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2,336,721

ELECTRIC SWITCH

Filed Jan. 16, 1942

2 Sheets-Sheet 1

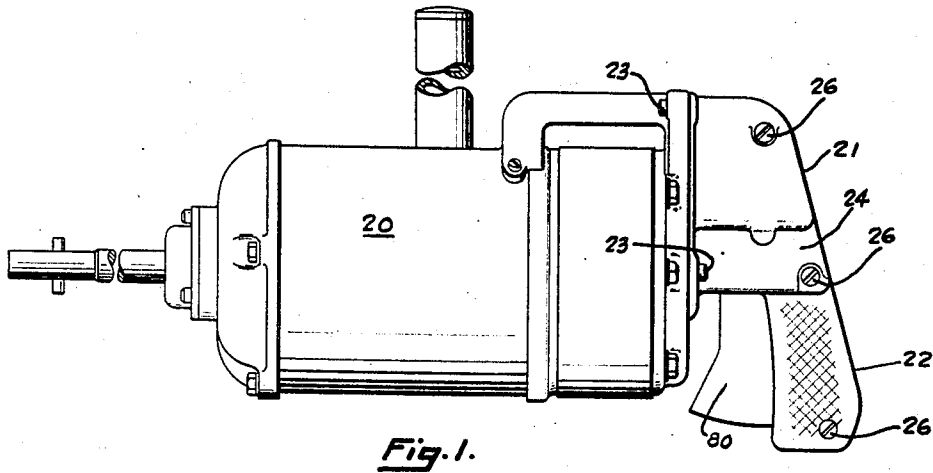


Fig. 1.

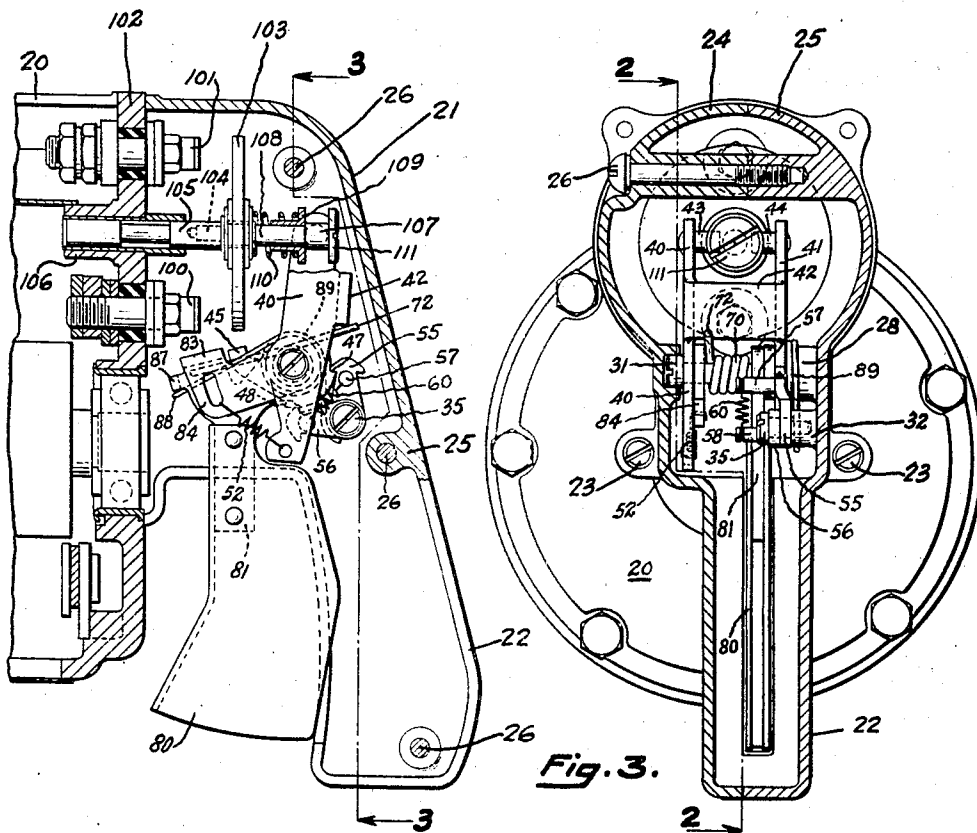


Fig. 2.

Fig. 3.

