June 13, 1944. G. A. HEALIS 2,351,426

ELECTRIC SWITCH

Filed Aug. 22, 1942

Fig. 1.

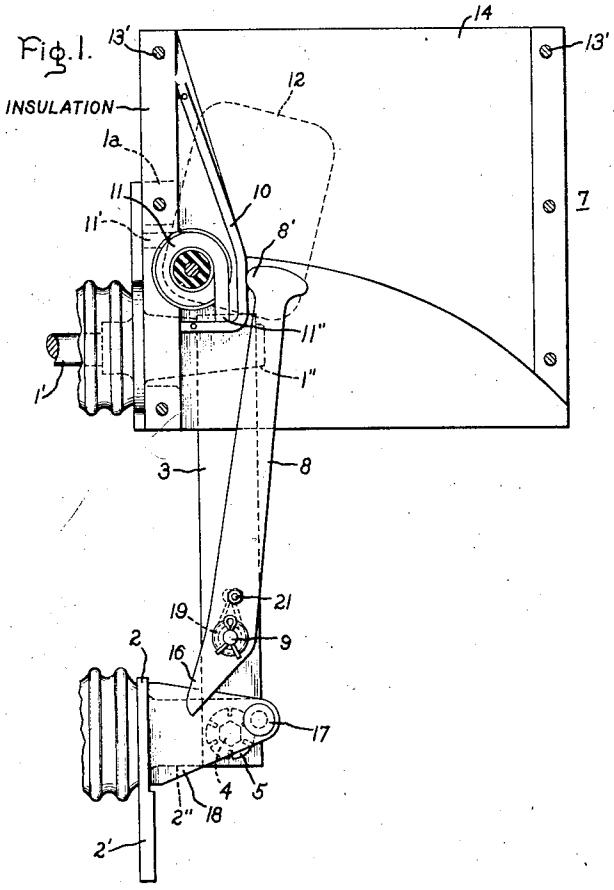


Fig. 2.

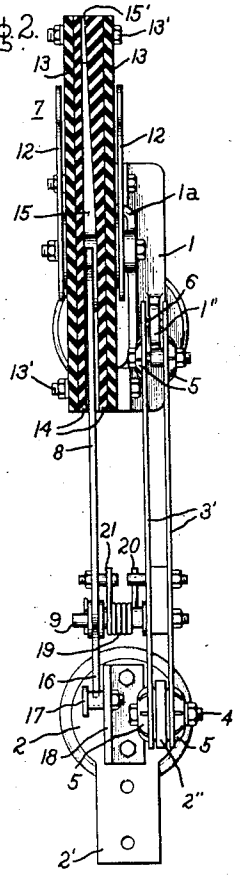


Fig. 3.

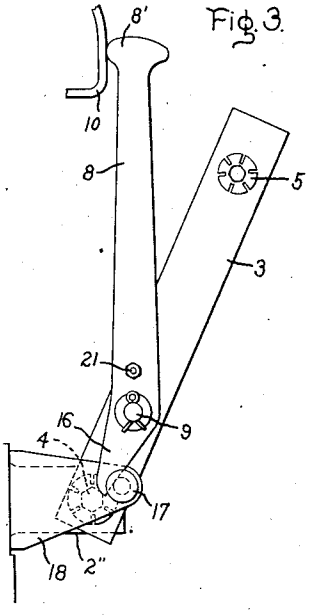
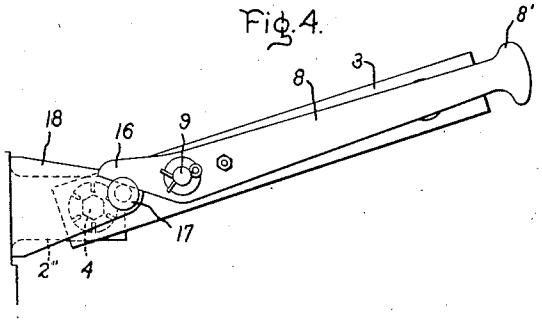


Fig. 4.



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Patented June 13, 1944 2,351,426

UNITED STATES PATENT OFFICE

2,351,426

ELECTRIC SWITCH

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Application August 22, 1942, Serial No. 455,771

5 Claims. (Cl. 200—146)

My invention relates to electric switches, more particularly to those of the load-break switch type wherein means are provided for interrupting load power currents as well as for carrying the normal load current and disconnecting the circuit.

The problem of both interrupting and disconnecting a high voltage power circuit at points where conventional power circuit breakers, such as oil circuit breakers, are impractical or uneconomical involves a number of difficulties including those associated with the usual requirements for simplicity and ruggedness in structure, compactness, economical construction and operation, and electrical efficiency in both interrupting the load power arc and disconnecting the circuit. Although a great deal of design work has been devoted to this type switch, the devices in general have been somewhat complicated and expensive, particularly for moderate interrupting duty such as for example interrupting the magnetizing current of a 15,000 volt power transformer.

