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2,548,220

ARC TRANSFERRING MEANS FOR SWITCHGEARS

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2 Sheets-Sheet 1

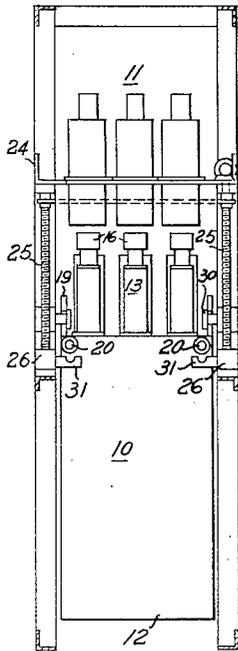
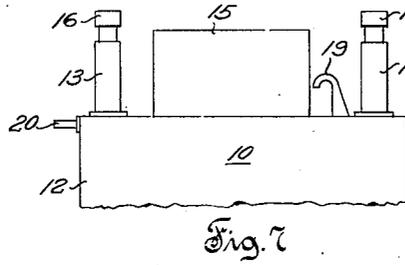
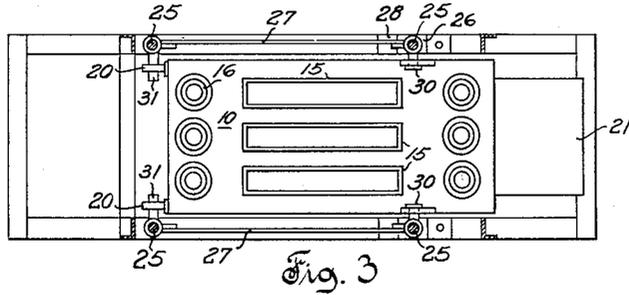


