Nov. 16, 1943. I. R. LATTA 2,334,562

ELECTRIC CONTACT ELEMENT

Filed Jan. 14, 1942

Fig. 1.

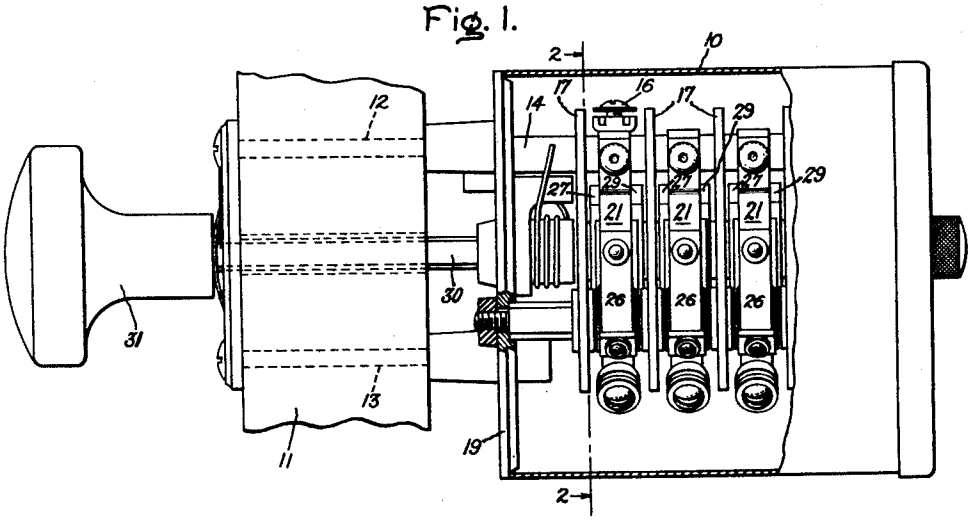


Fig. 2.

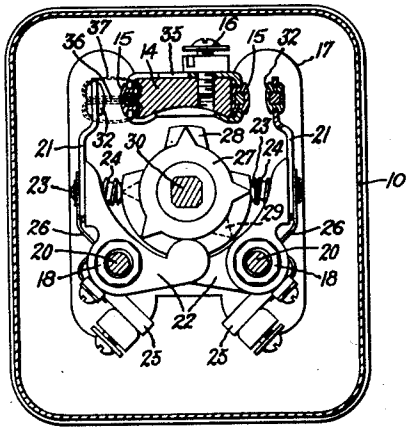


Fig. 3.

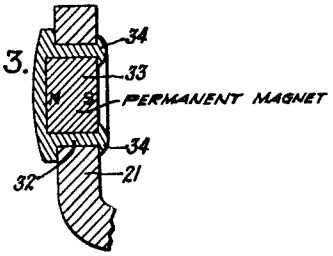
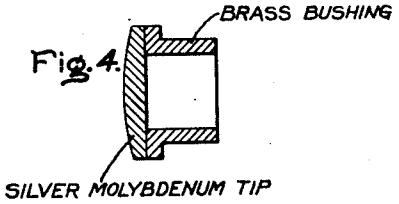


Fig. 4.



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UNITED STATES PATENT OFFICE

2,334,562

ELECTRIC CONTACT ELEMENT

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Appliction January 14, 1942, Serial No. 426,741

4 Claims. (Cl. 200—147)

My invention relates to electric contact elements and particularly to means for extinguishing electric arcs between circuit breaking contacts. While not limited thereto, the invention is particularly applicable to the contacts of manually operable or other slow moving electric switches such as selector switches, controllers and the like.

One object of this invention is to provide new and improved magnetic means for extinguishing an arc between separable electric contacts.

It is a further object of this invention to provide magnetic means for the above purpose which shall be of simple, durable and inexpensive construction.

It is a still further object of the present invention to provide magnetic blowout means for the separable contacts of an electric switch which shall be relatively small in size and easily mounted within a confined space.

It is another object of the invention to arrange arc extinguishing magnetic blowout means in connection with electric switch contacts in such a manner as to obtain an optimum effect in lengthening and attenuation of the electric arc.

To the attainment of the above and other objects my invention preferably comprises one or more wafer-like or disk-like permanent magnets mounted preferably within and coaxially with either the stationary or moving contact or both of an electric switch thereby to establish a main magnetic flux between the contacts and a return magnetic flux substantially parallel to the main flux and in the region of the arc but radially displaced from the main flux. Preferably the invention is carried out by providing a wafer-like magnet in both the stationary contact and the moving contact and disposing the magnets relative to each other so that unlike poles are in juxtaposition.

