Aug. 13, 1929. G. J. MEUER ET AL 1,724,675

ELECTRIC SWITCH

Filed Jan. 22, 1923

Fig. 1.

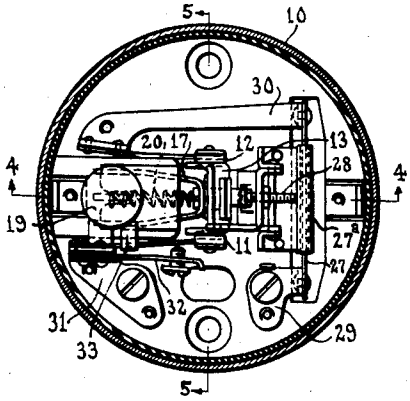


Fig. 2.

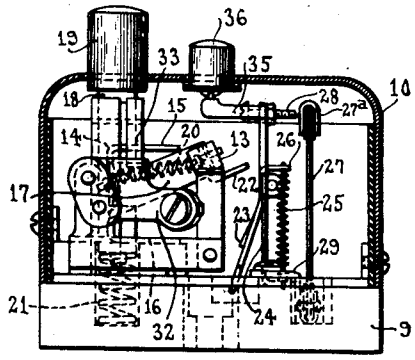


Fig. 3.

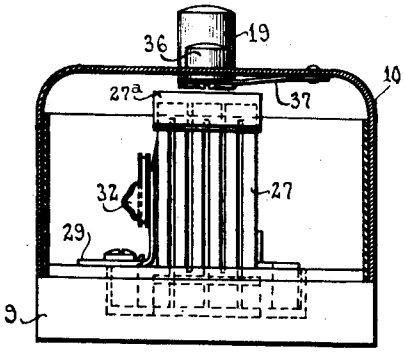


Fig. 4.

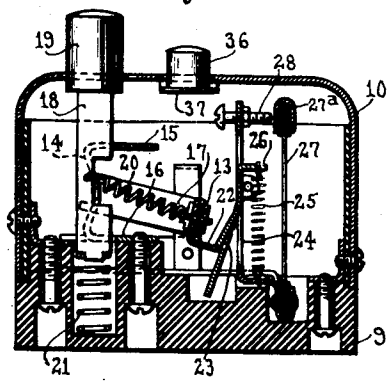
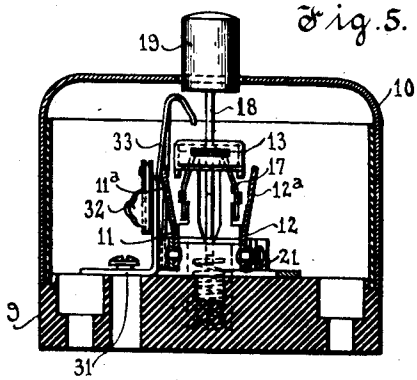


Fig. 5.



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UNITED STATES PATENT OFFICE.

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ELECTRIC SWITCH.

Application filed January 22, 1923. Serial No. 614,098.

This invention relates to electric switches and while not limited thereto is particularly applicable as a starting and control switch for single phase and other motors having plural circuit connections requiring different commutation for starting and running respectively.

The present invention has among its objects that of providing a snap switch for the foregoing and other purposes having combined therewith thermo-responsive means to act thereon for providing features of automatic control of the motor or the like.

Another and more specific object is that of providing a peculiarly advantageous combination involving such a switch and thermo-responsive means.

Another object is that of providing an improved thermo-responsive element for use in the foregoing and other relations.

Another object is that of providing improved snap switch mechanism adapted to control both of alternating and direct current and applicable with peculiar advantage to control of the former.

Other objects and advantages will hereinafter appear.

In the accompanying drawing, wherein is illustrated an embodiment of the invention,

Figure 1 is a plan view thereof, the housing being shown in section;

Fig. 2 is a side elevational view of the same;

Fig. 3 is a similar view but from a rectangularly displaced position; while

Figs. 4 and 5 are vertical sectional views upon lines 4—4 and 5—5 of Fig. 1 respectively.

