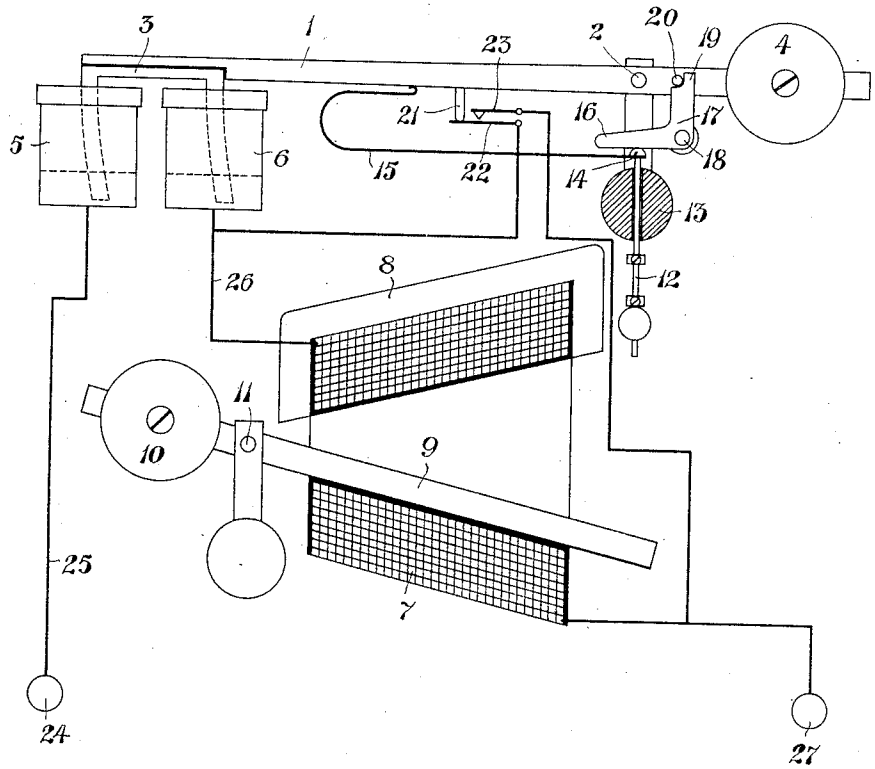
E. T. R. MURRAY AND G. F. SHOTTER.

ELECTRIC SWITCH.

APPLICATION FILED MAY 14, 1919.

1,349,429.

Patented Aug. 10, 1920.



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ELECTRIC SWITCH.

1,349,429. Specification of Letters Patent. Patented Aug. 10, 1920.

Application filed May 14, 1919. Serial No. 296,988.

To all whom it may concern:

Be it known that we, ETHELBERT THOMAS RUTHVEN MURRAY, a subject of the King of Great Britain, residing at Hertfordshire, England, and GEORGE FREDERICK SHOTTER, a subject of the King of Great Britain, residing at London, England, have invented a certain new and useful Improvement in Electric Switches, of which the following is a specification.

This invention relates to electric switches of the kind comprising a movable switch arm and contact members operated thereby, and has for its object to provide an improved construction of apparatus of this character whereby certain advantages hereinafter set forth will be obtained.

The improved switch of the invention is particularly although not exclusively adapted for use as a current limiter and may with advantage be embodied in the form of current limiter described in the specification of Letters Patent No. 1,262,234 granted to us and dated the 9th April 1918.

In order that the nature of the invention may be clearly understood it will now be described with reference to the accompanying drawing, the single figure of which is a view in side elevation, mainly diagrammatic, of a simple form of switch and operating mechanism therefor embodying the essential features of my invention.

Referring now to the drawing, the switch therein shown comprises a switch arm or lever 1 pivotally mounted at 2 so as to be capable of oscillation or rotation through a limited arc of movement in a vertical plane.

The switch arm 1 is provided as indicated at 3, with a forked bridge contact mounted thereon at one extremity of the arm, an adjustable counterweight 4 being mounted on the opposite end of the switch arm 1. The weight and adjustment of the counterweight 4 are such that the switch arm 1 under the action of gravity, normally occupies the position shown in the drawing and tends to return to this position when displaced therefrom as will be hereinafter described.

