

June 21, 1932.

B. J. PEPPER

1,864,369

ELECTRICAL SWITCH

Filed July 22, 1929

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Fig. 1.

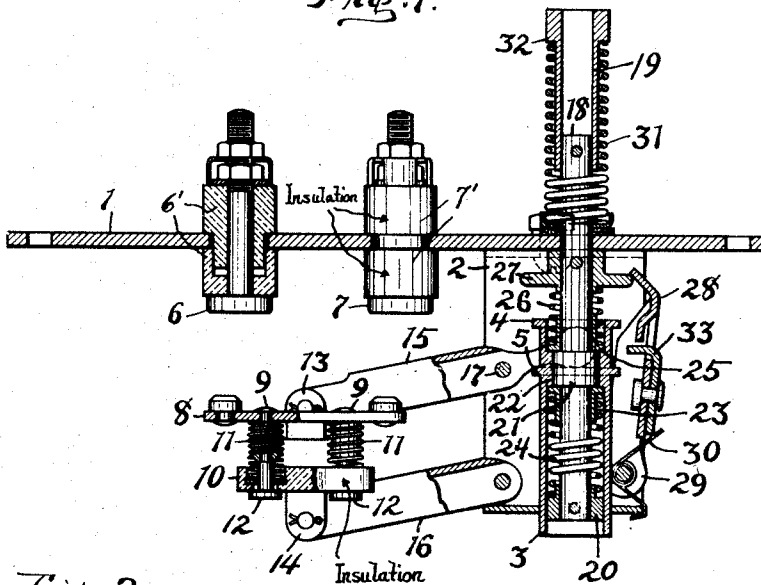
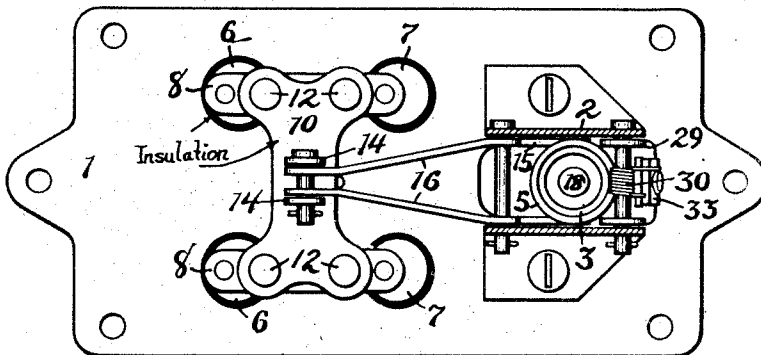


Fig. 2.



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Fig. 3.

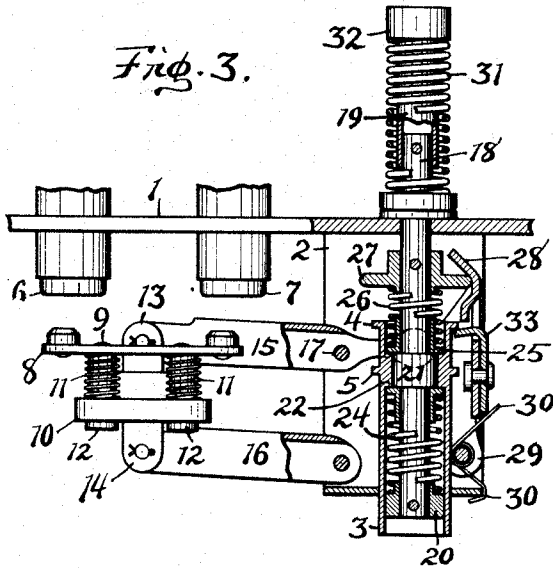


Fig. 4.

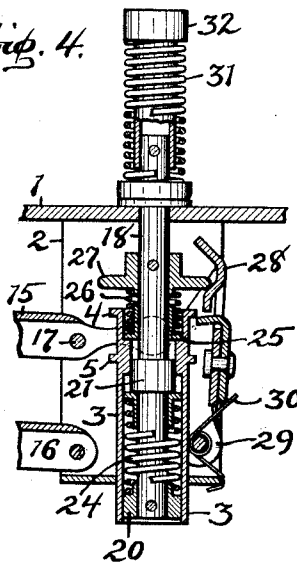


Fig. 5.

