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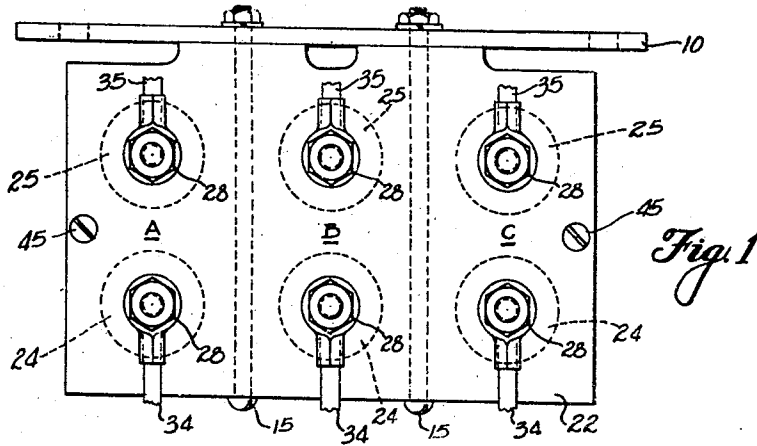
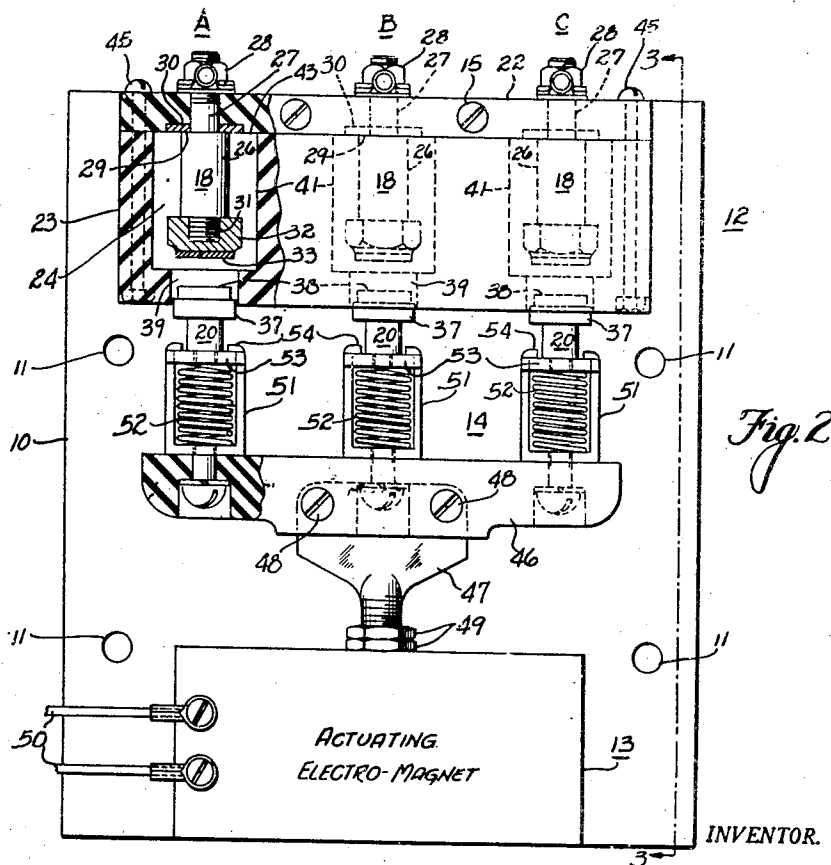
G. W. PETERS