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2 Sheets-Sheet 2

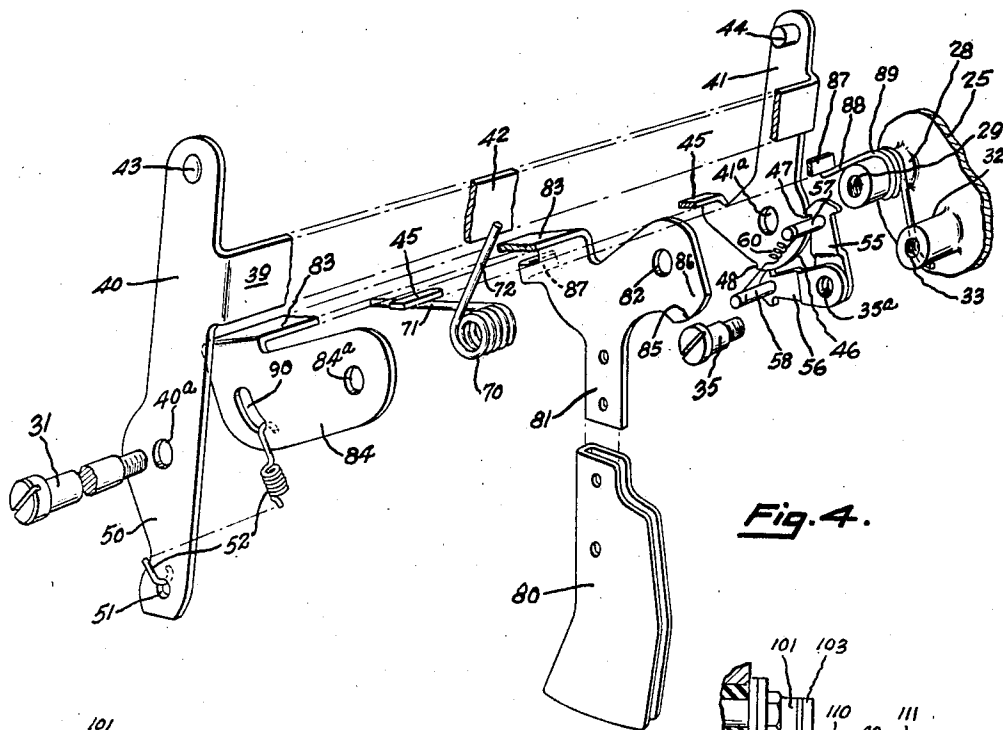


Fig. 4.

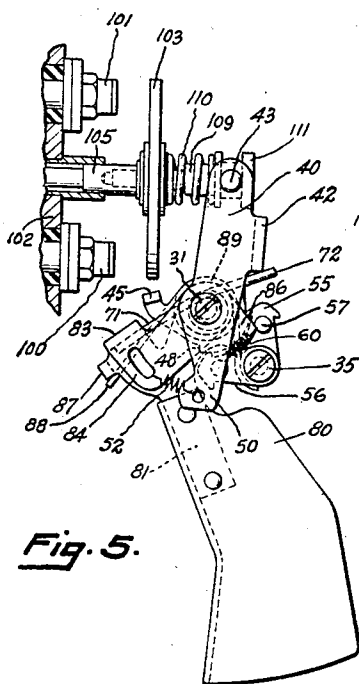


Fig. 5.

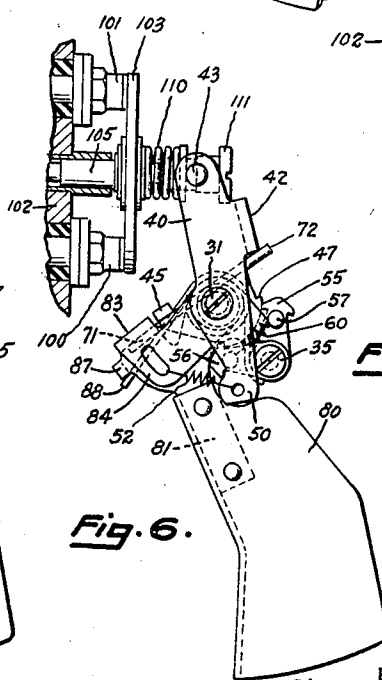


Fig. 6.

