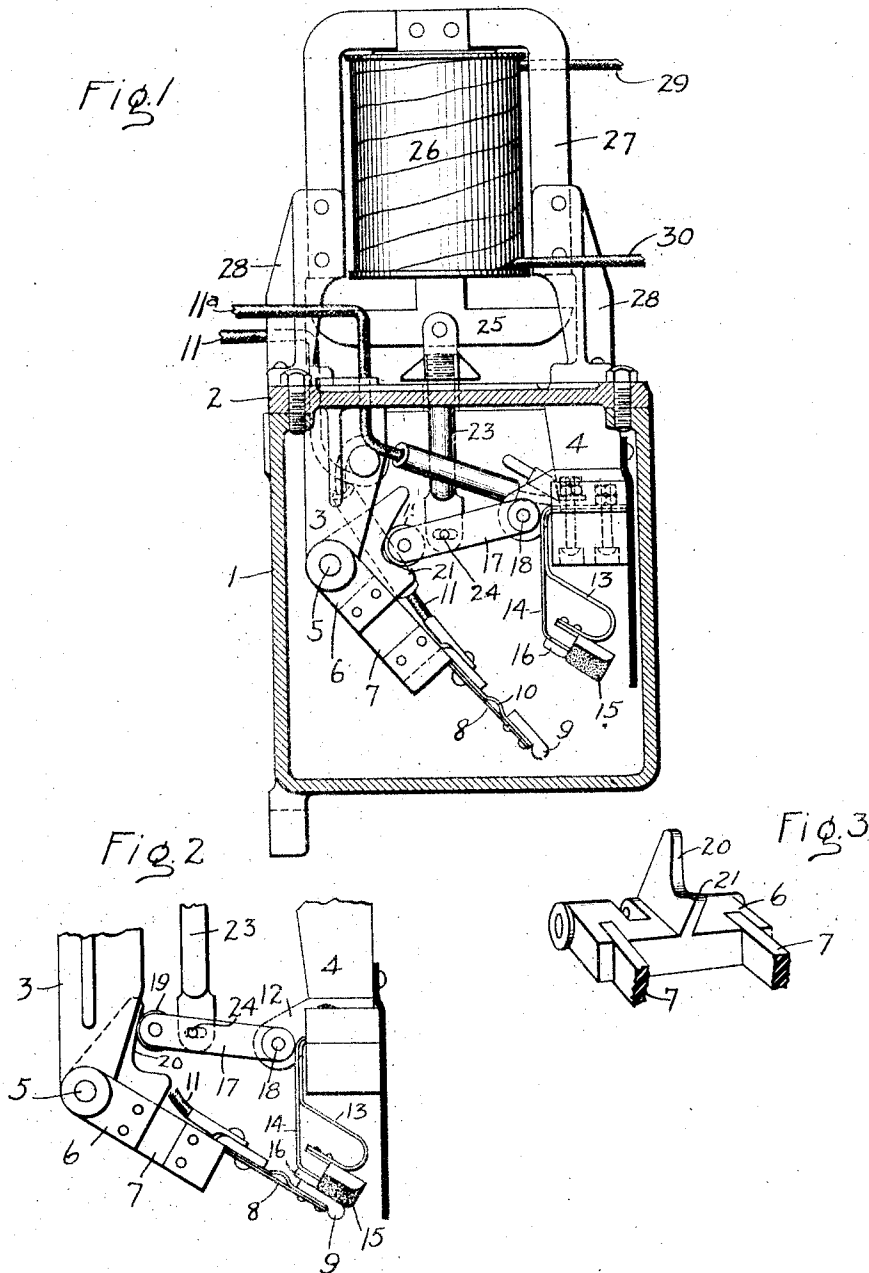


H. L. SMITH.
SOLENOID OPERATED SWITCH.
APPLICATION FILED JUNE 8, 1906.

982,100.

Patented Jan. 17, 1911.



Witnesses:
Lloyd C. Bush
Allen Oxford

Inventor:
Henry L. Smith,
By *Albert G. Davis*
Att'y

UNITED STATES PATENT OFFICE.

HENRY L. SMITH, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY A CORPORATION OF NEW YORK.

SOLENOID-OPERATED SWITCH.

982,100.

Specification of Letters Patent.

Patented Jan. 17, 1911.

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To all whom it may concern:

Be it known that I, HENRY L. SMITH, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Solenoid-Operated Switches, of which the following is a specification.

