Aug. 1, 1950 H. N. SCHNEIDER 2,517,136

CONTACT STRUCTURE FOR ELECTRIC CIRCUIT BREAKERS

Filed Sept. 13, 1949

Fig. 1.

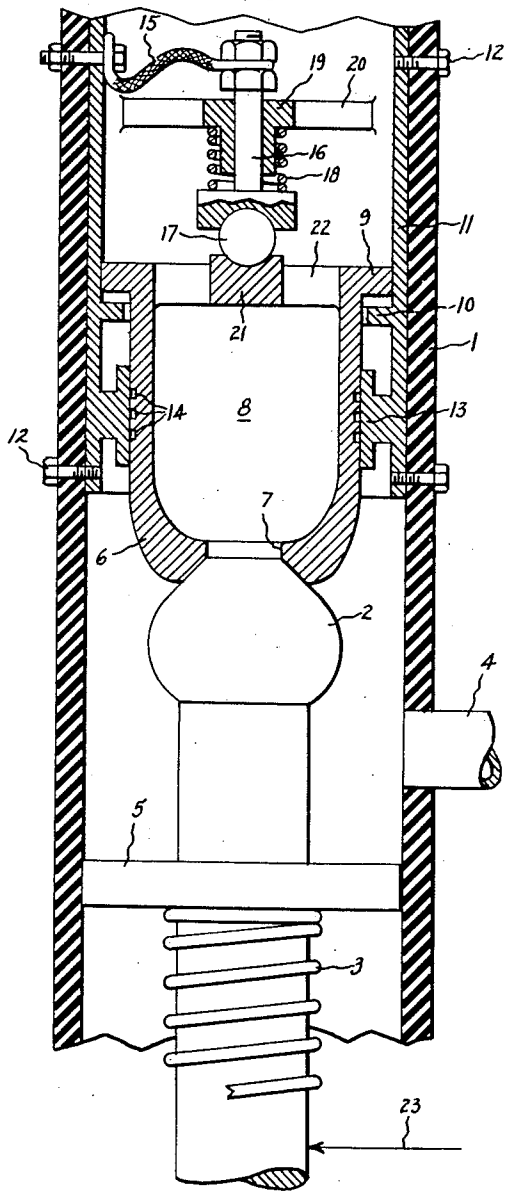
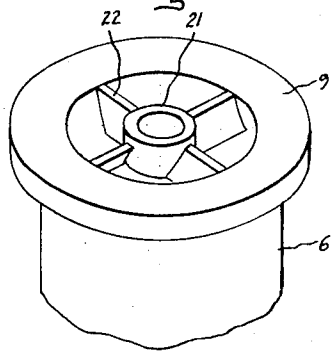


Fig. 2.



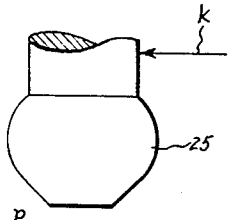
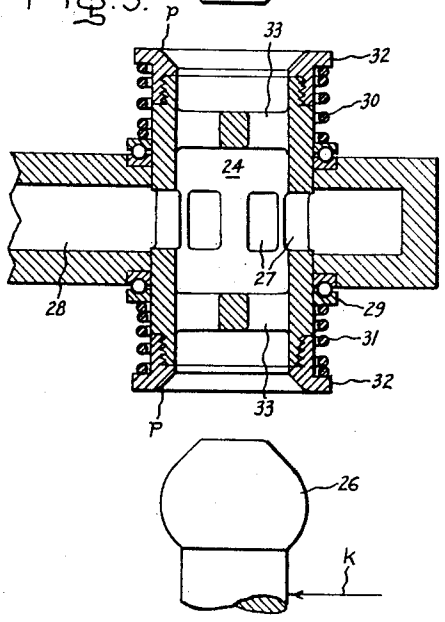


Fig. 3.



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CONTACT STRUCTURE FOR ELECTRIC CIRCUIT BREAKERS

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8 Claims. (Cl. 200—148)

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My invention relates to contact structure for electric circuit breakers and more particularly to an arrangement for causing relative motion between the arcing surfaces of the cooperating contacts in a direction transverse with respect to the arc drawn between the contacts upon separation thereof.