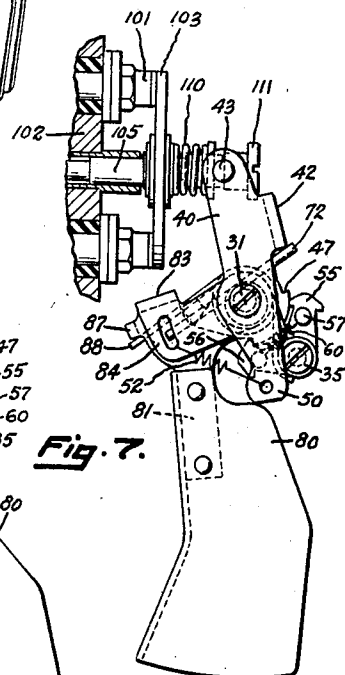


Fig. 7.

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ELECTRIC SWITCH

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9 Claims. (Cl. 200—157)

This invention relates to improvements in snap action devices and particularly to devices adapted to move a control member into "on" and "off" positions with a sudden snap movement.

It is among the objects of the present invention to provide a snap action mechanism which is controlled by a manually operated member for quickly moving a shiftable member into engagement with a relatively fixed member and for causing the shiftable member to be locked in engagement with the fixed member in response to movement of the manually operated member a certain distance in one direction, and for causing the shiftable member to be unlocked from engagement with the fixed member and to be quickly moved out of engagement with the fixed member in response to a movement of the manually operated member a certain distance in the opposite direction, whereby the pressure of engagement of the shiftable member with the fixed member is independent of movement of the manually operable member into intermediate positions.

This object is accomplished by providing a device comprising a shiftable member; locking means for retaining said member in either one of its positions; actuators such as springs, adapted to be energized above normal to move said shiftable member between its two positions respectively; and a manually operable member adapted first to energize one actuator spring so that it exerts an increasing force upon the shiftable member tending to move it into contact with the fixed member, and adapted to release a first lock which holds the shiftable member in normal position whereby the shiftable member is quickly actuated into contact with the fixed member, said manually operated member being adapted to permit a second lock to lock the shiftable member in contact with the fixed member. The mechanism provides for quickly returning the shiftable member to normal position in the same manner as it is moved into contact with the fixed member. When the manually operated member is returned to normal position, the second lock retains the shiftable member in contact with the fixed member while a second actuator spring is being stressed to urge the shiftable member toward normal position. At a predetermined point in the travel of the manually operated member toward normal position the second lock is released to permit the second actuator spring to return the shiftable member quickly to normal position, and the first lock becomes

operative to retain the shiftable member in normal position.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 is a view of the improved snap action switch applied directly to an electric motor, the switch being in the form of a pistol grip attached to the motor.

Fig. 2 is an enlarged fragmentary part sectional view taken from the side along line 2—2 of Fig. 3 and illustrates the snap action switch.

Fig. 3 is a view partly in section taken along the line 3—3 of Fig. 2.

Fig. 4 is an exploded detail view showing the various cooperating elements of the snap action mechanism. In this view details of the switch mechanism are omitted for the sake of clarity.

Fig. 5 is a fragmentary detail view of the snap action switch mechanism showing the mechanism in partially operated position.

Fig. 6 is a view similar to Fig. 5, illustrating, however, the snap action mechanism in full switch contact closing operated position.

Fig. 7, similar to Figs. 5 and 6, shows the snap action mechanism in a partially released position just prior to the breaking of contact engagement.

The snap action switch of the present invention may be applied in any suitable manner to any electric device circuit connections to which it is adapted to control. In the present drawings the switch is illustrated applied to an electric motor designated as a whole by the numeral 20. The switch as illustrated is in the form of a pistol grip which comprises a housing portion 21 having a depending portion 22 in the form of a pistol grip adapted to be grasped in the hand of the user. This housing 21 is attached to the electric motor by screws 23. As shown in Fig. 3, housing 21 comprises two shell portions 24 and 25 held together in proper relation by screw studs 26. Housing portion or shell 25, only a fragment of which is shown in Fig. 4, has a lug 28 extending therefrom provided with an interiorly threaded bore 29 which is adapted to receive the threaded end 30 of a supporting stud 31. This stud pivotally supports several of the operating parts of the snap action mechanism, as will be described. A lug 32, similar to lug 28, is provided on the housing shell portion 25, this lug 32 having a threaded

opening 33 for receiving the threaded end of a stud 35. This stud 35 pivotally supports other operating parts of the snap action mechanism.