Fig. 2

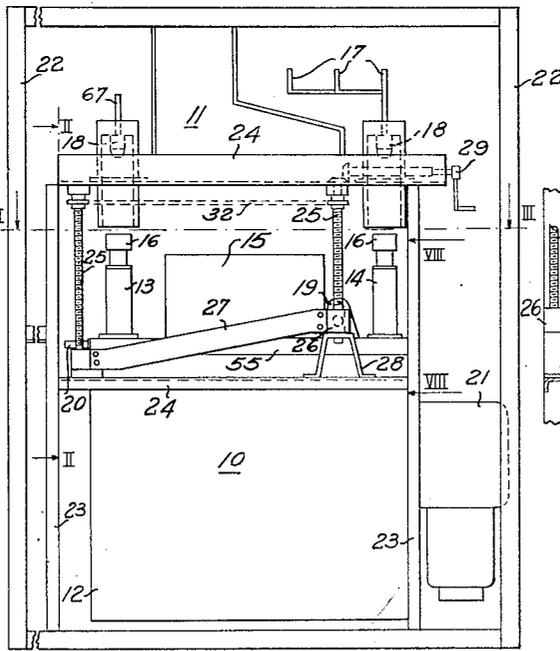


Fig. 1

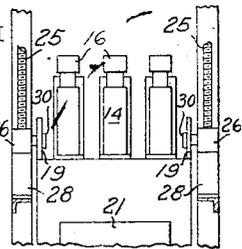


Fig. 8

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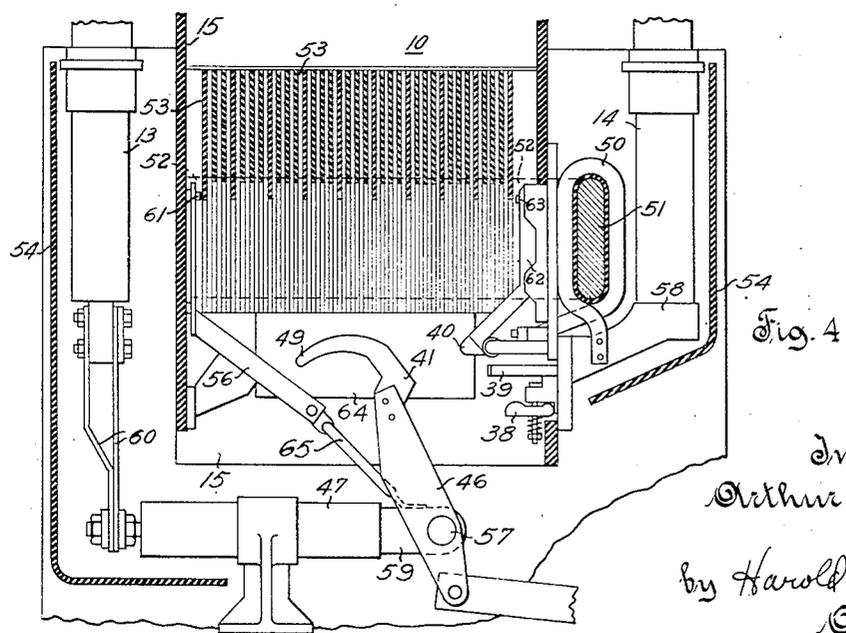
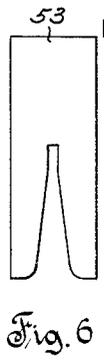
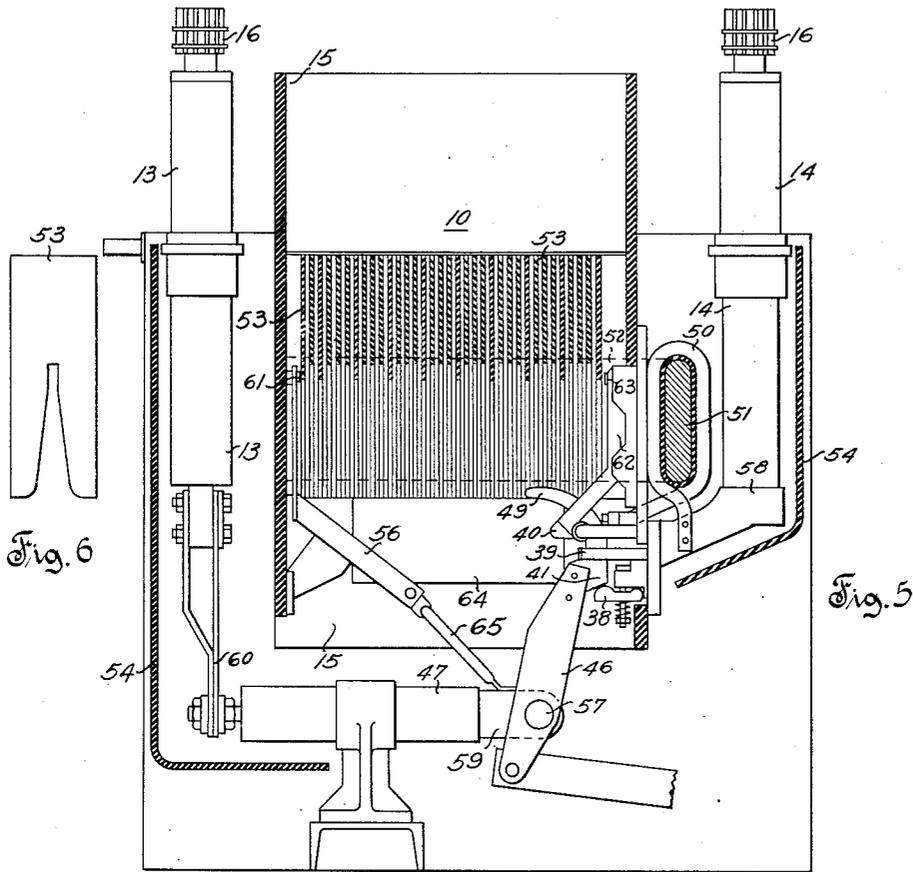
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ARC TRANSFERRING MEANS FOR SWITCHGEARS

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2 Sheets-Sheet 2



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ARC TRANSFERRING MEANS FOR SWITCHGEARS

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2 Claims. (Cl. 200—147)

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This invention relates in general to circuit breaker of the oilless type and more particularly to means for drawing an arc and directing it into an arc extinguishing structure.

Heretofore, oilless type circuit breakers were used mainly for low voltage installations and only recently has the knowledge of arc interruption progressed to the point where interruption at moderately high voltages could be accomplished by breakers of this type.

In order to complete with the oil circuit breaker on space limitations as well as efficiency in operation it is necessary to provide a small compact means for opening a circuit which would form an arc and direct it into an arc extinguishing structure. In prior art switchgear of the oilless type the means for drawing an arc and directing it into an arc chute was usually a bulky, inefficient structure which prohibited the oilless circuit breaker from competing with the oil circuit breaker on installations imposing rigorous space limitations.

