Aug. 2, 1927. 1,637,461

W. F. WELLS

ELECTRICAL SWITCH

Filed March 8, 1926

Fig. 1.

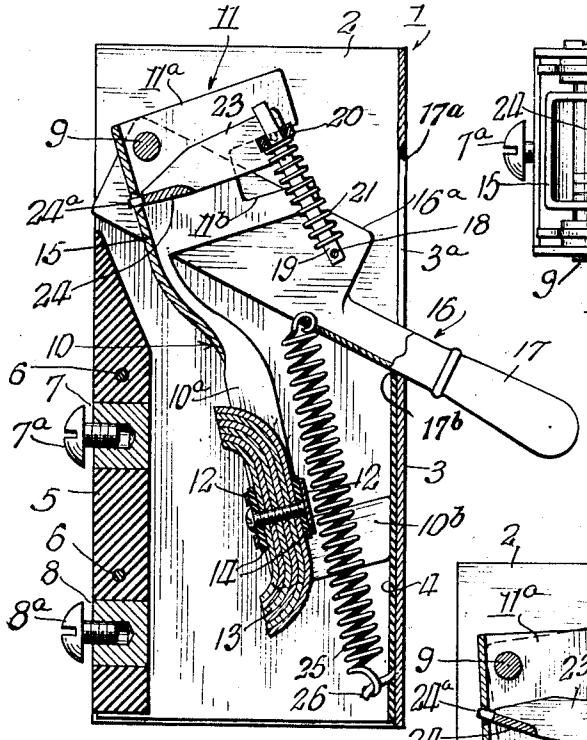


Fig. 3.

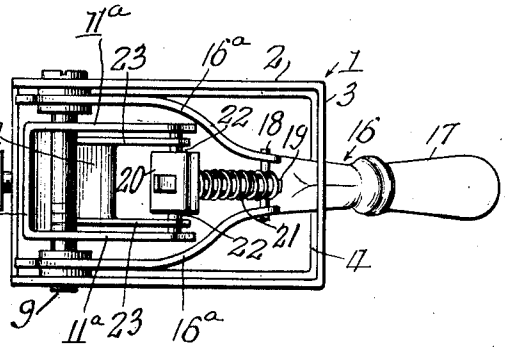


Fig. 2.

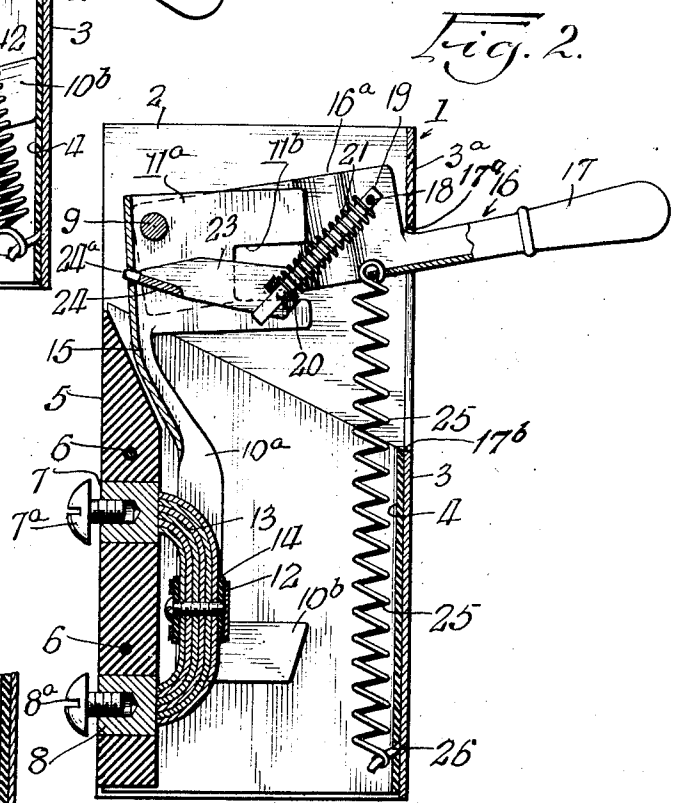
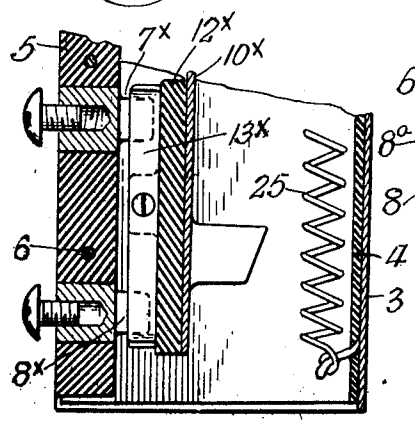


Fig. 4.