The snap action mechanism comprises a shiftable member 39 which is pivotally supported upon the stud 31. This shiftable member comprises two arms 40 and 41 held in properly spaced relation on the stud 31 by a cross arm or web 42 shown in the present drawings to be integral with the arms. Each arm has an inwardly extending lug, the one on the arm 40 being designated by the numeral 43, the one on arm 41 by the numeral 44, these lugs extending into an operating spool provided on the switch mechanism, to be described detailedly hereinafter. Arm 41 has a finger 45 formed integral therewith and extends inwardly toward the arm 40. The hub portion of arm 41 has a part 46 substantially concentric with the stud 31 passing through an opening 41a in the hub of arm 41 and in this substantially concentric edge of the hub of arm 41 there are provided two offsets or steps, one designated by the numeral 47 and the other by the numeral 48. Arm 40 has a depending portion 50 provided with an opening 51 for receiving one end of a spring 52.

The means for locking the shiftable member in one or its other position comprises two spring loaded latches, one designated by the numeral 55, the other by the numeral 56. These latches are rotatably supported by the screw stud 35. Each latch has a pin extending therefrom, the pin 57 extending from the latch 55, the pin 58 extending from latch 56. These pins as shown in Fig. 4, are substantially parallel and spaced from each other. Interposed between these pins is a spring 60 which yieldably urges the latches toward and into engagement with the edge of the hub of arm 41 which, as has been described, has this portion thereof substantially coaxial with the stud 31 upon which lever 41 is pivotally carried. When in normal position, that is, the position in which the switch contact actuated by said member is out of engagement with its cooperating contacts, the step 47 of arm 41 will be engaged by latch 55, the spring 60 urging the latch into such engagement while it urges latch 56 into rubbing engagement with the other surface of the hub of arm 41. This engagement of latch 55 with the step 47 on the hub of lever 41 locks the shiftable member 39 against counterclockwise movement as regards Fig. 4, which movement would actuate the movable contact of the switch into engagement with its cooperating contacts, as will later be described.

The device of the present invention has two actuators, one for moving the shiftable member 39 in one direction to cause contact engagement, the other to move the shiftable member in the opposite direction for disengagement of the switch contacts. The actuator adapted to move the said shiftable member 39 so that contact engagement will result is a coil spring 70, the convolutions of which fit about the stud 31. Initially this spring is predeterminedly tensioned, the one end 71 thereof engaging and resting against the lower surface of the finger 45 on the arm 41 of the shiftable member 39, the opposite end portion 72 of the spring engaging and resting against the outer surface of the cross arm 42 of the same shiftable member. Thus, although initially tensioned, this spring will be inert due to the fact that its ends both engage an integral part of the same shiftable member 39.

The present device comprises an operating lever adapted to be actuated to engage and move the actuator 70 to exert an increasing moving effort upon the shiftable member 39. This operating lever is in the form of a trigger adapted when the operator grasps the piston grip like portion of the switch 22 in the palm of his hand and his fingers engage and press upon this lever, to be moved counterclockwise as regards the illustration in the drawings. This operating lever or trigger is shown comprising two portions, the finger grip portion 80 of the trigger secured to the trigger proper 81 in any suitable manner. These two parts might just as readily be integral. The operating lever or trigger has an opening 82 for receiving the stud 31 which pivotally supports said trigger. A shelf portion 83 extends angularly from the trigger 81, this shelf portion terminating in another angular portion 84 substantially parallel with, but spaced from the main trigger portion 81. Shelf 83, connecting trigger portions 81 and 84 is substantially parallel with the finger 45 of shiftable member. The trigger portion 81 has an edge 85 substantially concentric with the stud 31 supporting said trigger. This edge 85 forms one surface of a cam 86 provided by the trigger portion 81, this cam projecting or extending into the space between the two pins 57 and 58 carried by the respective latches 55 and 56. Trigger portion 81 also has an angular finger 87 which is substantially parallel with the finger 45 and cross arm 42 of the shiftable member, this finger 87 extending toward the housing shell 25 and forming an abutment for the end 88 of spring 89 whose convolutions surround the stud 31 formed on the housing shell 25. The opposite end of spring 89 abuts against the stud 32 on the housing. This spring 89 is the trigger load spring exerting a yieldable force to maintain the trigger in its outer inoperative position as shown in the Figs. 1 and 2. When in this normal inoperative position the cam-shaped portion 86 of trigger 81 will engage the pin 58 on latch 56 to hold it out of engagement with the hub of arm 41 and at the same time said cam portion 86 will be spaced from the pin 51 on latch 55 thereby permitting the switch 60, interposed between pins 51 and 58, to maintain latch 55 in locking engagement with the offset or step 47 in the arm 41 of the shiftable member, consequently locking this shiftable member 39 in its normal position and preventing any movement thereof out of this normal position.

