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SWITCH

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Fig. 1.

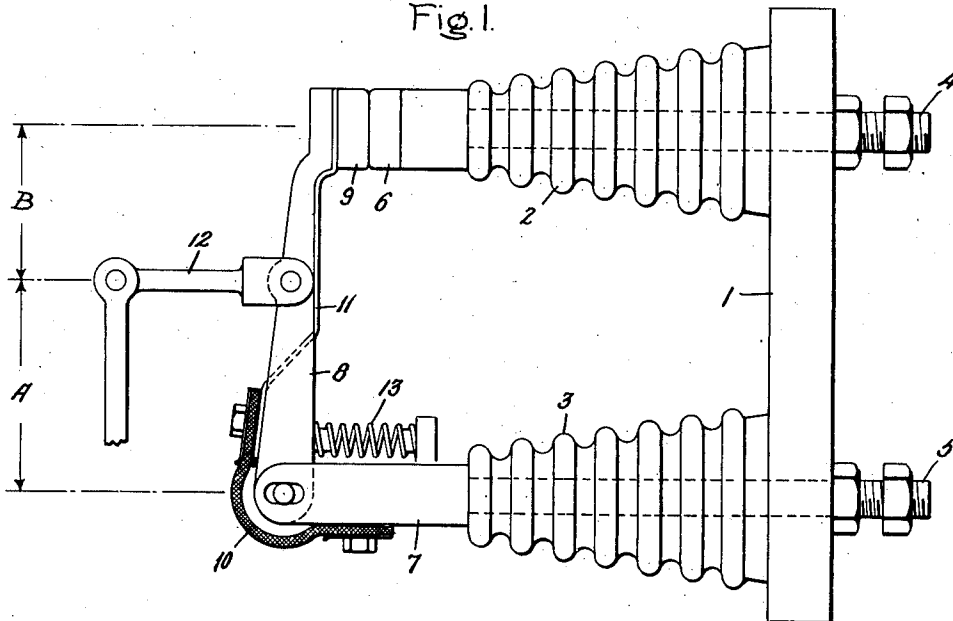
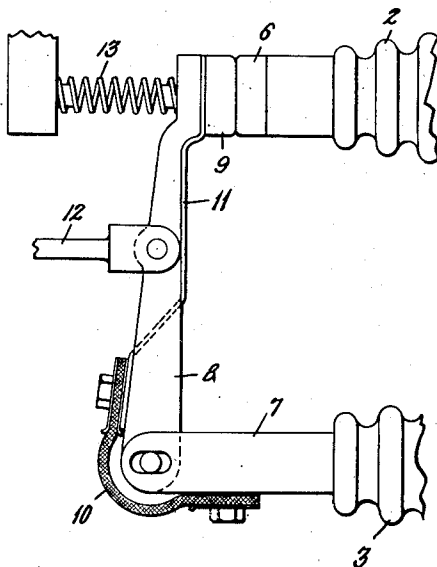


Fig. 2.



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UNITED STATES PATENT OFFICE

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SWITCH

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4 Claims. (Cl. 200—87)

This invention relates to electric switches and more particularly to improvements in single-pole single-throw type switches or contactors which are associated with transformer tap-changing-under-load equipment.

It is well known that current carrying conductors are surrounded by a magnetic field and that when the conductors of a circuit are relatively close together and carry a large current there is a relatively large force exerted on the conductors tending to move them apart so as to decrease the flux density between them.

In certain switches the arrangement is such that the current enters the switch in one direction through a conductor and leaves it in the other direction through a return conductor, the conductors being joined electrically by a movable contact carrying arm. In switches of this type when the current carried is relatively heavy the electro-magnetic force which is produced tends to open the switch by moving the contact carrying arm outwardly away from the fixed contact with which it co-operates. This causes injurious arcing and burning of the contacts and objectionable surges in the circuit.

In accordance with this invention there is provided a novel and simple arrangement for overcoming this effect, and in fact reversing this effect so that the electro-magnetic force tends to close the contacts of the switch tighter instead of tending to open them.

An object of the invention is to provide a new and improved electric switch.

Another object of the invention is to provide an improved arcing contactor for transformer tap-changing-under-load equipment.

A further object of the invention is to provide a switch which utilizes the inherent reaction between the magnetic field of its circuit and the current therein for forcing the switch contacts together instead of forcing them apart.

The invention will be better understood from the following description taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

In the drawing, Fig. 1 shows an embodiment of the invention, and Fig. 2 shows a modification thereof.

Referring now to the drawing, and more particularly to Fig. 1, there is shown a main support in the form of an insulating panel board 1 on which is mounted a pair of insulating bushings 2 and 3 through which pass conductors 4 and 5 of an electric circuit. This circuit may be the main load circuit of a transformer. Mount-

ed on the end of the bushing 2 is a fixed contact 6 of any suitable material while mounted on the end of the bushing 3 is a bracket 7 in which is pivotally mounted a switch arm 8 carrying at its upper end a movable contact 9 which cooperates with the fixed contact 6. In order to reduce the resistance of the circuit the electrical connection from the conductor 5 to the movable contact 9 is made through a braided ribbon conductor 10 bolted at its ends to the bracket 7 and the arm 8 respectively. The latter bolted connection clamps one end of a low resistance conductor 11 and the other end of this low resistance conductor is connected directly to the movable contact 9.