A principal object of my invention, therefore, is the provision of an improved load-break switch that is simple, rugged and inexpensive in construction, and that is capable of efficiently interrupting moderate load currents in high voltage power circuits and disconnecting the power circuits.

My invention will be more fully set forth in the following description referring to the accompanying drawing, and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

Referring to the drawing, Fig. 1 is an elevational view, partly in section, of a load-break switch embodying the present invention in the closed circuit position thereof, Fig. 2 is an elevational end view, partly in section, of the switch shown by Fig. 1, Fig. 3 is a detail view of the switch contact structure illustrating the switch in the partly open position thereof, and Fig. 4 is a similar view showing the contact structure in the open circuit disconnecting position.

The load-break switch shown by Fig. 1 comprises a pair of stationary terminals 1 and 2 to which the fixed and movable contact structures, respectively, are connected. The terminals to which the power circuit is connected at 1' and 2', respectively, are adapted to be bridged and electrically connected by a main current-carrying contact blade 3 pivotally mounted at 4 on a conducting extension 2'' of the terminal 2. As viewed in Fig. 2, the main blade 3 comprises a pair of spaced conducting members 3' provided at opposite ends of the blade with spring washers 5 for biasing the blade into clamping engagement with the associated terminal members. At the terminal 1, the blade is adapted to engage a conducting extension 1'', the contact engagement between the blade and the co-acting fixed contact 1'' being made at ridges 6 on the blade. The ridges are biased by the spring washers 5 into high pressure line contact with the fixed contact. An electrical contact is similarly made at the lower terminal contact 2'' so that the blade 3 in the closed circuit position shown is capable of carrying large power currents across the switch terminals without overheating.

For the purpose of interrupting load power currents when the switch is to be opened, there is mounted on a bracket 1a on the upper terminal an arc extinguishing structure 7, such as an arc chute of the narrow slot type. There is also provided an arcing contact 8 that is pivotally mounted at 9 on the main blade and operable within the arc chute for extinguishing arcing at the terminal 1. As best shown by Fig. 2, the arcing contact 8 and its cooperating arc chute 7 are materially offset with respect to the blade 3 so that the blade operates free of the arc chute so as not to be subject to the effects of arcing. The arcing contact 8 is provided with contact portion 8' arranged to engage a combined arcing contact and runner 10 within the arc chute. The contact 10 is connected to the terminal 1 through a magnetic blowout coil 11, one terminal of which at 11'' is connected to the contact 10 and the other termianl at 11' to the switch terminal 1. Accordingly it will be seen that the blowout coil is energized when arc current flows between the arcing contacts 10 and 8. The blowout coil 11 is provided, in accordance with well known practice, with iron pole pieces 12 placed at opposite sides of the arc chute as shown in Fig. 2.

The arc chute that I have shown merely by way of example, comprises a pair of spaced insulating plates 13 clamped together at 13' and having on the inner sides facing each other insulating liner plates 14 composed of a suitable arc resisting material such as asbestos. The asbestos plates are quite closely spaced so as to form a narrow slot for the arcing contact 8 and are so shaped that the resulting slot-like arc chamber 15 is tapered so that the exhaust opening 15' at the top of the chute is but a slit.

An important feature of my invention is the

contact arrangement whereby the main blade 3 is first opened, thereby shunting the power current through the blowout coil and the arcing contacts 10 and 8, and after the blade contact has moved a safe distance from the fixed contact the arcing contact 8 is opened to draw the interrupting arc within the chute at a rate that is determined solely by and in accordance with the opening movement of the blade 3. To this end the contact 8 is provided with a tail-like extension 16 below the pivot 9 arranged to be directly in the path of a fixed offset pin 17 carried by a bracket 18 that is mounted on the lower terminal 2. The contact 8 is also provided with a biasing spring 19 mounted on the pivot pin 9 and secured at 20 and 21, respectively, to the blade 3 and contact 8 for biasing the arcing contact counter-clockwise about its pivot 9 toward contact making engagement with the fixed contact 10.

Accordingly when the blade 3 is opened by conventional means, such as a pole hook (not shown), the arcing contact 8 will at first remain in engagement with the arcing contact 10 so as to provide for arc-free opening of the blade 3. After predetermined opening movement of the blade 3, the pivot 9 of the arcing contact has moved clockwise sufficiently to cause the tail 16 to strike the fixed pin 17. Continued opening movement of the blade 3 thereupon causes clockwise rotation of the arcing contact 8 at a rate dependent on the rate of opening movement of the blade 3. Since the contact 8 in addition to rotating clockwise about its pivot 9 is also rotating clockwise about the blade pivot 4, it will be apparent that the opening speed of the arcing contact is greater than that of the blade 3 so that at some point in the opening movement the two will have reached the same position. This position is shown by Fig. 4 which represents the open and disconnected position of the switch. In this position it will be noted that the blade and arcing contact are compactly arranged with their longitudinal axes substantially in alinement with each other and thereby provide the maximum disconnecting gap between the movable contact structure and the terminal 1 with the minimum space requirement.