In accordance with the invention claimed a new and improved means for drawing an arc and directing it into an arc extinguishing structure is provided. This means provides a small compact structural unit which permits oilless circuit breakers to compete favorably with oil circuit breakers. More particularly, the disclosure and claims set forth a new and improved means for separating a pair of arcing contacts and substantially simultaneously providing a current path and producing a given magnetic field to direct the arc toward the arc chute. As the arc begins to move toward the arc chute the root of the arc on the movable arcing contact transfers from the arcing contact to an arc runner. This transfer of the arc causes a substantially parallel displacement of the current flow from one current path through the movable arcing contact to a terminal stud to a second substantially parallel current path through the arc runner to the same terminal stud. The magnetic fields of the two current paths being substantially the same do not oppose the current transfer.

It is, therefore, one object of the present invention to provide a new and improved oilless type switchgear unit which competes favorably on space requirements with a comparable oil type switchgear unit.

Another object of this invention is to provide a new and improved means for drawing an arc and directing it into an arc extinguishing structure.

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A further object of this invention is to provide a new and improved arc interrupting device in which an arc current flowing in a given current path including an arcing contact is transferred to a second substantially parallel current path through an arc runner without opposition from the magnetic fields of the current paths.

Objects and advantages other than those above set forth will be apparent from the following description when read in connection with the accompanying drawing, in which:

Fig. 1 is a front elevational view of an electrical switchgear embodying the present invention;

Fig. 2 is a sectional end view taken on the line II—II of Fig. 1;

Fig. 3 is a sectional top view taken on the line III—III of Fig. 1;

Fig. 4 is a sectional detailed view of the circuit breaker shown in Figs. 1, 2 and 3 in incompletely opened position;

Fig. 5 is a view similar to the view of Fig. 4 but with the circuit breaker contacts in the closed position;

Fig. 6 is a detailed view of one of the plates in the arc extinguishing device of the circuit breaker shown in Figs. 4 and 5;

Figure 7 is a front elevational view of the removable portion of the switchgear shown in Figs. 1 and 2; and

Fig. 8 is a partial sectional end view taken on the line VIII—VIII of Fig. 1.

The switchgear of Figs. 1 and 2 comprises generally a removable circuit breaker portion 10 and a stationary portion 11 for supporting the portion 10 in line connecting relation. The removable portion 10 comprises generally a circuit breaker having two stud members 13 and 14 having connectors 16 at the upper ends thereof for connecting the circuit breaker to the line conductors 17 and 17' at connectors 18. The circuit breaker studs are supported in spaced relation on a frame member 55 which with other frame members and with closure members form a casing 12 for the circuit breaker. An arc chute 15 extends from the casing 12 between the studs 13 and 14. As shown in Figs. 2, 3 and 8, there is one arc chute for each pair of circuit breaker studs. Lift hooks 19 and lift pins 20 are provided on the removable circuit breaker portion 10 for positioning the same relative to the fixed portion 11 while the circuit breaker is being lifted to connected position. An operating mechanism 21 for operating the movable contact 41 of the circuit breaker is also supported on the removable portion 10.

The stationary portion 11 of the switchgear comprises generally outer frame members 22 and inner frame members 23. The inner frame members 23 are connected by cross members 24 between which the lifting mechanism is supported. The lifting mechanism comprises generally four rotatable screw members 25 connected by a chain 32 so that the four lift screws 25 can be rotated by a single shaft having a crank 29 thereon. Rotation of the screws 25 raises or lowers traveling nuts 26 having cross braces 27 therebetween. Attached to the nuts 26 are lift members 30 and 31 which cooperate respectively with the lift hooks 19 and the lift pins 20 as shown more clearly in Figs. 2 and 8.

The lift members 30 and 31, cooperating with the lift hooks 19 and lift pins 20, serve to position the removable portion 10 both laterally and longitudinally in the correct position so that the connectors 16 are alined with the bus bar connectors 18. These lift members function to lift the circuit breaker to connect the same to the line leads 17 and 67 upon raising of the circuit breaker by rotation of crank 29.

As shown more clearly in Figs. 4 and 5 the present improved arrangement of circuit breaker studs 13 and 14 with the arc chute 15 therebetween, permits separation of the circuit breaker contacts in a substantially horizontal direction in or adjacent the lower portion of the arc chute 15, without sacrificing the advantages incident to vertical lift for connecting to and disconnecting from the line conductors 17 and 67. The drawing of an arc horizontally permits full utilization of the thermal action of the arc and the chimney effect of the arc chute in rapidly moving the arc into the arc extinguishing plates 53.