2,411,894

ARC EXTINGUISHING CHAMBER FOR CIRCUIT BREAKERS

Filed Feb. 9, 1944

2 Sheets-Sheet 1



INVENTOR.
BY *Gerhard W. Peters*
Woodling and Krost
attys

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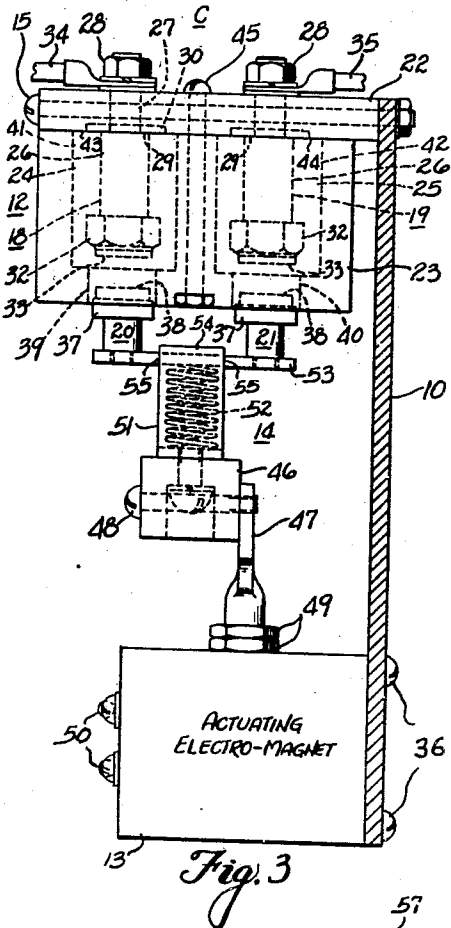
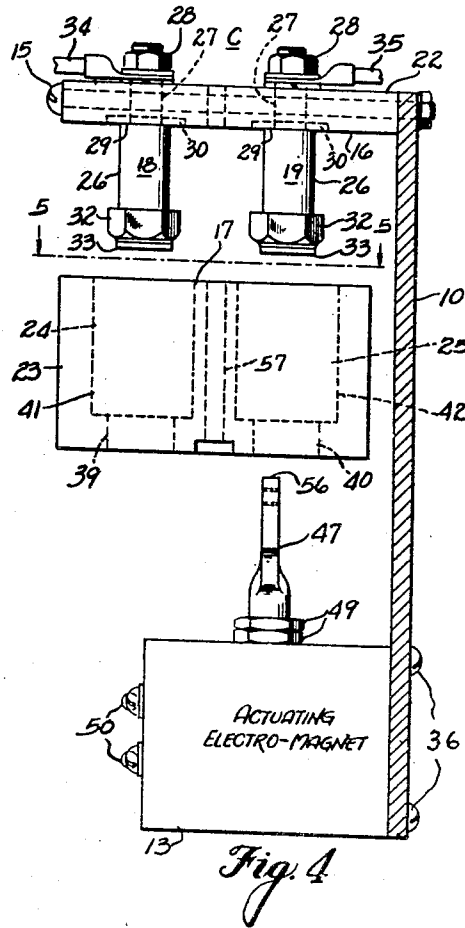
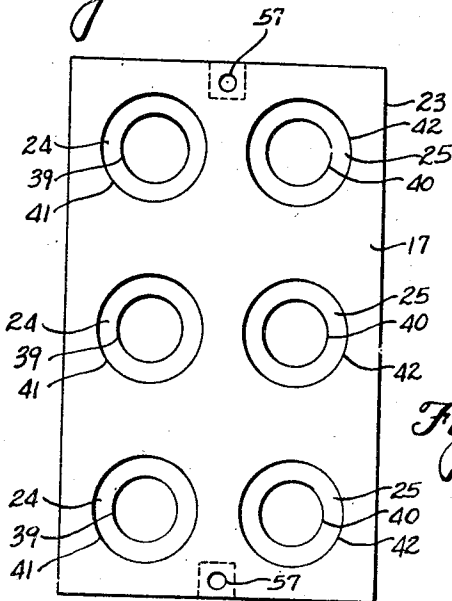
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ARC EXTINGUISHING CHAMBER FOR CIRCUIT BREAKERS

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2 Sheets-Sheet 2



INVENTOR.
Gerhard W. Peters
BY
Woodling and Krost
attys

UNITED STATES PATENT OFFICE

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ARC EXTINGUISHING CHAMBER FOR
CIRCUIT BREAKERS

Gerhard W. Peters, Akron, Ohio

Application February 9, 1944, Serial No. 521,613

3 Claims. (Cl. 200-144)

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My invention relates in general to electric switches and more particularly to quick-acting circuit interrupting switches which may be actuated electro-magnetically or otherwise.