The portion 84 of the trigger has a slot 90 for receiving one end of spring 52. Thus spring 52 is interposed between the trigger portion 84 and the lower end 56 of the shiftable member arm 40. Spring 52 is the second predeterminedly tensioned actuator and is utilized to actuate the shiftable member clockwise as regards the drawings.

From the foregoing it may be seen that the stud 31 screwed into the recessed lug 28 of the switch housing pivotally supports the snap action mechanism, extending through the opening 40a of the arm 40, the openings 84a and 82 of the trigger portions 84 and 81 respectively, the spring 70 by passing through its convolutions and the opening 41a of the arm 41 of the shiftable member. The stud 35 threadedly received by the lug 32 on the housing pivotally supports the two latches 55 and 56 by extending through the aligned openings 35a therein.

The switch mechanism actuated by this snap

device comprises two stationary contacts and a movable bridging member. The stationary contacts are designated by the numerals 100 and 101, they being in the form of conducting studs insulatively supported in spaced relation by the end plate 102 of the motor 20 in any suitable manner. The movable bridging member 103 is insulatively carried by a stud 104 screwed into a plug 105 slidably supported within an elongated passage provided in a lug 106 on the end plate 102 of the motor. This screw stud 104 has body portions of two different diameters, the larger diameter portion being designated by the numeral 107 and the smaller by the numeral 108. A collar 109 having an annular flange at its one end is slidably supported on the smaller diameter body portion 108 of the screw stud 104, this collar 109 being urged against the shoulder formed by the larger diameter body portion 107 through the agency of a coil spring 110 interposed between the annular flange of the collar 109 and the bridging contact 103.

The enlarged head 111 of the screw stud 104 is spaced from the annular flange of the collar 109, this flange and screw head cooperating with the body portion 107 to form a spool-like structure for receiving the inwardly extending lugs 43 and 44 of the shiftable member 39. Thus when the shiftable member moves counterclockwise as regards the drawings, it will move the entire assembly including the screw stud 104 and the bridging contact 103, insulatively mounted thereon, together with the plug 105, slidably carried in the lug 106, toward the left or to approach stationary contacts 100, and 101, finally causing engagement of such contacts by the bridging member 103 and a partial compression of the spring 110 due to relative movement between the collar 109 and stud portion 108. Any excessive movement of the shiftable member counterclockwise beyond the point of contact between the bridging member 103 and the stationary contacts 100 and 101 will thus be compensated for by the compression of the spring 110 interposed between the bridging member 103 and the collar 109 slidably carried on the body portion 108 of the screw stud 104.

The operation of the device will now be described. If the operator wishes to operate the motor 20 the pistol-grip 22 of the switch mechanism supported on the motor is grasped in the palm of the hand and the fingers of the operator naturally fold about the trigger 30 of the switch. As pressure is exerted upon the trigger 30—31 it will be moved counterclockwise about its supporting stud 31. After having moved a slight distance counterclockwise the shelf 33 of the trigger 31 will engage the end 71 of the spring actuator 70 which normally is resting against the bottom surface of the tongue 45 formed on the lever 41 of the shiftable member 39. Continued counterclockwise movement of the trigger 31 against the opposing effect of the spring 39 will cause shelf 33 of the trigger to wind up the spring 70, energizing said spring increasingly as the trigger is moved counterclockwise. The continued energization of the spring 70 by the trigger as it moves the end 71 of the spring 70 away from the finger 45 will naturally increase the pressure of the end 72 of the spring against the cross arm 42 of the shiftable member. This tends to rotate the shiftable member counterclockwise; however, such rotative movement at this time is prevented for the latch 55, engaging the offset or step 47 in the

hub portion of the lever 41 of the shiftable member 39, will lock said shiftable member against such movement by the actuator 70.

