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AUTOMATIC SWITCHES

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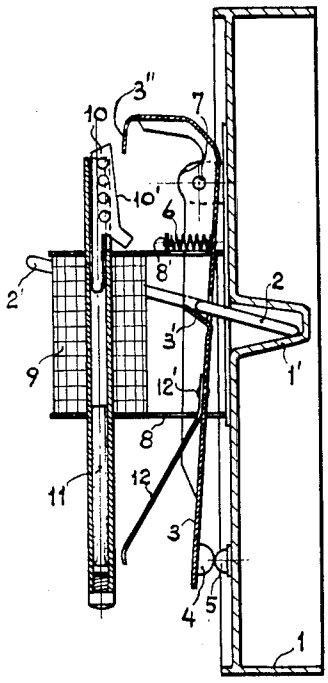

Fig. 1

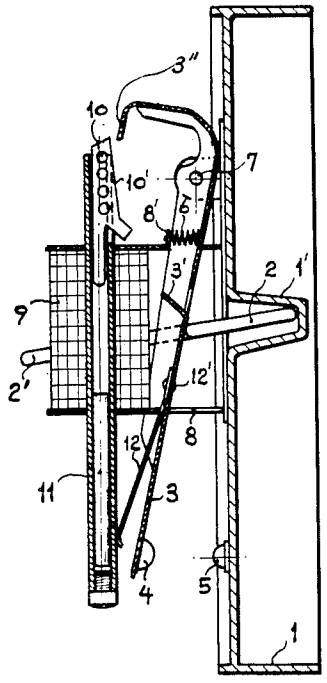

Fig. 2

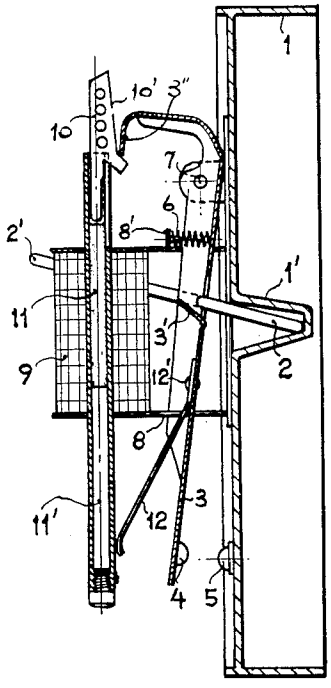

Fig. 3

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AUTOMATIC SWITCHES

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The present invention relates to switches capable of slow manual opening of automatic opening when traversed by excess current and also capable of quick closing under the influence of spring means. In the preferred embodiment, a lever carrying the movable contact is controlled for the automatic opening operation by the movable core of a solenoid traversed by the current to be interrupted, the core acting on a bar slidably mounted along the vertically disposed axis of the solenoid.

The known switches of this type are so arranged that the automatic opening takes place at all times with the same explosive distance, independently of the overload conditions, which necessitates the ampere-turns to be proportional to the minimum value of the excess current that is to be interrupted and, consequently, the use of considerable quantities of copper.

Furthermore, either on account of the structure of the contact carrying lever, or of the way it is mounted or works, this lever is easily susceptible to vibration at the instant of the opening, which action may easily cause the reestablishment of the arc after it has been cut out.

All of these drawbacks are overcome by the switch of the present invention, which while substantially based on the same general principles as the known switches, is still differentiated therefrom by the fact that the active part of the control bar of the contact carrying lever has a wedge-like profile having a constant inclination, so as to obtain at the moment of opening an explosive distance of the contacts increasing according to a linear function of the excess current to be interrupted. The switch of the present invention also provides means for dampening the oscillations tending to occur in the contact-carrying lever during the opening, which means co-operate to ensure the quickness of the closing.

To the end of preventing play in the pivot of the contact-carrying lever and the consequent appearance of vibrations, the ordinary spring means for the quick closure of the switch are furthermore caused to act upon the contact-carrying lever at a point located between the contact and the fulcrum point of the lever, in the immediate neighbourhood of the fulcrum point.

These features will more clearly appear from the following description of a preferred embodiment of the invention given by way of example only and diagrammatically represented in the annexed drawings, in which:

Fig. 1 is a longitudinal section of one embodiment of the invention with contacts closed;

Fig. 2 is a similar section with the switch in the open position caused by actuation of the hand control, and

Fig. 3 is also a similar section, but in the open position caused by operation of the automatic control.

As appears from the drawings, the switch is composed in a known way of a base **1** having a cross cavity **1'** housing an oscillating pivoted lever **2** by means of which is effected the manual control of the switch, this lever contacting a wing **3'** obtained by partially shearing a piece from a lever **3** carrying movable contact **4**. Fixed contact **5** carried by base **1** as shown.