My invention will be better understood by referring now to the following detailed specification taken in conjunction with the accompanying drawing in which Fig. 1 is a side view, partly broken away, of a panel-mounted multiple contact finger manually operable control switch embodying my invention; Fig. 2 is a sectional view taken along the lines 2—2 of Fig. 1; and Fig. 3 is an enlarged sectional view of one of the movable switch contacts shown at Figs. 1 and 2; and Fig. 4 is an enlarged sectional view of a contact element of modified form.

Referring now to the drawing, and particularly to Figs. 1 and 2, I have shown a manually operable multi-finger control switch generally similar in construction to that described and claimed in my Patent 2,202,698, issued May 28, 1940. The switch is mounted within a casing 10 and attached to a support such as the panel 11 by means of supporting bolts 12 and 13 passing through the panel. The switch itself comprises a stationary contact block 14 having stationary contacts 15 mounted on opposite sides thereof and provided with a terminal connector 16. Between each oppositely disposed pair of stationary contacts 15 is arranged an insulating barrier 17 provided at its lower end with a pair of octagonal bosses 18 on one side thereof and a pair of aligned octagonal recesses on the opposite side thereof. The bosses 17 and aligned recesses are assembled in nesting relation to space the barriers, and the barriers are bolted firmly together and to a front supporting plate 19 by means of threaded tie rods 20 passing through the octagonal bosses 17. The support 19 is recessed to receive the adjacent octagonal boss 18 and illustrates the manner in which the barriers 17 are nested together.

Between each pair of barriers 17 two oppositely disposed movable fingers 21 are pivotally mounted upon the octagonal bosses 18, as illustrated in Fig. 2. Each movable contact finger 21 is formed of a strip of copper or other electrically conducting material resiliently connected to a rotatable cam lever 22 by means of a pin 23 and a wipe spring 24. Each contact finger 21 is electrically connected to a terminal block 25 by means of a flexible shunt 26. The movement of each pair of oppositely disposed movable contact fingers 21 is controlled by three centrally located rotatable cams 27, 28 and 29. The cams are mounted upon a manually rotatable operating shaft 30 extending through the panel 11 and terminating in an operating handle 31. The cams 27 and 29 are each suitably shaped to move one contact finger 21 to its circuit closing position by engagement with one of the cam levers 22, while the cam 28 is suitably shaped to move both oppositely disposed contact fingers 21 to their circuit opening positions in a desired sequence by engagement with the pins 23.

Referring now particularly to Fig. 3, which is an enlarged sectional view of one of the movable contact members, the copper strip 21 is bored to provide a circular aperture at its upper end for receiving a contact button 32. The button 32 is of a cylindrical shape having one end closed to form a contact surface and the other end open to receive a disk-like or wafer-like permanent magnet 33. The button 32 may be integrally

formed of suitable contact material such as fine silver, although in the preferred form of my invention the button comprises a silver molybdenum contact tip brazed onto a brass bushing, as illustrated in Fig. 4. In assembly, the contact button whatever its composition, initially has the shape illustrated at Fig. 4 and the permanent magnet 33 is inserted therein with one of its poles adjacent and underlying the contact surface. The assembly comprising the button 32 and the magnet 33 is then inserted in the aperture of the contact finger 21, and the open end of the button or bushing is spun over both ways as indicated at 34 in Fig. 3, thereby to hold the button on the contact strip 21 and to hold the magnet 33 within the button.

In order to facilitate assembly of my new and improved magnetic blowout means within a confined space, I prefer to use a permanent magnet formed of a material having a relatively high coercive force in relation to its size. A suitable material for this purpose is an alloy comprising 6 to 15 per cent aluminum, 12 to 30 per cent nickel, about 5 per cent copper, if desired, and the remainder iron, such as described and claimed in Patents 1,947,274 and 1,968,569, issued February 13, and July 31, 1934, respectively, to William E. Ruder.

In the form of my invention illustrated in the drawings the stationary contacts 15 are formed in the same manner as the movable contacts 32 and are connected to a copper strip 35 overlying the contact block 14. While I have shown my invention in its preferred form in which wafer-like permanent magnets are mounted in both the stationary and moving contacts, it will be understood that the advantages of my invention may be partially realized by mounting a magnet only in one of these contacts. Where magnets are mounted in both the moving and stationary contacts the magnets are so disposed that unlike poles of the two magnets are juxtaposed. For example, if a north pole of the magnet mounted in the moving contact is adjacent the contact face, a south pole of the magnet mounted in the cooperating stationary contact will be adjacent the contact face.