Current normally flows through the circuit breaker, when in the closed position shown in Fig. 5, from line conductor 17, through the connectors 18 and 16 on stud 14, through stud 14 and conducting member 58, current carrying fixed contact 38, movable contact 41, link 46, connector 59 supported in bushing 47, connectors 60, through stud 13 and connectors 16 and 18 to line conductor 67. Upon actuation of the operating mechanism 21 to open the circuit breaker, the link 46 is rotated about its pivot 57 in a counterclockwise direction as viewed in Fig. 4. The movable contact 41, removably supported on link 46 to rotate therewith, cooperates with three fixed contacts 38, 39 and 40 to break contact therewith in the order given. The separation at contact 38, which is first to take place, transfers the main current flow through the contacts 39 and 41. This transfer is made without arcing at contact 38. Further opening movement of the movable contact 41 opens contacts 39 and 41, and current then flows through the magnetic blowout coil 50 and arcing contact 40, thereby magnetically energizing core 51 and blowout poles 52. Further opening movement draws an arc in a substantially horizontal direction between the movable contact 41 and the arcing contact 40.

As the movable contact is further rotated in a counterclockwise direction, the arc is extended in length and is rapidly forced into the plates 53 by reason of the combined actions of the magnetic field established by blowout coil 51 between poles 52, the thermal action of the arc and the chimney effect of the arc chute 15. The upward movement of the arc is aided by the provision of an arc runner 62 connected to fixed contact 40

and of a second arc runner 56 connected to conductor 59 through a connector 65.

The arc root on the fixed contact 40 is moved rapidly upward along the runner 62, possibly reaching the target 63 before the arc is extinguished. The arc root on movable contact 41 moves along a horn 49 provided thereon and tends to continue to travel upward.

The flow of current through link 46 produces a magnetic field thereabout or, stated otherwise, link 46 has a certain amount of inductance. This inductance tends to maintain the flow of current through link 46 constant and to prevent the transfer of such current to another circuit element spaced from the link. Likewise, connector 65 has a certain inductance, a magnetic field being produced thereabout by any current flowing therethrough, and the transfer of current to link 65 from another circuit element distant therefrom is opposed from such inductance.

However, when link 46 finally reaches a position alongside connector 65 and substantially parallel thereto, the magnetic field about elements 46 and 65 is substantially the same regardless of whether current flows through link 46 or through connector 65. The transfer of the root of the arc from horn 49 to arc runner 56, which causes a substantially parallel displacement of the current flow from link 46 to connector 65, therefore causes no appreciable change in the magnetic field thereabout. The inductances of link 46 and of connector 65 thus are substantially without effect on such current transfer, whereas such inductances and the inductance of stud 59 would oppose such transfer if conductor 65 were disposed in a position extending from arc runner 56 to connector 60.

The arc is extinguished by movement thereof into slots in the plates 53, one of which is shown in detail in Fig. 6, the plates 53 being similar except that the slot is deeper in some plates than in others. The plates 53 cool, extend and deionize the arc to extinguish the same, thereby interrupting the circuit. Sheets 64 of heat resistant material may be used to prevent deterioration of the arc chute 15, and insulating shields 54 are provided between the casing and the current conducting members.

Although but one embodiment of the present invention has been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

It is claimed and desired to secure by Letters Patent:

1. In an electrical switchgear comprising a casing having a top wall, the combination of a circuit breaker substantially enclosed in said casing, first and second vertical terminal studs extending through the top wall of said casing, a fixed contact connected to said first terminal stud, an arc chute disposed alongside said terminal studs and forming a vertical passageway directed toward an opening in the top wall of said casing, an arc runner, means positioning said fixed contact and said arc runner adjacent said arc chute so that an arc extending between said fixed contact and said arc runner is movable upward into said arc chute, a connector between said arc runner and said second terminal stud, a pivoted link connected to said second terminal stud, a movable contact mounted on said link and connected therethrough to said second terminal

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stud, and means for actuating said link from a position providing for engagement of said fixed and movable contacts into a position alongside and parallel to said connector to draw an arc between said contacts and to transfer one root of said arc from said movable contact to said arc runner by a substantially parallel displacement of the current flow from said link to said connector.

2. An electric circuit breaker comprising first and second circuit terminals, a fixed arcing contact connected to said first circuit terminal, an arc chute, an arc runner, means positioning said fixed contact and said arc runner adjacent said arc chute so that an arc extending between said fixed contact and said arc runner is movable into said arc chute, a connector between said arc runner and said second circuit terminal, a pivoted link connected to said second circuit terminal, a movable arcing contact mounted on said link and connected therethrough to said second circuit terminal, and means for actuating said link from a position providing for engagement of said

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fixed and movable contacts into a position alongside and parallel to said connector to draw an arc between said contacts and to transfer one root of said arc from said movable contact to said arc runner by a substantially parallel displacement of the current flow from said link to said connector.

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