When electrical contacts are separated, there is a tendency for the arc roots to adhere to a particular spot on the arcing surfaces of the contacts and by so doing to cause harmful pitting of the arcing surfaces. For example, in interruupters wherein the incoming and outgoing leads together with the contact structure form a loop circuit, the arc drawn upon separation of the contacts is urged outwardly by magnetic forces in such a way as to tend to enlarge the loop. In this way, the arc roots tend to adhere to a particular spot on the contact surfaces each time an interrupting operation is performed so that pitting of the contacts at this spot is likely to occur. Also, in interrupters utilizing but type contacts, damage due to mechanical wear and to arcing is likely to be confined to a very small area during repeated operations of the interrupter. Known means have been utilized to obviate this difficulty by causing the arc roots to move over a substantial portion of the arcing surfaces of the contacts. For example, magnetic means have been utilized for this purpose in known devices.

An object of my invention is to provide mechanical means for preventing destructive pitting of the contacts due to the tendency of the arc to dwell at a particular spot on the arcing surfaces of the contacts.

In accordance with the invention, provision is made for relative motion between the arcing surfaces of the contacts in a direction transverse with respect to the arc and thereby prevent the arc roots from remaining at a particular spot on the arcing surfaces of the contacts. This relative motion is preferably achieved by utilizing means responsive to the flow of arc extinguishing fluid directed at the arc upon separation of the contacts.

For a better understanding of my invention, reference may be had to the accompanying drawings, in which Fig. 1 is a sectional view of a circuit breaker embodying the contact structure of my invention; Fig. 2 is a perspective view of a portion of one of the contacts comprising my invention; and in which Fig. 3 is a sectional view of an interrupter embodying a modification of the invention shown in Fig. 1.

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The arrangements shown in the drawings are more nearly representative of circuit breakers of the gas blast type than of breakers of the liquid blast type. It will be understood, however, that my invention is not limited to gas blast interrupters but could be applied to liquid blast circuit breakers, particularly to those of the type wherein piston means are utilized to establish a blast of arc extinguishing liquid.

With reference to Fig. 1, the contact structure is housed within a tubular casing 1 constructed of insulating material. Disposed within the enclosing casing 1 is a reciprocable contact 2 which is biased toward the contact closed position by compression spring 3. Fluid pressure is supplied to the arcing chamber within the tubular housing 1 through the inlet passage 4. Contact 2 is provided with an enlarged section 5 which acts as a piston and which imparts contact opening movement to contact 2 when a blast of pressure fluid is supplied to the arcing chamber from conduit 4.

Disposed in cooperative relation with respect to the reciprocable contact 2 is a rotatable nozzle type contact 6 having a throat portion 7 and a hollow portion 8. Contact 6 is provided with a flanged portion 9 which is engageable by the flange 10 on the tubular metallic member 11 disposed within the insulating tubular member 1 and secured thereto by means of bolts 12. Metallic tubular member 11 is provided with a guide sleeve 13 of reduced internal diameter for slidably engaging the exterior surface of the contact 6. In order to prevent the passage of pressure fluid between the guide sleeve 13 and the contact 6, a plurality of grooves, such as are indicated by the numeral 14, may be cut into the exterior surface of the contact 6 to form a labyrinth type seal.

Contact 6, being rotatable, is electrically connected to the metallic tube 11 through flexible lead 15, plunger 16 and a spherical electrical conducting element which constitutes the low friction bearing 17. Plunger 16 is biased downwardly by means of a compression spring 18 and is slidably supported by the hub portion of spider 19 constructed with open exhaust ports or vents between adjacent spider arms 20 which are welded or otherwise secured to the tubular member 11. Bearing 17 engages the hub portion 21 supported by spider arms 22 which are secured to the inner surface of the contact 6 in the upper hollow portion of this contact. Bearing 17 should be constructed of a suitable alloy mate-

rial to insure proper electrical and mechanical characteristics.

As is more clearly shown in Fig. 2, the spider arms 22 are constructed with curved surfaces which constitute a plurality of vanes arranged to exert a thrust on the contact 6 tending to rotate the contact in a clockwise direction as viewed in Fig. 2.

The circuit through the interrupter shown in Fig. 1 comprises the schematically represented terminal 23, contacts 2 and 6, bearing contact 17, plunger 16, yieldable strap 15, and metallic tube 11. One of the bolts 12 may be used as a terminal of the breaker.