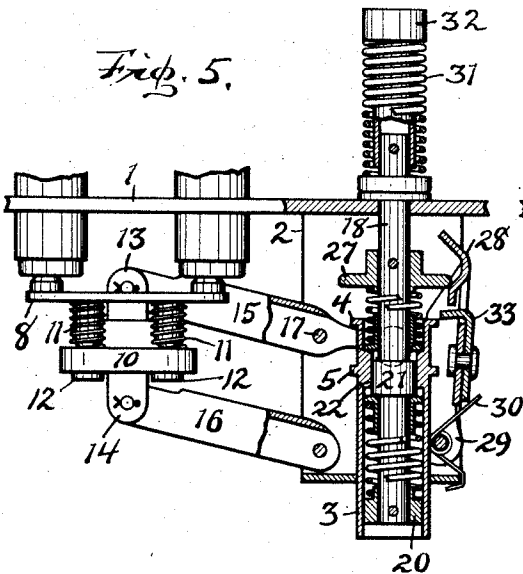
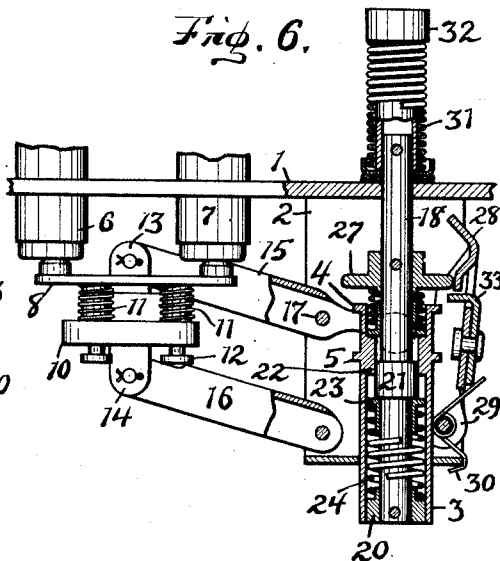


Fig. 6.



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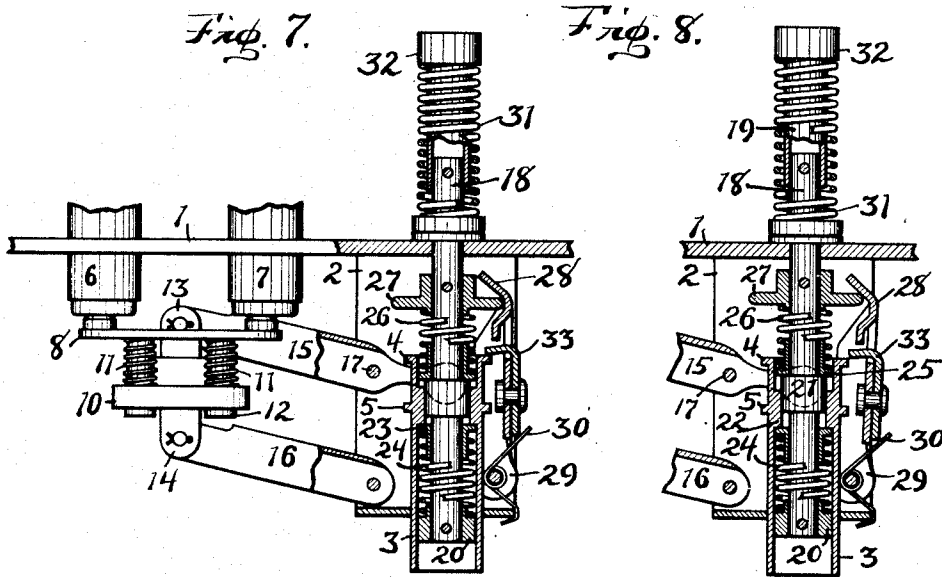
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UNITED STATES PATENT OFFICE

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ELECTRICAL SWITCH

Application filed July 22, 1929. Serial No. 379,977.

This invention relates to improvements in an electrical switch of the quick closing and quick opening type, and the objects thereof are: First, to provide a switch whereby the contacting member for the terminal leads is closed and opened by snap action, and the tendency of arcing between the contacting points of said member and terminals is reduced to a minimum, or practically eliminated; second, to provide a switch structure wherein the contact member is applied to the lead terminals firmly and instantly, and to quickly and widely separate the contact member from the terminals when the operating member is moved to open position; third, to provide in an electrical switch an automatically operated latch whereby the closing or opening movement of the contact member is deferred, and to provide in connection with the operating plunger means for the development of stored spring pressure, during engagement of the latch and operating movements of the plunger, to be subsequently applied in moving the contact member accordingly upon release of the plunger by the latch; and fourth, to provide in connection with the operating member for a switch, means of developing stored spring pressure, upon movement of the operating member, and an automatically operated latch controlling said pressure in its application to the mechanism for moving the contactor of the switch.