Referring to the drawing the same illustrates a circular insulating base 9 for support of the hereinafter described parts, a snap switch mechanism carried by the base and biased to open position but provided with a latch for holding the same closed, thermostatically controlled means for tripping said latch and jointly operable auxiliary switching apparatus adapted in the illustrated structure to complete the circuit of the auxiliary starting winding of the motor or the like upon actuation of the closing means for the snap switch and further adapted to interrupt said circuit of the auxiliary starting winding automatically upon release of the snap switch closing mechanism.

Said base 9 is further provided with suitable openings for the necessary lead-in wires and is adapted to receive a substantially cylindrical housing 10 having openings through which the voluntarily controllable operating elements for the device are adapted to project.

More specifically the snap switch mechanism comprises a pair of similar fixed contacts 11 and 12 carried in spaced and insulated relation upon the base 9 and adapted to be bridged by an oscillatable contactor 13. The supporting and operating means for said contactor 13 may preferably comprise a rigid U-shaped metallic support 14 fixed upon the base 9 with its parallel portions 15 and 16 arranged substantially parallel to the upper or frontal plane of the base 9 and extending toward the switch fixed contacts. A U-shaped contact arm 17 is terminally pivotally mounted upon the central portion of the support 14 for oscillation with respect thereto in substantially coplanar relation to the support 14. An operating member 18 having a suitably located push button or the like 19 is arranged to slide within a suitable slot of the support 14 and substantially at right angles to the portions 15 and 16 thereof. A tension spring 20 is terminally connected to the free end of the contact arm 17 and to an intermediate portion of the operating member 18, whereby in extreme positions of said operating member the tension of said spring serves to hold the contact arm 17 in a corresponding extreme position and against one or the other of the laterally projecting portions 15 and 16 of the support 14 whereas upon movement of the operating member from one extreme position to the other the fulcrum of the spring is shifted past the pivotal axis of said contact arm whereby the latter is drawn to its opposite extreme position with a snap action in a conventional manner. The contactor 13 is carried by and in insulated relation to the free end of the contactor arm 17 and is adapted in its down position to bridge the fixed contacts 1 and 12 and in its up position to be relatively widely separated from both of said contacts whereby the controlled circuit is respectively completed and interrupted.

A relatively heavy spring 21 is located within the base 9 and adapted to exert a

thrust upon the operating member 18 thereby serving to bias the switch to open position. A projecting lug 22 is provided upon the contact arm 17 to extend radially of the latter and preferably beyond the position of the contactor 13. A pivoted latch 23 is carried upon a suitable support 24 which latter is fixed to the base 9, said latch having a light tension spring 25 terminally connected to the support, and to said latch by means of an integral projecting lever 26 located beyond the pivot point of said latch, the function of said spring being that of biasing the latch into a position such as to engage the lug 22 of the contact arm for holding in the contactor.

Here it may be noted that the aforedescribed combination and arrangement of the restraining latch with the switch mechanism whereby the former acts directly upon the contacting element and moreover under exceedingly favorable conditions of mechanical advantage, enables mounting and adjustment of the latch member such as to enable release of the latch by a minimum expenditure of force operating through a minimum distance while nevertheless providing for exceedingly positive and reliable latching and holding action.

The thermo-responsive releasing means for said latch may preferably comprise a thermostatic element 27 of special construction to be hereinafter described, said element being preferably terminally anchored to and insulated from the lower end of the latch support 24 and adapted to extend substantially parallel with the upper portion of the latch 23. Said latch is provided with an adjustable screw 28 extending toward the upper end of said thermostatic element for actuation by the latter under given thermic conditions to thereby effect tripping of the latch against the tension of the spring 25 with consequent release of the switch contactor and opening of the switch under the tension of the spring 20.

The thermostatic element 27 preferably comprises a bimetallic or other suitable sheet or strip of reflexed or substantial grid formation as illustrated more clearly in Fig. 3, one terminal of the grid being riveted or otherwise mechanically and electrically connected with a suitable terminal 29 which may preferably comprise one of the connections to the motor or similar appliance to be controlled. The opposite terminal of the grid is similarly connected to a bus bar or jumper 30 which is in turn electrically connected with contact 12 of the snap switch whereby the thermostatic element is adapted to be traversed by the current passing through the motor or other controlled device.

The free end of thermostatic element 27 is provided with an insulated clip or binding element 27^a serving to insure against independent or relative movement of the several convolutions of said thermostatic element.