When a blast of fluid is supplied to the arcing chamber constituted by the tubular casing 1 through the conduit 4, pressure exerted on the working face of piston 5 causes contact 2 to move out of engagement with contact 6 against the bias of the closing spring 3. If it is desired to have contact 2 remain in the open position, suitable latch means, such as are known in the art, may be provided for this purpose. When contact 2 separates from contact 6, a blast of fluid will pass through the throat 7 of contact 6 into the hollow portion 8 of the contact and in passing between the spider vanes 22 will cause contact 6 to rotate in a clockwise direction, as viewed in Fig. 2. This rotary motion of contact 6 will tend to stretch the arc established between two particular points on the arcing surfaces of contacts 2 and 6. This stretching action will result in movement of both the arc roots relative to their respective contacts, this movement being in such a direction as to produce a shorter arc than would have been drawn had the roots remained anchored at their points of initiation. As contact 6 continues to rotate, the arc roots will continue to change position with respect to both arcing surfaces so that any tendency for the arc roots to dwell upon their points of initiation is defeated and, as a result, harmful localized burning and pitting is avoided so that generally uniform contact erosion is produced whereby the useful life of the contacts is considerably prolonged.

It will be understood that the rotary contact or electrode of my invention can readily be adapted to serve as a floating or intermediate contact disposed between relatively movable contact structure whereby series arcs are produced in the interrupting circuit of a power circuit breaker. Such a hollow, floating, but non-rotatable intermediate contact is disclosed in U. S. Patent 2,075,749 to Paul, which is assigned to the same assignee as the present application.

A specific embodiment is illustrated by Fig. 3 wherein 24 generally designates a rotatable intermediate contact structure disposed in floating relationship between the relatively separable interrupting contacts 25 and 26. In the present instance, it may be assumed that both the contacts 25 and 26 have moved away from the relatively fixed but rotatable contact 24. In other words, Fig. 3 depicts a double axial-blast interrupter which operates in substantially the same manner as that described in U. S. Patent 2,444,765 to Boisseau et al., which is assigned to the same assignee as the present application. More specifically, coincident with the separation of contacts 25 and 26 from contact 24, opposing blasts are caused to flow through the arc gaps therebetween, these blasts impinging one upon the other within the contact 24 and then dispersing radially outwards through suitable ports 27 in the rotating contact 24 and thence through the cavity 28 in the stationary supporting structure respectively. The hollow contact 24 is mounted for free rotational movement in its fixed supporting structure through the agency of suitable low-friction bearings, such as the ball thrust elements 29, while the springs 30 and 31, which are constrained between the thrust bearings and the flanged screwed arcing rings 32, provide for any appropriate floating axial movement which may be required or desirable. It will be understood that, where the contact 25 is fixed, with contact 26 being the only externally actuated contact member as in the aforesaid Paul patent, the contact 24 may be caused to separate from the contact 25 at high speed by providing a spring 31 of much greater preponderating strength than that of the other spring 30 which serves merely as a resilient spacer.

In accordance with my invention, hollow intermediate contacts, such as 24, would be provided with an appropriate oblique-vaned spider for causing contact rotation; and, in the opposed blast arrangement illustrated in Fig. 3, the contact would have a pair of such vaned spiders 33 which might be cast integral with the body portion of the contact 24. Obviously, the vanes of one spider would be pitched oppositely from the pitch of the other spider member so that the dual opposing blasts would both combine to rotate the contact 24 in the same rotational direction. Alternatively, equivalent vane structure could be incorporated or associated with the ports 27; e. g. the bars separating these radial ports could themselves constitute vane members.

In view of the state of the circuit interrupting art, it is thought that further explanation of operation is unnecessary and it is believed that the embodiments shown in Figs. 1 and 3 are indicative of the broad field of application for which the rotatable contact of my invention is suited to and adaptable for.