A further object of the invention is to provide an electrical switch that is highly efficient in its operations and capable of withstanding extensive usage without impairment.

These objects are accomplished by the construction illustrated in the accompanying drawings, in which:—

Fig. 1 is a side elevation of a switch structure in normal open position, in which the invention is embodied, parts being cut away and in section;

Fig. 2 is a bottom plan view projected from Fig. 1, the guide bracket being in section;

Fig. 3 is a side elevation of the structure showing the latch engaging the plunger and

detaining it against closing movement, parts being cut away;

Fig. 4 is a similar fragmentary view showing the latch as it is releasing the plunger;

Fig. 5 is a side elevation of the structure with the parts disposed as immediately after the plunger is released by the latch, and connection between the lead terminals is made by the contactor.

Fig. 6 is a similar view showing the parts disposed as when the operating member has reached the end of its closing stroke;

Fig. 7 is a side elevation of the structure showing the latch engaging the plunger, detaining it against opening movement, parts being cut away; and

Fig. 8 is a similar fragmentary view showing the latch as it is releasing the plunger during the opening movement thereof.

The structure comprises a base-plate 1 having attached thereto a U-shaped guide bracket 2, the lower end of which is apertured and through which extends a movable cylindrical plunger 3 having at its upper end a pair of spaced annular shoulders 4 and 5. In the plate 1 are mounted lead terminals 6 and 7 for electrical circuits, the terminals being insulated from the plate by suitable non-conductors 6' and 7' respectively. A contactor for said terminals is provided consisting of bars 8 provided with studs 9 that project movably through a frame 10 spaced from said bars, there being compression springs 11 disposed between the frame and bars, and a head 12 on the end of each stud 9 to limit relative movement apart between the bars and frame. The frame 10 made of insulating material has oppositely disposed lugs 13 and 14 which lugs are connected respectively with a lever 15 and link 16 that have pivotal support in the guide bracket 2 and swing in parallel relation with each other. The lever 15 extends between the shoulders 4 and 5 so that as the plunger 3 is moved vertically, the lever is tilted accordingly upon its fulcrum 17. The operating member consists of a push-rod 18 having a tubular head 19 fixed on its top and an annular shoulder 20 fixed on its lower end, which rod has also an annular ledge 21 between its ends, that

has longitudinal play in an internal bearing 22 in the plunger 3, into which plunger the push-rod extends. The push-rod has guided movement in the plunger by the shoulder 20 and the ledge 21, which loosely fit therein, and has also guided movement in the plate 1 through which the upper part of the rod loosely extends. A thimble 23 is loosely mounted on the rod 18 beneath the ledge and has engagement with the lower end thereof and also with the lower end of the internal bearing 22, there being a compression spring 24 around the rod between the thimble and the shoulder 20 tending to sustain the thimble in its uppermost position. Another thimble 25 is loosely mounted upon the rod 18 above the ledge 21 and has engagement with the upper ends of said ledge and the bearing 22, there being a second compression spring 26 around the rod between the thimble 25 and a flange 27 that is fixed upon the rod beneath the plate 1, which spring tends to hold the corresponding thimble in its lowermost position respecting the rod. The flange 27 limits the upward movement of the push-rod 18 by having contact with the lower face of the plate 1, and has operative relation with a cam 28 that is fixed on the upper end of a lock lever 29, whereby said lever is permitted to swing inwardly through the action of a spring 30 applied thereto, or is forced outwardly in opposition to said spring 30 accordingly as the push-rod is actuated.

A compression spring 31 is disposed about the upper end of the push-rod 18 and its tubular extension, between the plate 1 and an enlargement 32 at the top of said extension, which spring tends to hold the operating member in its uppermost or normal position.