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ELECTRICAL SWITCH.

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This invention relates to improvements in electrical switches and it consists in the matters hereinafter described and more particularly pointed out in the appended claims.

The primary object of the present invention is to provide a simple and efficient electrical snap switch of the quick acting make-and-break type which is positive in operation and reduces arcing to a minimum.

A further object of the invention is to provide a quick make-and-break switch which must be manually held in its circuit making position, thus rendering it especially adapted for use in electrically driven hand tools and machines.

Still another object of the invention is to provide a switch of the kind specified which comprises but few parts, of a rugged construction and which may be easily assembled and will not readily get out of order.

These objects of the invention, as well as others, together with the many advantages thereof will more fully appear as I proceed with my specification.

In the drawings:

Fig. 1 is a longitudinal vertical section through one form of switch embodying my invention with the parts thereof in the position they occupy when contact is broken.

Fig. 2 is a view similar to Fig. 1 but with the parts in the position they occupy when contact is made.

Fig. 3 is a top plan view of the same with the parts in the position shown in Fig. 1.

Fig. 4 is a detail view of a modified form of contact members capable of being embodied in my improved switch.

My improved switch includes a rectangular box-shaped casing 1, which is open at its ends and at its rear, comprises side walls 2—2 and a front wall 3. The lower portions of the side and front walls of the casing are lined with a suitable sheet of insulating material 4 as best shown in Figs. 2 and 3. The greater portion of the open rear of the casing is closed by a block of insulation 5 suitably secured in position by pins 6 extending through the same and through portions of the side walls. In said insulation block 5 are fixed spaced contacts 7 and 8, each provided with a binding screw 7^a and 8^a, respectively, at the rear of the casing for the attachment of the circuit wires to be controlled but not shown herein. Said contacts as shown in Figs. 1 and 2 are of the flush face kind but may be made of a different form as will later appear.

Spaced a suitable distance from the rear and top edges of the casing is a pin or screw 9 upon which the major parts of the switch are mounted. Fulcrumed on said pin is a bell crank shaped contact lever including a long arm 10 and a shorter arm 11. The long arm extends toward the bottom of the casing and includes spaced side members 10^a—10^a (only one of which is shown herein) and between said side members are cross bars 12 in which a laminated contact member 13 is securely clamped. Strips 14—14 are of suitable material and are interposed between said contact member and the said cross bars to insulate them. When the contact lever is in one position, the contact 13 bridges the gap between the fixed blocks 7 and 8 and due to its laminated form, said contact bears with a good contacting pressure thereon. Each side member 10^a of the contact lever includes at its bottom end a forward extension 10^b which limits the movement of the contact lever away from the contacts 7 and 8 by engaging that portion of the insulating material 4 on the front wall 3 of the casing. It is apparent from the foregoing that an insulated contact chamber is thus provided at said end of the casing.

The shorter arm 11 of the bell crank contact lever includes side plates or members 11^a—11^a and in the forward end of each plate and opening through the same is a notch or recess 11^b, the top and bottom edges of which provide opposed stop shoulders for a purpose later to appear. The bell crank contact lever includes a rear wall 15 with which the side plates or members of both arms of the lever are integrally made.

16 indicates as a whole the main actuating hand lever or trigger which includes spaced side plates or member 16^a—16^a, fulcrumed at their rear ends upon the pin 9, the front ends of said plates merging into a handle or actuating trigger 17. Said trigger projects through a suitable slot 3^a provided therefor in the front wall 3 of the casing. When the actuating lever is in place, its side plates or members 16^a are interposed between the side plates 11^a of the shorter arm of the bell crank lever and the side walls 2—2 of the casing as best shown in Fig. 3. The

movement of said hand lever 17 is limited by the stop-shoulders 17ª and 17ᵇ of the casing.

Means are provided between the contact lever and actuating lever or trigger which in the initial part of the movement of the actuating lever in either direction stores up power, to be released in the final part of the movement of said actuating lever, to impart a quick snappy movement to the contact lever so that it snaps or jumps toward and away from the fixed contacts 7 and 8 according to the direction of movement of the actuating lever. Such means are as follows:—Extending between the front ends of the side plates or members 16ª of the operating hand lever or trigger is a fulcrum pin 18 and pivoted at one end thereto is a second or toggle pin or spring supporting member 19. The free or other end of the toggle pin 19 has a sliding guiding bearing in an abutment block 20, a helical expansion spring 21 surrounding said toggle pin 19 between the fulcrum pin and abutment block. The block 20 has laterally extending trunnions 22—22 which pass through suitable openings in the front end of the side members 23—23 of a toggle arm 24, the said side members being positioned between the side plates 11ª of the short arm 11 of the contact lever. The rear end of said toggle arm is provided with one or more extensions 24ª which extend through and have a substantially loose fit in openings in the rear wall 15 of the contact lever so as to be capable of a limited swinging or rocking movement thereabout. The said trunnions 22 of the block 20 project beyond said side members of the fulcrum arm to extend into the recesses 11ᵇ of the short arm of the contact lever so as to engage the opposed shoulders formed by the top and bottom edges of said recesses.