As the trigger 31 is moved counterclockwise, increasingly energizing the spring actuator 70, its cam portion 36 which, as has been described, extends between the two pins 57 and 58 of the locking latches 55 and 56 respectively, also moves counterclockwise. Cam portion 36 of the trigger will, at a predetermined point in the movement of the trigger counterclockwise, engage the pin 57 of trigger 55 and move it so as to actuate the latch 55 out of locking engagement with the offset or step 47 in the lever 41. As soon as the latch 55 disengages the hub of lever 41, said lever and consequently the shiftable member 39 is released, thus permitting the energized spring actuator 70 to become active to rotate the shiftable member 39 comprising arms 40—41 and the cross arm 42 counterclockwise with a snap action. As a result of such counterclockwise movement of the shiftable member, the assembly including the bridging contact 103 on slidable stud 105 will be moved toward and into engagement with stationary contacts 100 and 101, thereby quickly closing the motor circuit to render the motor operative. At the same time spring 110 will be partially compressed, for the arm 40 will be moved toward contacts 100 and 101 beyond the point of instant contact engagement by the bridging member 103 due to the action of the released spring actuator 70. As long as the trigger is held in the operated position, that is, in the position wherein hand pressure holds the trigger within the piston grip 22, or more specifically as shown in Fig. 6, the switch will be held in circuit closing position for, as the shiftable member including arm 41 is moved into the circuit closing position by the spring actuator 70 the latch 56 will engage offset or step 48 in the hub portion of the lever 41, thereby permitting this latch 56 to lock the shiftable member against return movement clockwise toward normal circuit braking position. This locking of arm 40 against returning clockwise movement takes place before the spring 110 is completely relaxed and thus the partially compressed spring 110 exerts a pressure upon the bridging member urging and holding it in such contact engagement. Of course the trigger must be maintained drawn to hold the switch in circuit making position for the cam portion 36 of the trigger must be held in the position in which it will hold latch 55 out of engagement with the hub of lever 41 and be spaced from pin 58 of latch 56 to permit it to be spring actuated into locking engagement with the hub of the said lever 41.

The Fig. 5 illustrates the mechanism in the initial operated position, that is, in the position into which the trigger has been operated so that its shelf 33 has engaged the end 71 of spring 70 and has moved it a slight distance away from the finger 45 of the shiftable member 39. As has been stated, Fig. 6 shows the relative position of the various elements of the snap action device when contact engagement has been effected.

As soon as the shiftable member has reached its contact closing position, spring actuator 70, having finished its work, is again reduced to its normal energized state and is completely inert for now it again assumes its normal position, that is, its end 71 engages the finger 45 of the shiftable member and end 72 is in engagement with the cross arm 42 of said shiftable member, thereby having both ends of the actuator sup-

ported upon two parts 45 and 42 of the same piece or member 39.

In order to discontinue motor operation and break the electric circuit to the motor by opening contact engagement, the operator releases the trigger 80. Such release permits the trigger to be moved clockwise under the effect of its actuating spring 89. As the trigger 81 moves clockwise and therefore the trigger part 84, the spring 52, interposed between the clockwise moving trigger part 84 and the lever 40 of the shiftable member 39 now locked against movement by the latch 58, will be energized or tensioned increasingly as the trigger portion 84 is moved clockwise. This causes the spring 52 to exert an increasing pull upon the lower end 59 of the lever 40. However at this time, as has been stated, movement of member 39 cannot take place, for the shiftable member is locked against movement by the engagement of the locking latch 58 with the step 48 on the lever 41 of said shiftable member.

During the movement of the trigger clockwise as it is released and as it increasingly energizes spring 52, the cam portion 86 of said trigger will at a predetermined point in the clockwise travel of the trigger move away from pin 57 of latch 55 and approach and finally engage pin 58 of the latch 58 now in locking engagement with the hub of lever 41. This permits latch 55 to approach and finally engage the edge of the hub of lever 41 while latch 56 is actuated out of locking engagement with the lever 41 the shiftable member is released, thereby permitting the energized spring 52 to become effective to move the shiftable member clockwise about its supporting stud 31 with a sudden action. This results in a quick shifting of the assembly including the bridging contact 103 toward the right as regards the drawings or out of contact engagement. As the shiftable member is moved clockwise the latch 55 will again engage the offset 47 in the hub of lever 41 thus locking said shiftable member against counterclockwise movement out of this position.