A latch 33 is fixed on the lock lever 29 and is adapted to be projected, upon inward movement of said lever, into the path of the shoulder 4 on the plunger and have engagement therewith so as to arrest vertical movement of the plunger during the first portions of the closing and opening movements of the push-rod, and to be moved out of engagement with said shoulder and release said plunger through opposite action of the lock lever. The cam 28 is so formed that the lock lever is held in its outermost position while the push-rod is in its uppermost and lowermost positions, and the lock lever is moved inwardly and outwardly during its intermediate stages of closing and opening actions. Thus, as the lock lever is moved inwardly the latch engages the shoulder 4 and arrests movement of the plunger until released by the subsequent outward movement of the lock lever.

The switch structure herein disclosed is an example of the invention, and is subject to such modifications as may be made by the exercise of skill whereby to adapt the invention to the particular use intended.

In the present example, two pairs of lead terminals 6—7 are shown disposed to be connected respectively by corresponding contactor bars arranged upon a common frame 10 so as to act simultaneously to close or open the circuits for which the respective pairs of terminals are provided.

In the operation of the invention, the lead terminals are connected up in the usual manner with corresponding circuits (not shown) to be controlled by the switch, which circuits are closed when the contactor engages the terminals and are opened when the contactor is withdrawn therefrom, the contactor being normally in open position, as shown in Fig. 1. Upon downward movement of the push-rod 18 by pressure manually applied, the plunger 3 and the flange 27 thereon are progressed downwardly. The flange 27, against which the cam 28 on the lock lever 29 bears, in the first portion of its downward stroke, permits inward movement of the lever and the latch 33 thereon, whereupon the latch intercepts the plunger by engagement beneath the shoulder 4 thereon, as shown in Fig. 3. As the push-rod is further progressed downwardly, it slides correspondingly in the plunger causing compression of the spring 26, the thimble 25 being detained by the bearing 22 in said plunger. During further downward movement of the push-rod the cam 28 is moved outwardly by the action of the flange 27, causing outward movement of the lever 29 and latch 33 (Fig. 4) and consequent release of the plunger from the latch, whereupon the plunger, impelled by the spring 26, is thrust downwardly relative to the push-rod, causing action of the lever 15 by which the contactor is closed against the terminals. (Fig. 5). When the plunger reaches the end of its downward stroke (Fig. 6) the spring 26 is further compressed, causing increased downward pressure on the plunger and corresponding upward movement, through the medium of the lever 15, of the frame 10, which movement compresses the springs 11 against the bars 8. Thus, the contactor is pressed firmly and with more or less uniform force against the terminals thereby enhancing efficient closing of the circuits.

The switch is opened by relieving the manually applied pressure from the push-rod which thereupon retracts toward its normal position through expansion of the spring 31. During the first portion of the upward stroke of the push-rod the corresponding rise of the flange 27 permits the cam 28, lock-lever 29 and latch 33 to swing inwardly to the extent that the latch projects across the path of the shoulder 4 over the top thereof, whereby upward movement of the plunger is arrested (Fig. 7), and upon further upward progress the push-rod moves relative to the plunger, causing compression of the spring 24, the thimble 23 being detained by the bear-

ing 22 in said plunger. During the completion of the upward stroke of the push-rod, the cam 28 is moved outwardly through the action of the flange 27, causing outward movement of the lever 29 and latch 33 (Fig. 8), and consequent release of the plunger from the latch, whereupon the plunger, impelled by the spring 24, is thrust upwardly relative to the push-rod, causing action of the lever 15 by which the contactor is withdrawn from the terminals to its normal or open position (Fig. 1).

The parts of the appliance are so constructed, proportioned and arranged that the contactor is normally held spaced a substantial distance from the terminals, and is brought suddenly into closed relation with said terminals, and suddenly removed therefrom by manipulation of the push-rod whereby arcing of the current in the operation of the switch is obviated.

During the latter portion of the opening the movement of the contactor, due to its momentum, the plunger is caused to move upwardly beyond its normal position on the push-rod and compress the spring 26 which has the effect of cushioning the opening action of the contactor. This is beneficial in that the shock incidental to the opening movement of the contactor upon its supporting connections is more or less absorbed by the spring 26, and thus the life of the apparatus is prolonged.