In its normal position the extremities or forks of the bridge contact 3 extend within a pair of stationary contact cups 5, 6, containing mercury and connected in the main circuit of the device. Located underneath the switch arm 1 is a switch operating mechanism comprising an energizing winding 7 of substantially wedge-shaped form and having a stationary U-shaped core 8 partly surrounding the upper portion of the winding 7. The magnetic circuit of the core 8 includes a pivotally mounted armature 9 provided with an adjustable counterweight 10, the pivot 11 of the armature 9 being so arranged as to permit the latter to perform a rotational upward movement under the tractive effort exerted by the core 8 when the winding 7 is supplied with energizing current of a predetermined amount.

The free extremity of the armature 9, when approaching the upward limit of its travel under the action above described, is arranged to engage with one end of a striker rod or stem 12 capable of limited vertical movement in a guide 13 located immediately under the pivot 2 of the switch arm 1 as shown in the drawing.

The upper extremity 14 of the striker rod 12 above the guide 13 is provided with a resilient contact arm or spring 15, the outer end of which is formed in a double curve and engages with the lower face of the switch arm 1 when the latter is in the position shown.

Immediately above the head 14 of the striker rod 12 is located one arm 16 of a bell crank locking lever 17 which is pivotally mounted as indicated at 18, the other arm 19 of the locking lever 17 being provided with a suitable notch or recess at the end thereof adapted to engage the locking pin 20 provided on the switch arm.

The lower face of the switch arm 1 is provided with a contact pin 21 adapted when the switch arm is in the position shown, to engage with a spring contact 22 and hold the latter out of engagement with a second spring contact 23, the contacts 22, 23 being connected to the extremities of the energizing winding 7 as clearly shown in the figure. The main circuit of the device may be traced from the terminal 24 through conductor 25 to the contact cup 5, thence when the bridge 3 is resting in the cups 5, 6, the circuit is continued through the bridge 3 to the cup 6, thence through a conductor 26 and the energizing winding 7 to the other main terminal 27.

The operation of the apparatus above described is as follows:

Assuming that the parts of the device are

in the position shown, the switch arm 1 is locked in position by the locking lever 17, the locking pin 20 on the switch arm 1 engaging with the recess in the arm 19 of the locking lever and preventing accidental movement of the switch arm.

Assuming that electric current is traversing the main circuit of the device of sufficient strength to effect the attraction of the armature 9 to the core 8, the armature 9 which is so counter-balanced as normally to remain in the position shown, is attracted and moves upward to engage with the poles of the core 8. As the armature 9 approaches the end of its upward movement it engages with the lower end of the striker rod 12 and imparts an upward movement to the striker rod and to the resilient arm 15 carried thereby. The resilient arm 15 serves to transmit this movement to the switch arm 1 which is previously unlocked by the head 14 of the striker rod 12 during the upward movement of the latter engaging the arm 16 of the locking lever 17, the locking lever being rotated on its pivot in a clockwise direction so as to move the arm 19 of this lever out of the downward path of the locking pin 20. The switch arm 1 under the impulse of movement transmitted through the resilient arm 15 is tilted upward about its pivot 2 carrying the bridge 3 away from the contact cups 5, 6, thereby breaking the main circuit through the device.

The upward tilt or oscillation of the switch arm 1 also disengages the contact pin 21 carried by the switch arm from the spring contact 22, thereby permitting the latter to effect electrical engagement with the other spring contact 23 thus short-circuiting the energizing winding 7.

The short-circuiting of the winding 7, which is arranged to occur prior to the interruption of the main circuit through the device at the contact cups 5, 6, causes the winding 7 to be deënergized with the result that the armature 9 is no longer attracted by the core 8 and returns to the position shown under the action of gravity. The switch arm 1 continues its upward tilt or swing to an extent determined by its mass and the amount of momentum imparted to it through the medium of the striker rod 12 and the resilient arm 15, subsequently returning to the position shown under the action of gravity. As the switch arm completes its downward movement to its normal position, the locking pin 20 reëngages with the notch or recess in the locking lever 17 and the contact pin 20 reëngages with the contact spring 22 thereby moving the latter out of contact with the other contact spring 23. The short-circuiting of the energizing winding 7 is thus interrupted and it will be obvious that this action can only occur when the switch arm 1 is fully returned to its normal position. It is consequently impossible for a second impulse to be imparted to the switch arm 1 until the upward and downward movement of the switch arm, due to a previous impulse, has been fully completed. The switch arm 1 therefore each time it is operated, receives the full impulse from the striker rod 12 since this impulse can only be received from the switch arm when in its normal predetermined position.

