remotely actuated by the control mechanism **32** by means of a flexible cable such as the Bowden cable **31**. The lever may control the cable **31** through the intermediary of a mechanism **32** which forms no part of this invention and which may be of any type, for example, the device described in the patent to Pelenc, No. 2,745,515, and assigned to the assignee of this application.

Fig. 2 is a side view of one of the insulators which carry respectively the arc-extinction chamber and the movable contact assembly. Fig. 3 is a top plan view of the insulator shown in Fig. 2 and Fig. 4 is a cross-section along line IV—IV of Fig. 2. According to the invention these insulators have an elliptical cross-section which, compared with insulators of circular cross-section, allows to reduce considerably their weight as well as their dimensions for a given bending force acting at their top in the direction of the long diameter of the ellipse. Though the manufacture of such oval insulators of a ceramic body is possible by a casting process, according to the invention the insulators will be manufactured of synthetic resins and preferably of epoxyd resins. The process of manufacture, contrariwise to that of ceramic

insulators, allows one to embed directly in the body of the insulator the mounting bolt **34** for the structure bearing the arc-extinction chamber, the studs **35, 36** at the top of the insulator destined to prevent a rotation of said structure about the bolt **34**, and the studs **37, 38** by which the insulator is bolted to the frame. Thus the insulator does not need the usual top and base cap. As a consequence the insulator may have the shortest length possible for a given insulation level (flash-over value), and the smallest cross-section for a given bending stress, owing to the minimum cantilever. Cost and overall dimensions are thus considerably reduced. Moreover it is possible to embed simultaneously the electrodes **39** and **40** which act favourably on the electrical field created around the insulator by impulse voltages and equalize the flash over values of positive and negative impulse waves allowing again to give the insulator the smallest length possible for a given impulse level.

Figs. 5 and 6 show an elevational and a plan cross-section of the positioning device permitting the adjustment of position of the arc-extinction chamber in a vertical and a horizontal plane. This adjustment is indispensable in order to allow on one hand the unimpeded movement of the arm **17** carrying the movable contact within the chamber **29**, and on the other hand to give to the auxiliary contacts the form of pincers which in a known manner are disposed in the arc-extinction chamber in the correct position allowing them to retain for the necessary time the auxiliary blade **18**. This device has been described in the pending application of Latour, Ser. No. 565,248.

The positioning and supporting device includes a channel iron **13** fixed to the insulator **12** by the bolt **34** and kept in vertical position by the studs **35** and **36**. Within the channel **13** is placed over its whole length a channel **42** of much heavier cross-section than that of channel **13**. Within channel **42** is placed the flat piece **14** constituting the input terminal. At the upper end, channel **42** has two threaded holes (see Fig. 6) wherein are screwed the screws **43** and **44**. The heads of these screws are of a smaller diameter than the screws themselves and pass through two holes in the channel **13** and in the cross-piece **45** so that they are accessible from the exterior. The screws **43** and **44** are flush with the rear (right) side of channel **42** (Fig. 6) and bear with their large diameter on the inside of channel **13**. Also at its upper end and in its median plane the channel **42** has a threaded hole wherein is screwed the screw **46** which passes through a hole in channel **13** and whose head bears on the aforesaid cross-piece **45** and presses together the upper ends of channels **13** and **42**. Further down an adjusting screw **49** is screwed into the channel **42**. This screw passes freely through holes in channel **13** and terminal **14**. Finally the legs of channel **13** are provided at their upper end with notches, **47** and **48**, in which are placed the ends of axle **30** integral with the chamber **29**.

The positioning of the chamber **29** in the vertical plane is obtained by means of the screw **49**. If the lower part of the chamber is to be lifted the screw **49** must be screwed further into its hole in channel **42**. The adjustment of the chamber **29** in a horizontal plane is achieved by means of the screws **43** and **44**. So for instance, if seen from a position in front of the chamber the same is to be displaced towards the left, first the screw **46** and then the screw **43** are unscrewed. The screw **43** then begins to come out of the channel **42** and to press against the channel **13**. As the channel **42** due to its large cross-section is considerably more rigid than channel **13**, the latter yields to the pressure exerted by the screw **43** and is deformed, as shown in Fig. 7. As a consequence the imaginary common axis of the notches **47** and **48** is deviated and so is the axle **30**, whereby the chamber **29** is slightly turned towards the left. When the chamber **29** has been adjusted in its correct position the screw **46** is

again tightened and all the pieces are thus blocked in their new position.

It will be appreciated that the improvements described hereabove not only secure to the breaker a highly efficient and aesthetic shape, but provide a very economical design affording the possibility of a most easy installation and a remarkable accessibility of all parts for purposes of inspection and maintenance.

What is claimed is:

1. A multi-pole circuit breaker comprising an arc chute for each pole, and a single cantilever insulator supporting each respective chute, the axis of each insulator disposed in a vertical plane, the cross section of at least one insulator by a vertical plane, normal to the first named vertical plane, being an ellipse, the long axis of which is vertical, and a movable contact assembly for each pole.

2. The circuit breaker as set forth in claim 1 including an actuating rod connected at one end to each contact, a control shaft connected to the other end of said rod, the said rod being in a position parallel to the edge of the said insulator in the open and closed position of the circuit interrupter.

3. A circuit-breaker according to claim 1, characterized in that the insulators carrying the arc-extinction chambers and the movable contact assemblies are made of synthetic resins and fixed to a vertical frame, and that the means for fixing the insulators to the frame and the means for fixing the chamber, and contact assemblies to the insulators are embedded in the body of synthetic resins of the insulators.

4. A circuit-breaker comprising a first unit having fixed and movable sets of contact elements, individual stand-off insulators for said elements, a base carrying said insulators, a common control shaft connected to all of said movable contact elements for conjoint motion thereof to open and closed conditions, a second unit physically separate from the first unit and comprising a control lever, and a flexible motion-transmitting connection between said control lever and said control shaft.

5. In an electrical circuit-breaker of the magnetic blow-out type, a first support on which are mounted movable contact blades forming the poles of the breaker and co-operating with contact elements to open and close the circuit upon movement of said blades, and common control means for controlling the position of the blades; a second support, structurally independent of said first support, including an operable control lever; and flexible motion-transmitting connections extending from the control lever on the second support to the control means on the first support, whereby the position of the current-carrying parts can be controlled from the lever regardless of the relative mounting positions of the two supports.

6. A multi-pole circuit interrupter comprising a frame, a plurality of pairs of contacts, an arc extinction chamber for each contact pair, a pair of cantilever insulators for each respective contact pair secured to said frame, one insulator of each pair arranged to support the arc extinction chamber and its associated fixed contact, the other insulator of each pair arranged to support the respective movable contact, the said insulators being elliptical in cross section and disposed with the long axis of the ellipse in a vertical plane, and means spaced from the said frame for controlling the position of the movable contact of each contact pair.

7. The invention as set forth in claim 6, including a crank and rod assembly connected at one end to each respective movable contact and at the other end to a control shaft to gang the contacts for motion together, the said rod being in a position parallel to the edge of the insulator in open and closed positions of the circuit interrupter.

8. The invention as set forth in claim 1, wherein the insulator has a longitudinal axis, the cross section by planes perpendicular to said axis being an ellipse, the long axis of which is in a vertical plane.

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