What I claim is:—

1. An electric switch consisting of a base having a guide bracket; a spring restrained push-rod supported in said base, which rod has thereon a ledge spaced from its ends; a cylindrical plunger guided in said bracket and provided with an internal bearing in which said ledge has sliding movement, and having also an external annular shoulder; an annular flange fixed on said push-rod at a point thereon spaced from said ledge; movable thimbles on said rod, each provided with a flange at one end, which thimbles have engagement with the corresponding ends of said ledge and bearing; a compression spring for each thimble, operatively related with the rod, tending to hold the thimble against the ledge and bearing; a spring-pressed lock lever having a cam operatively engaged with the flange on said rod, and a latch engageable with the shoulder on said plunger; spaced circuit terminals fixed on said base; and a movably supported contactor for said terminals actuated by said plunger, said cam being shaped so that the plunger is intercepted and subsequently released by the latch during the closing and opening actions of the switch.

2. An electric switch having circuit terminals and a movably mounted contactor therefor, and having a plunger operably connected with said contactor, provided with a shoulder and a bearing; a spring restrained

push-rod provided with a ledge that slides in said bearing; thimbles movably mounted on said rod disposed oppositely thereon with respect to said ledge, which thimbles have engagement with the corresponding ends of said ledge and bearing; a spring for each thimble, operatively related with the rod, and tending to hold the thimble against the ledge and bearing; a flange on said push-rod; and a spring-pressed lock lever having a cam operatively engaged by the flange on said rod, and a latch engageable with the shoulder on said plunger, said cam being shaped so that movement of the plunger is intercepted and subsequently released by the latch during the operations, of the push-rod, for closing and opening of the switch.

3. Actuating means for the terminal contactor of an electric switch, consisting of a plunger movably mounted and having a fixed bearing therein; a longitudinally movable push-rod having thereon spaced from its ends a ledge with which said bearing has sliding relation; thimbles movably mounted on said rod disposed oppositely with respect to said ledge, which thimbles have engagement with the corresponding ends of said ledge and bearing; a spring for each thimble, operatively related with the rod and tending to hold the thimbles against the ledge and bearing and thereby yieldingly sustain said push-rod and plunger in their normal relative positions; means operably relating said plunger and contactor; a lock mechanism having a latch engageable with said plunger; and means associated with the rod and mechanism for actuating said mechanism upon operation of the push-rod in each direction whereby the latch is moved and the plunger intercepted thereby and subsequently released therefrom during the operations of the push-rod, for closing and opening of the switch.

4. Actuating means for the terminal contactor of an electric switch, consisting of a movable plunger; means operably relating said plunger and contactor; a push-rod having relative longitudinal movement respecting said plunger; oppositely disposed spring pressed thimbles operably related with the push-rod and engageable with the plunger, arranged so as to yieldingly restrain relative movement of the push-rod and plunger in each direction; a lock mechanism having a latch engageable with said plunger; and means operably relating the push-rod and said lock mechanism so constructed that upon operation of the push-rod in either direction said plunger is intercepted and subsequently released by the latch.

5. Actuating means for the terminal contactor of an electric switch, consisting of a push-rod; a plunger mechanism operatively connected with said contactor and having

spring restrained relative longitudinal movement with respect to said push-rod in both directions; a lock mechanism engageable with said plunger and having a cam; and means on the push-rod engaging said cam for actuating said mechanism, said cam being shaped so that movement of the plunger is intercepted and subsequently released by said mechanism during each operation of the push-rod from one of its extreme positions to the other.

6. In an electric switch of the class described, circuit terminals and a contactor mechanism therefor, a longitudinally movable plunger for actuating said mechanism; a push-rod associated with said plunger and having relative longitudinal movement therein; means restraining said movement yieldingly in both directions; and a locking means controlled by the push-rod so that the plunger upon movement thereof is intercepted and subsequently released when operated by the push-rod in each direction, whereby action of the plunger is deferred and then accelerated with respect to that of the push-rod.

7. In an appliance of the class described, an electric switch having circuit terminals and a contactor mechanism therefor provided with a plunger; a push-rod longitudinally movable in said plunger; means yieldingly restraining longitudinal movement of the push-rod relative to the plunger in both directions; and a locking means controlled by the push-rod disposed so as to be moved into engagement with and subsequently release the plunger during operation of the push-rod in each direction, whereby action of the plunger is arrested and then accelerated with respect to that of the push-rod.

8. An electric switch, comprising a supporting base having a bracket; circuit terminals on the base; a movable terminal contactor having oppositely disposed lugs; an actuating lever connected pivotally to the bracket and one of said lugs; a link spaced from and extending parallel with said lever and connected pivotally to said bracket and the other of said lugs; and a plunger mechanism operatively related with said lever.

In testimony whereof I affix my signature.

BYRON J. PEPPER.

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