An object of my invention is the provision of a split insulating housing having an arc chamber for an electric switch having stationary contact means mounted upon one of the parts of the split housing and having the movable contact means projecting into an opening through the other part of the split insulating housing, the contact means and the split insulating housing means being so arranged that when the part having the opening therein is removed, the stationary contact means becomes readily exposed and accessible for inspection and replacement.

Another object of my invention is the provision of preventing the removal of one of the parts of the split insulating housing when the movable contacts are in their operative motion transmitting position.

Another object of my invention is to prevent the removal of one of the parts of the split insulating housing unless the movable contacts and the motion transmitting means which operate them are first removed.

Another object of my invention is the provision of resilient means interposed between the movable contact means and the actuating mechanism, the resilient means being so disposed that it is mounted externally of the insulating housing to be free from the arc in the insulating housing.

Another object of my invention is to prevent the movable contact means during the circuit interrupting movement from being withdrawn from the opening in the insulating housing in which the movable contact means operates.

Another object of my invention is the provision of a housing having a large chamber and a small chamber in which the separable contacts are first separated in the large chamber, after which the movable contact immediately moves into the small chamber, the movable contact being arrested in its separating movement in the small chamber, or at least prior to a point where the area between the movable contacts and the side wall of the small chamber equals the cross-sectional area of the small chamber.

Another object of my invention is to provide a housing having a large chamber in which the stationary contact is mounted and having a smaller chamber connecting the large chamber with the outside of the housing forming an opening through which the movable contact is actuated to engage the stationary contact.

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Another object of my invention is the provision of detachably removing the movable contact means without removing the insulating housing.

Other objects and a fuller understanding of the invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a top view of a switch embodying the features of my invention;

Figure 2 is a front elevational view of the device shown in Figure 1 with certain parts broken away to illustrate more clearly the construction of the arc chamber and the stationary contacts;

Figure 3 is a side elevational view of the device shown in Figure 2, taken along the line 3-3 thereof;

Figure 4 is a view similar to Figure 3, illustrating the manner in which one of the split parts of the insulating housing is removed; and

Figure 5 is a view along the line 5-5 of Figure 4, showing the split part of the housing which is removed.

With reference to the drawings, the switch is designated generally by the reference character 12 and is arranged to be operated by an actuating electro-magnet indicated by the reference character 13.

The switch 12 and the actuating electro-magnet 13 may be mounted on a base 10 having holes 11 therein to facilitate the anchoring of the entire assembly to a suitable support. The actuating electro-magnet 13 may be of any suitable design or construction and is arranged to be electrically energized by the conductors 50, and acts to close the switch 12 when energized, in a manner to be described. The actuating electro-magnet 13 has an operating member 47 extending upwardly from one side thereof. As illustrated, the operating member 47 is in its lower or retracted position. The downward travel of the member 47 opens the contacts and is arrested by means of the adjustable nuts 49.

In the drawings, the switch 12 is arranged to interrupt a three phase circuit by three sets of contacts designated, respectively, as A, B and C disposed in a split insulating housing. The set of contacts A, B and C for the respective phases of the electric circuit are of the same construction and corresponding parts bear the same reference character. As shown, each set of contacts is arranged to produce a "double-break" and comprises two stationary contact means 18 and 19 and two movable contact means 20 and 21. The contact means 18 and 20 comprise one pair of contacts and the contact means 19 and 21

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comprise another pair of contacts. The pair of contacts consisting of the contact means 19 and 21 are disposed closer to the base 10 than the pair of contacts consisting of the contact means 18 and 20. The movable contact means 20 and 21 are connected together by a bridge member 53. As illustrated best in Figure 2, the bridge members 53 for the respective phases A, B and C are arranged to be simultaneously actuated by a motion transmitting means 14 which is actuated by the member 47 of the actuating electro-magnet 13.