Furthermore, it will be appreciated that in any form that the rotatable arcing contact may assume, the useful life thereof will be appreciably extended beyond that of a non-rotatable one because, even though the arc is initiated at the contact always in a certain radial direction, for example, toward the points p in Fig. 3, these actual points on the rotatable contact will be different for each operation. This will be understood because rotation of the contact quickly shifts the roots on both the relatively fixed and relatively movable contacts, as already explained; and for the further reason that it is unlikely that the rotated contact will come to rest after an interrupting operation in exactly the same angular position from that in which it was at the start. Fig. 3 is illustrative of an interrupter in which the arcs would always tend to be initiated toward the left in the region of the points p if the terminal structure was such as to produce a loop in the interrupting circuit, as indicated by the arrows k contacting the relatively separable contacts 25 and 26 respectively.

While I have shown and described particular embodiments of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made without departing from my invention in its broader aspects and I, therefore, intend in the appended claims to cover all such changes and 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:

1. In an electric circuit breaker, an arcing

chamber, a pair of separable contacts in said chamber for drawing an arc to be extinguished, one of said contacts being rotatable, means for supplying a blast of fluid to said chamber to extinguish the arc drawn between said contacts upon separation thereof, and means operable in response to a blast of fluid supplied to said chamber for imparting rotary motion to said rotatable contact upon separation thereof from the other of said contacts.

2. In an electric circuit breaker, an arcing chamber, a rotatable contact and a reciprocable contact in said chamber, said contacts being separable to draw an arc therebetween when said reciprocable contact is moved out of engagement with said rotatable contact, means for supplying a blast of arc extinguishing fluid to said chamber to extinguish the arc drawn between said contacts upon separation thereof, and fluid actuated means formed integrally with said rotatable contact and operable by the blast of fluid supplied to said chamber to impart rotary motion to said rotatable contact.

3. In an electric circuit breaker, an arcing chamber, a rotatable nozzle type contact having a throat portion and a hollow portion, a reciprocable contact movable out of engagement with said rotatable contact to draw an arc therebetween, said contacts being disposed within said chamber, means for supplying a blast of arc extinguishing fluid to said chamber and through the throat portion of said rotatable contact upon separation of said contacts, and vane means disposed in the hollow portion of said rotatable contact and secured thereto for imparting rotary motion to said rotatable contact upon separation of said contacts in response to the flow of fluid through said rotatable contact.

4. In an electric circuit breaker, an arcing chamber, a rotatable nozzle type contact having a throat portion and a hollow portion, a reciprocable contact movable out of engagement with said rotatable contact to draw an arc therebetween, said contacts being disposed within said chamber, means for supplying a blast of arc extinguishing fluid to said chamber and through the throat portion of said rotatable contact upon separation of said contacts, a spider having a hub portion and a plurality of vanes disposed within the hollow portion of said rotatable contact for causing rotation of said rotatable contact in response to the flow of fluid through said rotatable contact, terminal means, and bearing means interposed between said terminal means and the hub of said spider for forming an electrical connection therebetween with minimum opposition to the rotary motion of said rotatable contact.

5. In an electric circuit breaker, the combination of a tubular contact, means for supplying a blast of fluid through said contact, spider structure including a hub portion and a plurality of arms disposed within said contact and secured thereto, said arms being configured and disposed to form a plurality of vanes for exerting a turning moment on said contact in response to said blast of fluid.

6. In an electric circuit breaker, the combination of supporting structure, a rotatable contact, vane structure secured to said contact, means for supplying a blast of fluid to said vane structure to rotate said contact, and bearing means interposed between said structure and said contact and forming an electrical connection therebetween.

7. A circuit interrupter of the fluid-blast type comprising relatively separable contact structure including a first, second, and third contact, said second contact constituting an intermediate contact between said first and third contacts for producing series arcs therebetween, means for directing a blast of dielectric fluid into said structure for extinguishing at least one of said series arcs, and means for mounting said intermediate contact so as to be freely rotatable upon separation of said contacts.

8. A circuit interrupter of the fluid-blast type comprising relatively separable contact structure including a first, second and third contact, said second contact constituting an intermediate contact between said first and third contacts for producing series arcs therebetween, means for directing a blast of dielectric fluid into said structure for extinguishing at least one of said series arcs, and means for mounting said intermediate contact so as to be freely rotatable upon separation of said contacts, said intermediate contact being rotatable in response to said fluid blast during a circuit interrupting operation.

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REFERENCES CITED

The following references are of record in the file of this patent:

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Number	Name	Date
2,445,529	Leeds	July 20, 1948