With the magnets disposed in the manner described, they will establish a main magnetic flux 36 passing in a straight line directly across the air gap between the contacts when separated, as indicated at Fig. 2. The returning magnetic flux will divide and take a path 37 parallel to the main flux 31 and radially displaced therefrom but still within the range of the arc. It will be understood that the flux path 37 is substantially cylindrical and surrounds the cooperating pair of contacts.

In operation, when any pair of contacts is separated while carrying current, an initial electric arc will be established between the contacts substantially along a straight line between the centers of the contact surfaces. It will be observed that this initial electric arc is substantially parallel to the main magnetic flux. So long as the arc remains parallel to the magnetic flux the magnetic field set up by the arc is perpendicular to the field of the permanent magnets and there is no magnetic reaction between these fields and hence no blowout effect. However, the arc tends to rise with the rising current of air heated by the arc, and as soon as the ends of the arc take up non-parallel positions with respect to the main magnetic flux 36, the opposite ends of the arc will be spun in opposite directions by the main field. For example, let it be assumed that when looking down from the top of the arc, the main magnetic flux 36 spins the arc in a clockwise direction. If this spinning of the arc and lengthening of its path does not attenuate the arc sufficiently to interrupt the current, the hot air heated by the arc will continue to force the center of the arc upward until it comes within the region of the return flux 37. The return magnetic field will have the same effect upon the center of the arc as the main magnetic field has upon its ends except that the return field, being of opposite polarity, will tend to spin the center of the arc in the opposite direction from the rotation of its ends. Thus, following the example assumed, if the ends of the arc are being spun in a clockwise direction by the main field flux 36, the center of the arc will be spun in a counterclockwise direction by the return field 37. In this manner a maximum lengthening and distorting effect is obtained upon the arc so that its rapid extinction is assured.

While I have shown a preferred embodiment of my invention by way of illustration, many modifications will occur to those skilled in the art, and I therefore wish to have it understood that I intend by the appended claims to cover all 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:

1. In a circuit interrupter, the combination comprising a pair of cooperating switch contacts having engaging surfaces, at least one of said contacts being movable substantially along the normal to said surfaces at their point of engagement to engage and disengage said contacts, each of said contacts being provided with a recess beneath the surface thereof, and a permanent magnet secured in each of said recesses and so positioned that the axes of said magnets are substantially aligned with said normal, said magnets being arranged with unlike poles in juxtaposition with said contact surfaces respectively, whereby the ends of an arc formed between said contacts when said movable contact is moved to its open circuit position are rotated in opposite directions adjacent said contact surfaces and the center of said arc is rotated in an opposite sense thereby quickly to extinguish said arc.

2. In a circuit interrupter, the combination comprising a pair of separable cooperating contacts having engaging surfaces, each of said contacts having a circular recess in the side opposite its contact surface, a disk-shaped permanent magnet provided with unlike poles on opposite sides secured in the recess in each of said contacts, said magnets being arranged with unlike poles adjacent said contact surfaces respectively whereby the ends of the arc formed between said contacts when said contacts are separated are rotated in opposite directions adjacent said contact surfaces thereby quickly to extinguish the arc.

3. In a manually operable circuit interrupter, fixed and movable contact members, each of said contact members comprising a circularly apertured strip of electrically conducting material and a cylindrical contact button mounted in the aperture in said strip, each of said contact buttons being closed at one end to provide a contact surface and having a circular recess in the opposite end thereof, a disk-shaped permanent magnet provided with unlike poles on

opposite sides secured in the recess in each of said buttons, said magnets being arranged with unlike poles in juxtaposition adjacent said contact surfaces, whereby the ends of an arc forms between said contacts when said movable contact is moved to its open circuit position or rotated in opposite directions adjacent said contact surfaces thereby quickly to extinguish the arc.

4. In a manually operable circuit interrupter, a pair of cooperating switch contacts separable to establish an initial arc along a substantially straight line between said contacts, at least one of said contact members comprising a circularly apertured strip of electrically conducting material and a cylindrical contact button mounted in the aperture in said strip, said contact button being closed at one end to provide a contact surface and having a circular recess in the opposite end thereof, a disk-shape permanent magnet provided with unlike poles on opposite sides secured in the recess in said button, said magnet being mounted so that its axis is substantially in alignment with said initial arc thereby to establish a main magnetic flux between said contacts along a line substantially parallel to said arc and a return magnetic flux in the region of said arc and radially displaced from said main flux.

ISAAC R. LATTA.