The toggle arm 24, the toggle pin or member 19 and the spring 21 together constitute a conventional spring-held toggle lever, the middle portion of which is arranged (in this instance via the trunnions 22) to engage the stop formations constituted by the walls of the recesses 11ᵇ. It will be observed that said stop walls are disposed substantially radially of the pivotal axis of the switch lever 10 and are so widely spaced apart with reference to the diameter of the trunnions 22 as to permit of a very considerable swing of the latter between said stops.

It will also be noted that the pivotal axis of the toggle arm 24 is offset laterally from the common pivotal axis of the switch lever 10 and the hand lever 17 in a direction substantially perpendicular to the radial plane of the last-named axis which passes midway between the stop-formations of the recesses 11ᵇ.

Assume that the parts are in the position shown in Fig. 1 when the switch is "open" and it is desired to close the same. An upward lift on the handle or trigger 17 will cause the same to fulcrum about the pin 9. In this movement the spring 21 on the toggle pin is compressed because of the shortening of the distance between the pin 18 and trunnions 22 of the block 20, the spring acting to hold said trunnions in engagement with the top shoulders formed by the top edges of the recesses 11ᵇ in the short arm of the contact lever. The compression action on the spring is increased until the pins 9 and 18 and trunnions 22 are all in a common plane or line and as the pin 18 passes through said plane under the further upward movement of the actuating lever 16, the toggle effect is broken and the expansion of the spring thus released causes the toggle arm to swing downwardly about its connection with the rear wall 15 of the contact arm. In this movement of the toggle arm 24, the lateral extensions or trunnions 22 will forcefully engage the shoulders formed by the bottom edges of the recesses 11ᵇ and will cause the contact lever to swing clockwise so that the laminated contact 13 on the bottom end thereof will engage with good contacting pressure against the fixed contacts 7 and 8 in the insulation block 5, thus bridging said contacts and closing the circuit therethrough as best shown in Fig. 2. To again open the switch, the lever 16 is swung in the other direction and the parts again operate as before described.

Particular attention is directed to the fact that at the moment that the axis of the spring 21 passes the so-called "dead-center" plane, the block 20 is thrown from one wall of the recesses 11ᵇ to the other wall thereof to thereby effect an instantaneous shifting of the said spring axis to such an angle relatively to the arms 11ª of the switch lever 11 as to exert substantially its full force on the latter to effect quick action especially where, as in the case of the knife-blade switch of Fig. 4, the movement of the switch lever is frictionally resisted. It is for this reason that the width of the recesses 11ᵇ is considerable as shown. The further effect of the wide spacing of the stops (which the opposed walls of the recesses 11ᵇ constitute) is to provide for a relatively long initial movement of the toggle lever between engagements with opposed stops, this long movement being under constantly increasing momentum to thereby effect a hammer blow on the stop to be engaged. This sharp hammer blow is directed so sharply laterally of the radius of swing of the switch lever as to afford substantially maximum leverage or pressure to be suddenly exerted on the switch lever to effectually throw the same from one position to another against such resistance as may be required to be overcome, as in the case of knife-switch contacts.

In effecting closing movement of the switch lever, a lesser degree of force is required because of the fact that the switch lever will have attained high momentum before the instant of its initial contact with the knife-switch contacts and thus momentum will serve to effect the requisite depth of engagement. By the particular arrangement shown, viz: the pivotal association of the toggle lever with the switch lever, or, more broadly, the offsetting of the pivotal axis of the toggle lever from that of the switch lever, the difference of directions of pressure of the spring is effected and adjusted to a nicety. This may be also expressed in terms of and accomplished by other means for varying the direction of pressure of the spring than the particular means herein shown and described.