My invention relates to switch-operating mechanism, and more particularly to mechanism actuated by a solenoid energized by single-phase alternating-current, which exerts a pull upon the core varying from zero to maximum twice during each cycle. As a result, if the core of an alternating-current solenoid be connected to a switch-arm carrying a movable contact which engages a fixed contact, the pressure between the contacts when the switch is closed is not constant, but is continually varying with the variations of current through the solenoid. Consequently, if the frequency of the current is comparatively low, and particularly if in addition to this, the switch-arm is resilient, the contacts tend to chatter, causing objectionable noise and destructive arcing. It has been proposed to equalize the pull upon the core of a single-phase alternating-current solenoid by the addition of short-circuited windings in which currents are induced which tend to maintain the core in its attracted position, but it is found in practice that these windings are objectionable, as they require considerable energy, and cause the solenoid to heat.

The object of my invention is to provide a connection between the core of an alternating current solenoid and the switch-arm operated thereby, which will permit the core to respond to variations in the current, but will maintain constant pressure between the contacts when the switch is closed, regardless of the recurring variations of pull exerted by the core when alternating-current flows through the solenoid; although the invention may be used in connection with any other operating device which exerts a variable force upon the switch.

My invention consists in so connecting to a switch-arm an operating means which exerts a variable force that the movement of said operating means to a certain point in its travel will cause the switch-arm to move, but movement of the operating means beyond that point will have no effect in mov-

ing the switch-arm; so that after the switch is closed, for instance, further movement of the operating means does not alter the position of the switch-arm or the pressure between the contacts.

My invention also consists in a simple and reliable mechanical means for maintaining constant pressure between the fixed contact and a movable contact actuated by the core of an alternating-current solenoid when the contacts are in engagement and in details of construction described in the accompanying specification.

My invention will best be understood by reference to the accompanying drawings, in which—

Figure 1 shows my invention applied to an oil-switch, the oil-can of the switch being shown in section, and the switch being shown in the open position; Fig. 2 shows parts of the device in the position assumed when the switch is closed; and Fig. 3 is a view of one of the elements of the switch.

The operating mechanism is shown applied to an oil-switch, but it is evident that it may be used to operate switches of various types.

In the drawings, 1 is the oil-can of the oil-switch, containing sufficient oil or other insulating liquid to cover the contacts. The oil-can is provided with a cover 2 secured thereto by bolts and carrying brackets 3 and 4 projecting into the oil-can. The bracket 3 carries a pivot 5, upon which is loosely mounted a block 6. Arms 7, preferably of insulating material, are securely mounted at one end in the block 6 and carry on the other end spring-blades 8 upon which are mounted movable contacts 9. A flexible strip 10 connects the movable contacts 9 to one insulated lead 11 of the main circuit, the other lead 11^a being connected to a clip 12 carried upon the other bracket 4, which also carries spring-blades 13 and 14, the spring-blade 13 having secured to the lower end thereof a fixed carbon contact 15, while the spring-blade 14 carries a fixed metallic contact 16. The movable contacts 9 cooperate with the contacts 15 and 16 as shown in Fig. 2.

The movable contacts 9 are brought into engagement with the fixed contact by an operating mechanism consisting of an operating member 17 mounted at one end upon a pivot 18 carried by the clip 12. On the other end of the operating member 17 a

roller 19 is mounted and engages an actuating surface 20 rigidly secured to the block 6. The lower portion of this actuating surface forms a shoulder 21, with which the roller engages to open the switch, as shown in Fig. 1, while the remaining portion of the surface is concentric with the pivot 18, so that the roller 19 during part of its travel moves parallel to the concentric portion of the surface. A link 23 is secured to the operating member 17 by means of a pin 24, which is rigidly mounted in one end of the link and engages a slot in the member 17. The other end of the link is pivoted to an armature 25 of a solenoid 26. The solenoid is supported by means of a yoke 27, preferably laminated to avoid losses due to eddy currents. The lower ends of the yoke are carried by supports 28, which are firmly secured to the cover 2. Leads 29 and 30 from a control circuit supplied from any suitable source furnish the current which is necessary to energize the solenoid 26.