The switch is opened and closed by a link or lever 12 which is fastened to an intermediate point on the switch arm 8. This point is characterized by being closer to the contacts than it is to the pivot of the arm 8, the latter distance being distance A and the former distance being B, as shown in the drawing. It is this feature which causes the switch to close tighter as the current through it gets larger, as will be explained more in detail below.

In order that the switch contacts will close with the same closing motion or stroke of the lever 12 regardless of wear of the moving parts or reasonable burning away of the contacts, the pivotal connection is made loose, that is to say, it has a substantial amount of lost motion. However, the slack in this lost motion is taken up by a spring 13.

The operation of the invention is as follows: With the parts in the position shown, the switch is closed and with no current flowing there-through the spring 13 in taking up the slack in the pivotal connection tends to rotate the arm 8 in a clockwise direction about the pivotal connection of the lever 12 so as to maintain the contacts firmly closed. If now a heavy current flows through the switch the magnetic field in the portion of the loop or single turn of the circuit comprising conductors 4 and 5 and the switch arm 8 acts so as to force all these current carrying members outwardly in an attempt to increase the area of the loop and decrease the flux density in it. This outward force would normally tend to rotate the arm 8 about its pivotal connection with the bracket 7 so as to open the switch but by reason of the fact that the lever arm A is greater than the lever arm B the resultant effect of the outward electro-magnetic force is in the same direction as the turning effect of the spring 13 and therefore tends to close the

contacts more and more tightly as the current increases.

In the modification shown in Fig. 2 the spring acts directly against the contact carrying end of the arm 8.

While there have been shown and described particular embodiments of this invention, it will be obvious to those skilled in the art that various changes and modifications can be made therein without departing from the invention and, therefore, it is aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

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

1. An electric switch having a fixed contact and an effectively pivoted switch arm whose free end carries a contact surface which makes and breaks contact with said fixed contact and whose pivoted end has a predetermined amount of lost motion, said switch being normally so oriented with respect to a circuit whose current it interrupts that the resultant electromagnetic force acting on said arm tends to rotate it about its pivot in a direction to open said switch, and means for reversing this electromagnetic effect comprising an operating member for said arm pivotally fastened thereto at an intermediate point thereon which is closer to said fixed contact than it is to said effective pivot.

2. In combination, an electric circuit, a switch connected therein, said switch having a pivoted switch arm with a predetermined amount of lost motion at its pivot, the conductors of said circuit being so oriented with respect to the said switch arm that the reaction between the current through said switch arm and the magnetic field produced by current in said circuit in the vicinity of said arm tends to move said arm in a switch opening direction, and pivoted operating means for applying force to said switch arm at an intermediate point thereon in such direction as to open and close said switch, the effective distance between said point and said pivot being greater than one half the effective length of said arm whereby when said switch is closed by said means the resultant effect of said reaction will be to rotate said arm about said point in a switch closing direction.

3. In combination, an electric circuit, a switch

connected therein, said switch having a pivoted switch arm, the conductors of said circuit being so oriented with respect to the said switch arm that the reaction between the current through said switch arm and the magnetic field produced by said circuit in the vicinity of said arm tends to move said arm in a switch opening direction, pivoted operating means for applying force to said switch arm at an intermediate point thereon in such direction as to open and close said switch, the effective distance between said point and said pivot being greater than one half the effective length of said arm whereby when said switch is closed by said means the resultant effect of said reaction will be to rotate said arm about said point in a switch closing direction, the pivot of said switch arm having a substantial amount of lost motion, and a spring for taking up the slack in said lost motion whereby a uniform closing movement of said operating means will always produce firm closure of said switch regardless of reasonable wear of the moving parts and burning away of the contacts.

4. A current interrupting contactor comprising, in combination, an insulating panel, a pair of spaced insulating bushings mounted on one side of said panel, conductors mounted in said bushings, a fixed contact mounted on the outer end of one of said bushings and connected to the conductor mounted therein, a conducting arm having one end thereof effectively pivotally mounted on the outer end of the other bushing with a predetermined amount of lost motion and connected to the conductor therein, a contact mounted on the free end of said arm in such a manner that rotation of said arm about its pivot in one direction will cause engagement of said contacts and rotation in the opposite direction will cause separation of said contacts, and operating means for said contactor comprising an operating rod pivotally connected to said arm at an intermediate point which is nearer to said movable contact than it is to said effective pivot as measured on a straight line therebetween whereby the electromagnetic forces acting on said arm due to a current flow from bushing to bushing through said arm and contacts will tend to rotate said arm about said intermediate point in such a direction as to urge said contacts more firmly together.

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