Each of the pair of contacts is arranged to be interrupted in a split insulating housing comprising two parts 22 and 23. The part 22 comprises an insulating support member and the part 23 comprises an insulating body member adapted to be detachably connected to the insulating support member by screws 45 which extend through holes 57 in the insulating body member 23. The insulating support member and the insulating body member have mating wall surfaces 16 and 17, respectively, abutting against each other and forming the split between the members. The split insulating housing has individual arc chambers for each of the pair of separable contacts. The arcs chambers are designated by the reference characters 24 and 25. The arc chambers 24 respectively enclose the stationary contact means 18 and comprise a recess 41 and the arc chambers 25 respectively enclose the stationary contact means 19 and comprise a recess 42. The upper end of the recess 41 is closed by a wall portion 43 which is part of the mating split wall 16 of the insulating supporting housing 22. Similarly, the upper end of the recess 42 for the stationary contact means 19 is closed by a wall portion 44 which also comprises a part of the mating split wall 16 of the insulating supporting housing 22. The lower end of the recess 41 is provided with an opening 39 in which the movable contact means 20 is operated by the motion transmitting means 14. The lowermost end of the recess 42 is provided with an opening 40 in which the movable contact means 21 is operated by the motion transmitting means 14. The stationary contact means 18 and 19 are of the same construction and comprise a post 26 having a terminal extension 27 provided on the upper end thereof and having a replaceable contact element 32 removably mounted on the lower end thereof. The terminal extensions 27 extend through openings in the insulating support member 22 and are securely fastened to the insulating support member 22 by terminal nuts 28. A shoulder 29 which is provided between the post 26 and the terminal extension 27 rests against a washer 30 which is embedded in the insulating support member 22. The lower end of the post 26 is provided with a reduced threaded portion 31 and is arranged to threadably engage a replaceable contact element 32. The underneath side of the replaceable contact element 32 may be provided with a contact tip member 33 which is arranged to be engaged by a contact tip member 38 provided on the contact element 37 of the movable contact means.

The insulating support member 22 and the actuating electro-magnet 13 are so positioned upon the base 10 that a gap exists between the contact tip members 33 on the stationary contact means and the end 56 of the operating member 47 to provide a space for the removal of the removable insulating body member 23. The stationary insulating support member 22 may be

anchored to the base 10 by means of screws 15 and the actuating electro-magnet 13 may be anchored to the base 10 by screws 36. The movable contact means and the motion transmitting means 14 in their operative position are disposed in the said gap and obstruct the withdrawal of the insulating body member 23, so that the removable insulating body member 23 cannot be removed when the switch is in its operative position.

As illustrated, the motion transmitting means 14 comprises a movable cross-arm 46 which is arranged to be detachably connected to the member 47 of the actuating electro-magnet 13 by means of screws 48. Mounted at spaced intervals upon the movable cross-arm 46 are three spring cages 51 which contain a spring 52 and the bridge member 53 which carry upon each end thereof the movable contact means 20 and 21. The spring cages 51 comprise a U-shaped member in which the side members thereof have their upper ends provided with inturned flanges 54 which constitute stops for holding the bridging member 53 within the spring cage 51 under the compression of the spring 52. Each side edge of the bridging member 53 is provided with a notch presenting shoulders 55 for engaging the side edges of the spring cage 51. The shoulders 55 prevent a lateral movement of the bridging member 53 within the spring cage 51. As the movable contact means engage the stationary contact means, the spring 52 is compressed and thereby assures that all of the pairs of contacts are making a resilient pressure engagement. Each of the bridging members 53 and the movable contacts carried thereby may be readily removed from the spring cage 51 by manually depressing the spring 52 and then turning the bridge member 53 until at least one of the notches on the side edge of the bridging member 53 clears the inwardly turned flange 54, after which the bridging member may be removed from the spring cage 51. A new bridging member 53 may be mounted within the spring cage 51 in the reverse manner. Therefore, in my invention the bridging members 53 and the movable contacts carried thereby may be individually removed with the insulating housing in its fixed normal operating position. In other words, I am able to remove and inspect the movable contacts without removing the housing.