Furthermore, owing to the resilient nature of the arm 15 through which the impulse is transmitted to the switch arm 1 the momentum imparted to the switch arm is substantially the same on each ocassion and is independent of the rapidity of movement of the striker rod 12. The provision of the locking device 17 not only serves to prevent accidental displacement of the switch arm from its normal position when inoperative but also avoids any risks of the switch arm rebounding from this position upon its return thereto.

The movement of the switch arm to open and close the main circuit of the device is consequently performed on each occasion in an extremely regular and accurate manner, the period of interruption of the main circuit being determined solely by the natural frequency of oscillation of the switch arm 1, and being independent of the current value at which the apparatus is adjusted to operate. The interruption and reconnection of the main circuit by the action of the switch arm is thus definite, constant and periodic, which renders the apparatus particularly suitable for use as a current limiter, the current at which the device will operate being capable of adjustment by varying the initial position of the armature 9 or the magnetic properties of its circuit by arrangements which need not be herein described. Suitable arrangements for this purpose are for instance described in the specification of our prior Letters Patent No. 1,262,233.

It will be observed that our invention provides a construction and arrangement of switch mechanism which will enable the opening and closing of an electric circuit under predetermined conditions to be effected in a deliberate and definite manner, thereby preventing injurious arcing or partial connection or disconnection of the circuit.

The invention is however not to be regarded as limited to the precise constructional details or arrangements above described which are merely given for the purpose of illustrating the principles of the invention as defined in the appended claims.

Having now described our invention, what we claim as new and desire to secure by Letters Patent is:—

1. In an electric switch the combination of a movable switch arm, contact members

operated thereby, resilient means for imparting movement to said arm and means for preventing the operation of said means unless said arm is in a predetermined position.

2. In an electric switch the combination of a movable switch arm, contact members operated thereby, electrically actuated resilient means for imparting movement to said arm and means for preventing the operation of said electrically actuated means unless said arm is in a predetermined position.

3. In an electric switch the combination of a movable switch arm, means for causing said arm normally to assume a predetermined position, means for automatically locking said arm in said position, and means for unlocking and imparting momentum to said arm away from said position.

4. In an electric switch the combination of a movable switch arm, gravity actuated means for causing said arm normally to assume a predetermined position, resilient means for imparting movement to said arm away from said position and means preventing the operation of said means for imparting movement until said arm is in said position.

5. In an electric switch the combination of a movable switch arm, gravity actuated means for causing said arm normally to assume a predetermined position, means for automatically locking said arm in said position, means for unlocking and for resiliently imparting a movement to said arm away from said position and means for preventing the operation of said means for imparting movement until said arm is in said position.

6. In an electric switch the combination of a movable switch arm, gravity actuated means for causing said arm normally to assume a predetermined position, means for imparting momentum to said arm by resilient impact thereon and means for preventing momentum being imparted to said arm until the latter is in said position.

7. In an electric switch the combination of a movable switch arm, contact members operated thereby, gravity actuated means for causing said arm normally to assume a predetermined position, means for resiliently imparting momentum to said arm to cause its movement away from said position and electrically actuated means for preventing momentum being imparted to said arm unless the latter is in said position.

8. In an electric switch the combination of a movable switch arm, contact members operated thereby, an electromagnetic device for imparting movement to said arm and means for short-circuiting said device except when said arm is in a predetermined position.

9. In an electric switch the combination of a movable switch arm, contact members operated thereby, an electromagnetically actuated device for imparting movement to said arm and means operated by said arm for short-circuiting said device except when said arm is in a predetermined position.

10. In an electric switch, the combination of a movable switch arm, an electro-magnetically actuated striker for imparting movement to said arm, a resilient member connected to said striker and adapted to engage with said switch arm when the striker is operated, a device for locking said arm in a predetermined position and means for preventing the operation of said striker except when the switch arm is in said position.

11. In an electric switch the combination of a pivotally mounted switch arm, contact members operated thereby, gravity actuated means for causing said arm normally to assume a predetermined position, an electromagnetically actuated striker for imparting movement to said arm away from said position, means for automatically locking said arm in said position, means operated by said striker when actuated to unlock said locking means, a resilient member connected to said striker and adapted to engage with said arm when said striker is operated and means operated by said arm for rendering said striker inoperative except when said arm is in said predetermined position.

In witness whereof we have hereunto set our hands.

ETHELBERT THOMAS RUTHVEN MURRAY.
GEORGE FREDERICK SHOTTER.