The aforedescribed grid formation of the thermostatic element serves to constitute the latter in effect an ohmic heating device whereby the use of an extraneous heating element for the thermostat is obviated. Again the aforedescribed construction of the thermostatic element whereby a large number of plies of the latter are arranged in mechanically parallel relation serves to increase the mechanical force developed by said element under given thermic conditions, or more accurately to concentrate the developed force within a restricted range of movement, thereby peculiarly adapting the thermostatic element to co-operate with the latching mechanism aforedescribed.

The fixed contacts 11 and 12 of the snap switch are also of special and improved construction as illustrated particularly in Fig. 5. Said contacts are in practice preferably formed to provide collectively spaced parallel surface portions to be directly engaged and bridged by the contactor 13 and with upwardly extending divergent surface portions 11^a and 12^a between which said contactor is adapted to travel substantially longitudinally.

This arrangement has been found in practice exceedingly desirable, particularly in control of alternating current inductive circuits, since during circuit interruption the contactor after movement out of actual engagement with the fixed contacts continues to travel in close but gradually lessening proximity to the adjacent divergent contact surfaces, whereby the length of any resultant arcs is increased only very slowly thus affording time for the current to pass through its zero value and thus become interrupted while the arc remains relatively short and weak.

The aforedescribed coaction of the contactor and contacts provides, with either alternating or direct current, for closure of the circuit with a quick and positive snap action and also provides for presenting successively new and cold areas of the fixed contacts to the action of any arcs which may be drawn during interruption of circuit, thereby cooling and expediting extinguishment of such arcs and limiting the regions of possible burning of the fixed contacts to areas thereof which are not involved in the transmission of current while the switch is fully closed.

The snap switch contact 11 is connected by means of a suitable bus bar or the like to a terminal device 31 which in practice is preferably connected to the source of current supply.

Also where the switch is intended for the control of a single phase or other motor hav-

ing a starting winding or the like to be unenergized during normal running, the terminal device 31 is preferably extended upwardly as shown particularly in Fig. 5, whereas an additional contact and terminal device 32 is riveted or otherwise secured to such extension but insulated therefrom substantially as illustrated. A resilient contactor 33 is further riveted or otherwise mechanically and electrically connected to the terminal device 31 as shown more clearly in Fig. 1, said contactor having a part to engage the contact device 32 but being normally biased out of such engagement. The contact is further provided with a portion adapted to be engaged and actuated by the push button 19 or by another insulating element carried by the operating member 18 of the snap switch. The terminal 32 is utilized for circuit connection of the motor starting winding or the like. It is of course to be understood that the opening and closing action of the latterly described switching elements may be reversed or otherwise modified to suit the requirements of particular installations.

By the construction and arrangement just described upon actuation of the snap switch operating member 18 such as to effect closure of the snap switch the push button 19 engages the contactor 33 and forces the latter into engagement with the starting contact 32 thereby providing for energization of the auxiliary starting windings of the motor, the main windings being also energized through closure of the snap switch. Following starting and acceleration of the motor the push button is released and thereupon moves upwardly under the bias of the spring 21 and as soon as the push button 19 frees the contactor 33 the latter moves out of engagement with its co-operating contact 32 to thereby interrupt the circuit through the starting winding, the snap switch, however, being held in by the latch 23 in the manner aforedescribed

Said latch is provided in addition to the features aforedescribed with a laterally extending arm 35 in a position to be engaged by a suitable push button or actuating element 36 which in practice may be carried by the housing 10 and biased as by a spring 37 out of engagement with said arm. Said push button 36 thus provides for manual tripping of the latch 23 and consequent opening of the snap switch.

What we claim as new and desire to secure by Letters Patent is:

1. The combination with a switch having a part movable to opposite extreme positions with a snap action for making and breaking an electric circuit, means normally biasing said part to circuit breaking position, a latch for holding the same in circuit making position, and a bimetallic electro-thermally responsive latch-operating member in circuit with said part to control operation of the latter when in circuit making position.

2. The combination with a switch having a part movable to opposite extreme positions with a snap action for making and breaking an electric circuit, of electro-thermally responsive control means comprising a multiple reflexed bimetallic strip normally in circuit with said part during circuit making positioning thereof to provide for operation of said switch automatically under given abnormal electrical conditions.