In operation, all of the movable contact means are operated substantially simultaneously by upward movement of the motion transmitting means 14 for closing the three phases of the electrical circuit. Upon the interruption of the movable contact means by a downward movement, a "double break" occurs between the line conductors 34 and 35 of each of the phases A, B and C. The interruption occurs upon de-energizing the actuating electro-magnet 13, and is made to occur quickly by sudden expansion of the compressed springs 52 reacting upon the motion transmitting means 14 and giving it a quick kick downwardly. As the movable contact means for each pair of contacts is separated from the stationary contact means, the arc between the separable contacts is in the recessed arc chamber which houses the pair of contact means. As the movable contact means for the pair is quickly withdrawn from the stationary contact means, if the arc between the contact means is not immediately ruptured, it tends to follow the movable contact means into the opening through which the movable contact means operates. The movement of

the movable contact means is arrested when the adjustable nuts 49 engage the electro-magnet 13. In my invention, I preferably provide for arresting the movement of the movable contact means in the openings through which the movable contact means operates. These openings constitute guides for the movable contact means, which fit in the openings with a small clearance therebetween, and the small chambers above the movable contact means when in their downward arrested position, are therefore substantially closed chambers. As shown in the drawings, the post 26 in the recess 24 projects from the end wall portion 43 thereof into said recess to a point therein, whereby the contacts separate in a region which is closer to the opposite end wall of the recess containing the small chamber or opening 39 than to the end wall portion 43 constituting the top closure end for the annular recess. Similarly, the post 26 in the recess 25 projects from the end wall portion 44 thereof into said recess to a point therein whereby the contacts separate in a region which is closer to the opposite end wall of the recess containing the small chamber or opening 40 than to the end wall portion 44 constituting the upper closure end for the annular recess. Inasmuch as the contacts separate in a region relatively close to the small chambers or openings, the actuating means may quickly withdraw the movable contacts thereinto, whereby the arc is readily extinguished. The motion transmitting means 14 holds the movable contact means relatively stable so that the movable contact means may be adjusted by the adjustable nuts 49 to be further withdrawn from the said openings. In order that the movable contact means may restrict the openings in which they operate when the contact means are fully withdrawn, so that the small chamber will be formed, the area between the movable contact means and the said openings should be smaller than the area of the opening. In other words, the movement of the movable contact means is arrested prior to a point where the area between the movable contact means and the said opening equals the area of the opening.

In removing the insulating body member 23, it is first necessary that the motion transmitting means 14 and the movable contact means be removed from the gap between the end 56 of the member 47 and the contact tip members 33 of the stationary contact means. To insure safety of operation, the removable insulating body member 23 cannot be removed in the normal operative position of the motion transmitting means. However, the motion transmitting means may be readily removed by detaching the movable cross arm 46 from the member 47 by taking out the screws 48. When the motion transmitting means 14 and the movable contact means carried thereby are removed then the removable insulating body member 23 may be withdrawn or dropped downwardly into the gap between the end 56 of the member 47 and the contact tip members 33, as shown in Figure 4. The insulating body member 23 may then be removed laterally, whereupon the stationary contact means are readily accessible for inspection and replacement. Instead of using the screws 48, a suitable hinge construction may interconnect the member 47 and the movable cross arm 46, whereby the motion transmitting means 14 and the movable contact means may be removed from the gap by merely operating the hinge construction.

In my invention, the springs 52 are disposed

externally of the insulating housing so that they are free from the influence of the arc in the arc chambers. In other words, the springs 52 are free from heat or other damaging influences, or burning, which would otherwise occur if they were mounted within the arc chambers or otherwise exposed to the arc in the arc chambers.