In some instances it is desirable that the switch be so made as to be necessarily held in its closed position manually and that it open automatically as soon as the handle or trigger is released. Such a structure is desired in electrically operated tools as, for instance, hammers, drills and bonesaws and the like. To hold the switch normally open when the trigger is released, I employ a helical tension spring 25 which is fixed at its top end to the lever 16 and at its bottom end to an ear 26 punched out from the bottom end of the front wall of the casing. Thus when the lever or trigger 17 is actuated to close the switch, the spring 25 is placed under tension which, when the trigger is released, is sufficient to swing the trigger downward even against the resistance offered by the action of the spring 21.

Instead of the laminated and block contacts above described, I may employ the well-known "knife-blade" contacts shown in Fig. 4. In said figure the contact blocks 7 and 8 are provided with contact blades 7^x and 8^x and to the lever arm 10^x is fixed an insulating block 12^x which carries spaced blades 13^x to receive the contact blades 7^x and 8^x in the manner well-known.

The contact lever 10 in the operation of the trigger 16 is caused to snap back and forth with a quick action thus reducing arcing between the contacts with the usual burning thereof to a minimum.

While in describing my invention, I have referred in detail to the construction for and arrangement of the parts thereof, the same is to be taken as by way of illustration only and not by way of limitation except as may be pointed out in the appended claims.

I claim as my invention:

1. An electrical snap switch comprising a frame equipped with a pair of terminals, a switch lever for the latter pivotally mounted on said frame, a hand-lever pivotally mounted on said frame, a spring held toggle lever pivotally associated at its ends with said switch lever and said hand-lever, a pair of spaced stop formations on said switch lever disposed for alternate engagement by the middle portion of said toggle lever and disposed upon opposite sides of a radius of the pivotal axis of said switch lever, the pivotal axis of said toggle lever on said switch lever being disposed laterally of said radius.

2. An electrical snap switch comprising a frame equipped with a pair of terminals, a switch lever for the latter, a hand-lever, both levers pivotally mounted on said frame and having a common pivotal axis, a spring held toggle lever pivotally associated at its ends with said switch lever and said hand-lever, a pair of spaced stop formations on said switch lever disposed for alternate engagement by the middle portion of said toggle lever and disposed upon opposite sides of a radius of the pivotal axis of said switch lever, the pivotal axis of said toggle lever on said switch lever being disposed laterally of said radius.

3. An electrical snap switch comprising a frame equipped with a pair of terminals, a bell-crank switch lever pivoted at its elbow to said frame, a hand-lever having its pivotal axis coincident with said switch lever, a spring held toggle lever pivotally connected at its ends with said hand-lever and with one arm of said switch lever between the pivot of the latter and the end thereof for bridging said terminals, and a pair of spaced stop formations at the free end portions of the other arm of said switch lever disposed in the path of the middle portion of said toggle lever.

4. An electrical snap switch comprising a frame equipped with a pair of terminals, a switch lever pivoted between its ends to said frame for bridging said terminals at one end, the other end of said lever equipped with spaced stop formations, a hand-lever pivoted to said frame and adapted to rock through an arc opposed to said stop formations, a spring held toggle lever pivotally associated at its ends with both said levers and adapted to alternately engage said stop formations at its middle portion, the pivotal axis of the end of said toggle lever associated with the switch lever being offset laterally from the pivotal axis of said hand-lever.

5. An electrical snap switch comprising a frame equipped with a pair of terminals, three levers operatively pivotally associated with said frame and with each other, one thereof being a switch lever equipped with a pair of spaced stop formations, another being a hand-lever and the third a spring held toggle lever arranged to alternately engage said stop formations at its elbow portion, the pivotal axis of one end of said toggle lever being offset from the pivotal axis of at least one of the other levers laterally of the lon-

gitudinal axis of the latter which intersects the pivotal axis of its connection with the frame.

6. An electrical switch embodying therein a casing open at its ends and having side walls and a front wall, a block of insulation partly closing the rear of the casing, fixed contacts in said block of insulation, a fulcrum pin journalled in the side walls of the casing, a bell crank shaped contact lever pivoted on said pin and including a long arm and a short arm, a contact member carried by the long arm and adapted to engage and bridge the fixed contact members, there being means on said long arm adapted to engage the front wall of the casing and to limit its movement away from the fixed contacts, an actuating lever pivoted at one end on the fulcrum pin and having its other end projecting through a slot in the front wall of the casing, a toggle arm pivoted at one end to the long arm, a block carried by the other end of said arm, a toggle pin pivoted at one end to said actuating lever and having its other end slidable through said block, and a spring on said toggle pin, said block having extensions which project laterally into recesses in the short arm of the contact lever and which recesses provide opposed shoulders limiting the movement of the toggle arm.

In testimony whereof, I have hereunto set my hand, this 3rd day of March, 1926.

WILLIAM FRANKLIN WELLS.