3. In a controller for electric motors and the like, the combination with a switch having a part movable to opposite extreme positions with a snap action for making and breaking an electric circuit, of means normally biasing said part out of circuit making position, predominant holding-in means for said part, and automatically operable means comprising a bimetallic thermostatic strip normally in circuit with said part during circuit making positioning thereof for releasing said holding-in means under given abnormal electrical conditions.

4. In snap switch mechanism, the combination with a contact, a co-operating contactor, means for moving said contactor with a snap action into given positions for making or breaking an electric circuit, means for normally biasing said contactor out of one of said positions, a latch associated with said contactor to prevent movement thereof under said bias, and means operable automatically under given abnormal electrical conditions for tripping said latch, said means comprising a multiple reflexed bimetallic strip in circuit with said contactor.

5. In snap switch mechanism, the combination with a contact, a co-operating contactor, means for effecting movement of said contactor with a snap action to make or break an electric circuit, means for biasing said contactor out of circuit making position, restraining means to act directly upon said contactor for preventing movement thereof under said bias, and a bimetallic thermostatic member in circuit with said contactor and adapted under predetermined electrical conditions to automatically effect release of the latter by said restraining means.

6. In snap switch mechanism, the combination with a plurality of fixed contacts, a contactor movable with a snap action into and out of engagement with said contacts, of means to act upon said contactor for biasing the same out of engagement with said contacts, a latch, means carried by said contactor to be engaged by said latch for holding in said contactor, electro-thermally controlled means for automatically disengaging said latch under given electrical conditions, said means comprising a multiple reflexed

bimetallic strip in circuit with said contactor, and manually operable means for disengaging said latch independently of said electro-thermally controlled means.

7. The combination with independently operable sets of co-operating contacts, of snap operating means providing for closure of said sets of contacts jointly, means biasing said operating means to cause disengagement of a plurality of said sets of contacts and means for holding in certain of said contacts while permitting other of said contacts to open under such bias.

8. The combination with independently operable sets of co-operating contacts, of snap operating means providing for closure of said sets of contacts jointly, means biasing said operating means to cause disengagement of all of said sets of contacts, means for holding in certain of said contacts while permitting other of said contacts to open under such bias, and thermosatic releasing means for said holding-in means.

9. In a controller for electric motors having starting windings to be unenergized during running, the combination with independently operable sets of contacts for the starting and running windings, of operating means for the running contacts including means to effect conjoint closure of the starting contacts, means biasing said operating means to cause opening of all of said sets of contacts, latching-in means for said running contacts and thermostatic and manual releasing means for said latching means.

10. In a controller for electric motors having starting windings to be unenergized during running, the combination with independently operable sets of contacts for the starting and running windings, of snap operating means for the running contacts including means to effect conjoint closure of the starting and running contacts, means biasing said operating means to cause opening of all of said sets of contacts, latching-in means for said running contacts and thermostatic and manual releasing means for said latching means.

11. The combination with a snap make and break switch having means normally biasing the same to open position and mechanical latching-in means for the switch, of automatically operable releasing means for the switch comprising an electro-thermally responsive element of multiple reflexed form having fixed terminal portions and intermediate reflexed end portions to move jointly under electro-thermic influence for tripping said latching-in means.

12. The combination with a snap make and break switch having means normally biasing the same to open position and mechanical latching-in means for the switch, of automatically operable releasing means for the switch comprising an electro-thermally responsive element of multiple reflexed form having terminal and intermediate reflexed portions thereof anchored and other intermediate reflexed portions thereof movable under electro-thermic influence to exert jointly a tripping force upon said latch.

13. The combination with a snap make and break switch having means normally biasing the same to open position and mechanical latching-in means for the switch, of automatically operable releasing means for the switch comprising an electro-thermally responsive element of multiple reflexed form having terminal and intermediate reflexed portions thereof anchored and other intermediate reflexed portions thereof movable under electro-thermic influence to exert jointly a tripping force upon said latch, and means providing against relative movement of said reflexed portions of said electro-thermally responsive element.

In witness whereof, we have hereunto subscribed out names.

GEORGE J. MEUER.
ARTHUR H. FLEET.