The operation of the device is as follows: If the switch be open, as shown in Fig. 1, and single-phase alternating-current flows through the solenoid 26 by means of leads 29 and 30, the solenoid will be energized and will lift the armature 25, thereby moving the operating member 17 in a clockwise direction. The preliminary part of this movement puts pressure upon the surface 20 to move the contact 9 into engagement with the fixed contacts 15 and 16. After the roller 19 in its clockwise movement passes the point at which the movable contact 9 is brought into engagement with the fixed contacts, movement of the roller 19 in the same direction does not change the distance between the surface 20 and the pivot 18, nor alter the position of the movable contacts, nor does such movement change the pressure between the contacts. When the switch is closed the roller 19 is normally in the position shown in Fig. 2 and can move downward a slight distance before it engages the shoulder 21. As a result of this construction, therefore, a decrease in the pull of the solenoid permitting the operating member 17 to move downward to a slight extent does not alter the pressure between the contacts, since the actuating surface 20 is made in the form of an arc of a circle struck from the pivot 18 as a center, with the distance between the pivot 18 and the periphery of the roller 19 as a radius. It is apparent, therefore, that the movement of the roller 19 along the actuating surface 20 does not tend to alter the position of the contact 9. The surface 20 is made of sufficient extent so that movements of the operating member 17, due to the normal variations in the pull of the solenoid 26 as a result of the use of alternating-current, do not cause the roller 19 to move into engagement with the shoulder 21.

If, however, the energizing current be cut off from the solenoid, the armature 25 and the operating member 17 drop, and the roller 19 engages the shoulder 21 with a hammer blow which separates the contacts quickly and effectively.

It is apparent that many changes may be made in the embodiment of my invention, and I do not, therefore, wish to be restricted to the precise form shown and described, but intend to cover by the claims all changes and modifications which are within the scope and spirit of my invention.

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

1. In an electric switch, the combination with a horizontal support, an operating member movably mounted on said support, a fixed contact mounted on said support to face downward, a movable contact member mounted on said support to swing up and down and having a contact which coöperates with said fixed contact, said contact member being provided with an actuating surface which is engaged by said operating member, and part of which is shaped to cause every point thereof to be equidistant from the path of movement of said operating member when said contacts are in switch closing position, and another part of which is shaped to form a shoulder engaged by said operating member to separate said contacts, an electromagnet secured to said support, and an armature for said electromagnet connected to said operating member and mounted to move said operating member along said actuating surface and into and out of engagement with said shoulder.

2. In an electric switch, the combination of a support, an operating member pivoted to said support, a fixed contact secured to said support, a movable contact member having a contact and pivoted to said support eccentric to said operating member and having an actuating surface engaged by said operating member, said surface having a curved portion concentric with the pivot of said operating member when said contacts are in engagement, and a shoulder engaged by said operating member to separate said contacts, an electromagnet secured to said support, and an armature for said electromagnet connected to said operating member and biased to separate said contacts, said armature being mounted to move perpendicularly to said support.

3. In an electric switch, the combination of a horizontal support, a fixed contact secured to said support, an operating arm pivoted to said support adjacent said fixed contact, a movable contact member pivoted to said support and having a contact to coöperate with said fixed contact, said movable contact member having between its pivot and the pivot of said operating mem-

ber an actuating surface engaged by said operating member to actuate said movable member, said surface having a curved portion concentric with the pivot of said operating member when the contacts are in engagement and a shoulder portion which projects from said curved portion and is engaged by said operating member to separate said contacts, an electromagnet mounted upon said support, and an armature for said electromagnet connected to said operating member and mounted to move vertically.

4. In an electric switch, the combination with a support, an operating member pivoted to said support, a fixed contact secured to said support, a movable contact member having a cooperating contact and pivoted to said support eccentric to said operating member and having an actuating surface engaged by the free end of said operating member, said surface having a curved portion which is concentric with the pivot of said operating member when said contacts are in engagement and a shoulder which projects from said surface at one side of the pivot of said movable contact into the path of movement of the free end of said operating member, an electromagnet secured to said support, and an armature for said electromagnet mounted for vertical movement and connected to said operating member to hold said member with its free end in engagement with the curved

portion of said actuating surface and above said shoulder when said electromagnet is energized.

5. In an electric switch, the combination of a horizontal support, an oil tank secured to said support and partly filled with oil, two lugs depending from said support within said oil tank, a fixed contact secured to one of said lugs to face toward the bottom of said tank, an operating member pivoted on one of said lugs adjacent said fixed contact, a movable contact member having a cooperating contact and pivoted to the other lug to cooperate with said fixed contact, said contact member having an actuating surface which is engaged by said operating member, and has a curved portion which is concentric with the pivot of said member when said contacts are in engagement and another portion which projects from said curved portion to form a shoulder engaged by said member to separate said contacts, an electromagnet mounted upon said support, and an armature for said electromagnet mounted to move vertically and connected to said operating member.

In witness whereof, I have hereunto set my hand this 7th day of June, 1906.

HENRY L. SMITH

Witnesses:

BENJAMIN B. HULL,
HELEN ORFORD.