In closing the switch, the blade and arcing contact move as a unit from substantially the 90° open position until the blade 3 has completed an angular movement of approximately 60 degrees. At this point the arcing contact 8 has moved sufficiently in advance of the blade in the manner above described to make contact at 10 with the fixed terminal structure. Since the circuit is now complete through the arcing contacts the blade 3 can be moved into engagement with its fixed contact 1'' as shown in Fig. 1, without arcing.

By reason of the controlled movement of the arcing contact, it is possible to extinguish high voltage arcs entirely within the chute 7. If the arcing contact were not so controlled and were operated for example by snap-action the arc might in some cases be drawn too quickly through the chute so as to be drawn exteriorly of the chute before it is extinguished. Such operation is very undesirable as arcing exteriorly of the chute is objectionable to operatives.

It should be understood that my invention is not limited to specific details of construction and arrangement thereof herein illustrated, and that changes and modifications may occur to one skilled in the art without departing from the spirit of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An electric switch comprising relatively movable contact structures, one of said contact structures including a pivoted current-carrying member and an arcing member, said arcing member being pivotally mounted on and carried by said current-carrying member, a member fixed with respect to both said members, said arcing member having means arranged to engage said fixed member after predetermined opening movement of said current-carrying member for causing positive opening movement of said arcing member at a rate controlled by and in accordance with the opening movement of said current-carrying member, said arcing member being thereby moved to the open circuit disconnecting position with said current-carrying member, and means for causing said pivoted current carrying member and said arcing member to have their longitudinal axes substantially in alinement when said switch is in the open circuit disconnecting position.

2. A load-break switch comprising fixed contact structure and a relatively movable blade member having a fixed pivotal mounting, an arcing contact pivotally mounted on and carried by said blade member, means for resiliently biasing said arcing contact toward said fixed contact structure so that said blade member can separate from the fixed contact prior to separation of said arcing contact, a fixed member coacting with said arcing contact after predetermined opening movement of said blade member for causing positive separation of said arcing contact from the fixed contact against said bias, the rate of separating movement of said arcing contact being solely and directly controlled by the movement of said blade member, and means for causing said blade member and said arcing contact to have their longitudinal axes substantially in alinement when said load break switch is in the open circuit position.

3. A load-break switch comprising a fixed contact structure and a coacting relatively movable current-carrying blade having a fixed pivotal mounting, an arcing contact pivotally mounted on and carried by said blade at a point intermediate the fixed contact and said blade pivotal mounting, means for resiliently biasing said arcing contact toward said fixed contact structure so that opening movement of said blade precedes that of said arcing contact, said arcing contact having an extension beyond its pivot in a direction away from the fixed contact, and a fixed member coacting with said extension for causing after predetermined opening movement of said blade positive separation of said arcing contact at an angular rate greater than the angular rate of separation of said blade, said arcing contact being thereby moved to the open circuit disconnecting position into substantial juxtaposition with said blade.

4. A load-break switch comprising fixed contact structure having arc-extinguishing means and a coacting pivoted blade member, an arcing contact pivotally mounted on and carried by said blade member for coacting with said arc-extinguishing means, means for resiliently biasing said arcing contact toward said fixed contact structure so that opening movement of said blade precedes that of said arcing contact, and means coacting with said blade and arcing contact for

causing in response to opening movement of said blade positive separation of said arcing contact at an angular rate greater than the angular rate of separation of said blade, said blade and arcing contact being movable simultaneously to an open circuit disconnecting position at which position said arcing contact is in substantial alinement with said blade.

5. A load-break switch comprising fixed contact structure having arc-extinguishing means and a pivoted blade member, an arcing contact pivotally mounted on and carried by said blade member for coacting with said arc-extinguishing means, means for resiliently biasing said arcing contact toward said fixed contact structure so that opening movement of said blade member precedes that of said arcing contact, a fixed stop member arranged in the path of a portion of said arcing contact for engaging said portion at a predetermined point in the opening movement of said blade thereby causing positive opening movement of said arcing contact at an angular rate controlled solely by the movement of said blade member, said biasing means during the circuit closing operation causing said arcing contact to precede said blade and make the circuit substantially at said predetermined point, and means including said portion of said arcing contact and said fixed stop member for causing said pivoted blade member and said arcing contact to have their longitudinal axes in substantial alinement when said load break switch is in its open circuit position.

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