Spring **6**, which determines the quick closure when lever **2** is carried from the position shown in Fig. 2 to that shown in Fig. 1, acts at one end upon lever **3** at a point situated between its fulcrum **7** and movable contact **4** and at its other end is caused to react on a projection **8'** of a frame **8** which supports the solenoid **9**. Frame **8** is carried by the base **1**. Thus, the position of contact **4** that is under the direct action of spring **6**, is independent from any play that could exist in the bearings of fulcrum **7**, which ensures its perfect and constant adherence to fixed contact **5** in the closed position independently of the bearing wear. This reduces the danger of vibrations due to said bearing plays.

The vibrations to which lever **3** could be subjected in spite of this construction would be dampened by leaf spring **12** fastened as by rivet **12'** to lever **3** and reacting with its opposite end upon cylinder **11'** (see Fig. 3) depending from solenoid **9**. This leaf spring has shown itself to be very useful in practice either as a vibration dampener or as an auxiliary means co-operating with spring **6** for increasing the rapidity of closing.

Incline **10'** of bar **10** co-operates with tail **3''** of lever **3** for operating the automatic opening of the contacts and has uniform taper, so that the action exerted upon bar **10** by core **11** of solenoid **9**, variable in relation to the intensity of the current passing through the solenoid, always causes the contacts to open with an explosive distance variable in relation to the intensity of the excess current. Therefore, since the required work for opening varies proportionately, it follows that it will suffice if the number of turns of solenoid **9** is proportioned to the required explosive distance for the smallest excess current that is to be interrupted. The overall dimensions of the solenoid and the required quantity of copper are thus reduced to a minimum.

In operation, when an excess of current occurs in the line of utilization, solenoid **9** that is traverse by said current attracts core **11** which, developing a strength greater than the action of its own weight, of the weight of bar **10** and of the component of the action of springs **6** and **12** in the direction of the bar, lifts bar **10** causing its incline **10'** to slide in contact with the end of tail **3''** of lever **3**, which is thus caused to rotate clockwise. This opens contacts **4** and **5** by a quantity proportional to the thrust of core **11** against bar **10**; the reaction of spring **6** and **12** against incline **10'** blocks bar **10** at the point reached and prevents bar **10** from falling back, while core **11** falls due to the interruption of the current, thus ensuring the maintenance of the switch in the open position (Fig. 3). In this position manual control lever **2** is still in the position of closure of the switch; by carrying said lever **2** to the open position as represented in Fig. 2, a further clockwise rotation of lever **3** is caused, thus disengaging its tail **3''** from bar **10** which can thus fall back under the action of its own weight to predispose itself for a new automatic operation. Said manual control lever **2** may then be carried again to the position of closure represented in Fig. 1 with the certainty that when the excess current re-occurs, the automatic opening of the switch will again be effected.

Due to the presence of spring **12** and to the arrangement of fulcrum **7** of lever **3** it is possible to obtain, for the same dimensions of the switch, a maximum opening of contacts **4**, **5** much greater than that of the common switches of the same type, and consequently a much greater breaking power. Experience has shown that, for the same dimensions, it is possible to interrupt short circuit excess currents of an intensity more than double those which can be broken by known switches of the same type.

It is understood that, although in the preceding description reference has been made to a single pole switch it will still be possible to realize, without departing from the

scope of the invention, multipolar switches, by coupling together elements identical to the one described, all controlled by a single manual operating bar. Thus, it is evident that modifications of a constructional nature may be made to the switch without departing from the scope of the invention.

What I claim is:

1. A slow manual opening and quick closing switch with automatic opening for excess current, comprising a fixed contact, an oscillating pivoted lever, a movable contact carried by said oscillating lever, spring means acting on said lever for urging the movable contact into closing position, a solenoid traversed by the current to be interrupted upon separation of the contacts and having a vertical axis, an axial cylindrical guide in said solenoid, a core movable axially of said solenoid in said cylindrical guide, a rod slidably mounted in the same guide in alignment with said core and having a wedge-like head, said lever having a portion lying in the path of travel of said wedge-like head, said head being actuated by said core for engaging and controlling said oscillating lever for the automatic opening of the contacts against the action of said spring means and for yieldingly keeping said contacts open, and manually operated means for positively bringing said contacts in position of complete opening permitting the resetting of the rod with wedge-like shaped head for the automatic opening and for leaving them free to the action of said spring means for the closing.

2. A switch as in claim 1 wherein said spring means consist in a spiral spring acting on a point located between the contact and the fulcrum of the oscillating lever in the immediate proximity of the fulcrum.

3. A switch as in claim 2 wherein means are provided for dampening the oscillations of the oscillating lever during the opening and for aiding closing, said means consisting in a leaf spring fixed at one end to a point of the oscillating lever located between the fulcrum of said lever and the movable contact thereby carried and reacting at its other end on a fixed point of the frame.

4. A switch as in claim 3 wherein said fixed point is obtained on said cylindrical guide of the solenoid core.

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