Although I have described my invention with a certain degree of particularity, it is understood that the present disclosure has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. In combination, a quick-acting circuit interrupting switch having at least a first and a second pair of separable contacts, each of said pair including a stationary contact means and a movable contact means, a base, a split insulating housing mounted on the base, said housing having at least a first arc chamber for the first pair of contacts and a second arc chamber for the second pair of contacts, actuating mechanism mounted on the base for quickly operating the movable contact means to effect a quick circuit interrupting movement, said split housing comprising an insulating support member and a readily removable insulating body member adapted to be detachably connected to the insulating support member, said insulating body member having at least a first recess constituting a portion of the first arc chamber and a second recess constituting a portion of the second arc chamber, said insulating body member also having first and second openings connecting the first and second recesses respectively to the outside of the split housing, said movable contact means for the first and second pair of contacts being movable respectively in said openings upon the actuation thereof by the actuating means, said insulating members having mating wall surfaces abutting against each other and forming the split between the said members, said mating wall surfaces extending transversely of the said recesses, said stationary contact means for each pair having a first end portion mounted to the insulated support member and having a second end portion provided with a contact element, said contact element and said movable contact means for each pair having abutting contact surfaces between which current is interrupted, the stationary contact means for said first pair of contacts being disposed closer to said base than the stationary contact means for said second pair of contacts, said second end portion for each stationary contact means projecting from said insulating support member into said recess respectively and extending beyond said split, whereby said second end portions and the contact elements provided thereon for said pairs of stationary contact means are readily accessible upon removal of the insulating body member, and stop means to prevent the said movable contact means from being withdrawn from said openings in the insulated body member during the circuit interrupting movement.

2. In combination, a switch having stationary contact means and movable contact means, a split housing having a first and a second chamber for the contact means, said second chamber being smaller than the first chamber and comprising an opening extending from the first chamber to the outside of the housing, said split

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housing comprising an insulating support member and a readily removable insulating body member having an annular internal wall constituting a portion of the first chamber, an elongated element mounted on the insulated support member and having a projection portion extending into said first chamber toward the second chamber, said projection portion supporting the stationary contact means upon the end thereof, said internal annular wall of the first chamber and the external surface of the stationary contact means and the projection portion of the said elongated element defining an annular recess extending from the stationary contact means toward the insulating support member and away from the second chamber, actuating means for initially separating the movable contact means from the stationary contact means in the first chamber, said actuating means quickly withdrawing the movable contact means into said second chamber, means for arresting the movement of the movable contact means in the second chamber, whereby an arc drawn between the contact means is confined substantially in said chambers, said insulating members having mating wall surfaces abutting against each other and forming the split between said members, said mating wall surfaces extending transversely of said first chamber, said projection portion of said elongated element projecting from said insulating support member into said first chamber and extending beyond said split, whereby said stationary contact means is readily accessible upon removal of the insulating body member from the insulating support member.

3. In combination, a switch having stationary contact means and movable contact means, a housing having a first and a second chamber

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for said contact means, said first chamber having an internal annular wall portion, a first end wall portion and a second end wall portion, said second chamber being smaller than the first chamber and comprising an opening extending from the first chamber through said second end wall portion to the outside of the housing, an elongated element mounted on the said first end wall portion and having a projection portion extending into said first chamber toward the second chamber, said projection portion supporting the stationary contact means upon the end thereof, said internal annular wall portion of the first chamber and the external surface of the stationary contact means and the projection portion of the said elongated element defining an elongated annular recess extending from the stationary contact means toward the first end wall portion and away from the second chamber, actuating means for initially separating the movable contact means from the stationary contact means in the first chamber, said actuating means quickly withdrawing the movable contact means into said second chamber, and means for arresting the movement of the movable contact means in the second chamber, whereby an arc drawn between the contact means is confined substantially in said chambers, said projection portion of the elongated element projecting from the said first end wall portion into said first chamber to the point therein whereby the contact means separate in a region which is closer to said second end wall portion containing the second chamber than to the first end wall portion constituting an end for the said annular recess.

GERHARD W. PETERS.