The shiftable member is positively locked in normal position, hence it cannot accidentally move into contact with the fixed member, until unlocked in response to a certain movement the manually operated member in a direction toward operated position. The shiftable member is positively locked in contact with the fixed member, hence it cannot accidentally move out of contact until unlocked in response to a certain movement of the manually operated member toward normal position. Between said functioning position of the manually operated member, the pressure of the shiftable member upon the fixed member remains practically unchanged, altho the manually operated member may move between its functioning positions. The contact pressure remains practically at a predetermined value until the instant of separation of the shiftable member from the fixed member. To maintain the manually operated member intermediate its functioning positions, the hand of the operator is not required to operate against pressure of the first actuator spring (which has been released), but only against the action of the return spring the force of which is being opposed the second or return actuator spring. Hence the force required to hold the manually operated member intermediate its functioning positions is much less than that required to stress the return spring and the first actuator spring when causing the

shiftable member to move into contact with the fixed member.

While the embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A snap action device comprising in combination, a member movable between two positions; a separate detent adapted to hold said member in each one of said positions; a normally inactive actuator; an operating lever adapted, when moved, to urge the actuator with increasing pressure against the shiftable member, immediately urging said member against its holding detent with increasing pressure, said lever when reaching a predetermined position being adapted to move the holding detent to release said member whereby to permit the actuator to shift said member into its other position with a snap action.

2. A snap action device comprising in combination, a member shiftable back and forth between two positions; a separate detent each locking said member in one of its two positions; a normally inactive, resilient actuator; an operating lever adapted to be moved to engage said actuator and energize it increasingly to exert a moving effort upon the shiftable member against its locking detent; and detent actuating means rendered effective, when said lever reaches a predetermined position, to move the locking detent and release the shiftable member whereby the actuator quickly shifts said member into its other position with a snap action.

3. A snap action device comprising in combination, a shiftable member; a spring-loaded latch engaging and locking said member in one position; a spring for actuating said member from the one into another position; an operating lever adapted to be moved to engage an end of said spring and bias it increasingly to urge the member in one direction and against said latch; and an unlocking cam moved by the actuation of the operating lever to engage and shift the latch out of locking engagement with the shiftable member whereby the spring shifts said member in said one direction from the one, into the other position with a snap action.

4. A snap action device comprising in combination, a shiftable member; a spring-loaded latch engaging and locking said member in one position; a coil spring; a trigger having a portion adapted to engage and move one end of the spring when said trigger is actuated, thereby tensioning the spring in one direction and urging its other end against the locked shiftable member with an increasing pressure against its locking latch; and a cam associated with the trigger and adapted to engage the latch and move it to release the shiftable member whereby the tensioned spring will move said member into its other position with a snap action when said trigger is operated into a certain position.

5. A snap action device comprising in combination, a member shiftable between two extreme positions; separate means each locking said member in one of its two positions; separate normally inactive actuators adapted to be rendered effective to move said shiftable member in one direction or the other respectively; and manually operable means adapted, during its movement in one direction or the other to energize one or the other of said actuators and increase its mov-

ing effort upon the shiftable member in the same one direction or the other respectively against a locking means and then to actuate the locking means to release said member and effect movement thereof away from said locking means with a snap action and predetermined force.

6. A snap action device comprising in combination, a member shiftable between two positions; separate detents for locking said member against movement from said two positions respectively; separate, normally inactive springs adapted to actuate the shiftable member, each in a direction opposite the other; a manually operable member movable in one direction or the other to energize one or the other of said springs whereby it will exert an increasing effort to move the shiftable member against the locking detent; and means associated with said manually operable member for engaging the locking detent and move it to release the shiftable member and permit the energized spring quickly to move it with a snap action and predetermined force into locking engagement with the other detent.

7. A snap action device comprising in combination, a member oscillatable between two positions; spring loaded detents adapted to engage and lock said member against movement out of each of said positions respectively; separate, normally inactive resilient actuators engaging said member; a spring loaded lever, manually controlled to energize one or the other of said resilient actuators to exert an increasing moving effort upon said member against its locking detent; and means associated with said lever for engaging and moving the active detent to release the member and permit the resilient actuator to oscillate the member in one direction with a snap action and predetermined force into locking engagement with the other detent.

8. A snap action device for an electric switch

which is provided with stationary contacts and means adapted to be moved to bridge said contacts, comprising in combination, a member shiftable from one position into another; compressible means connecting said member with the bridging means of the switch; a locking detent adapted to hold the shiftable member against movement in one of its positions; a normally inactive actuator for said shiftable member; and an operating lever adapted, during the greater portion of its movement, to energize the actuator increasingly to urge the shiftable member against the detent, said lever being adapted, adjacent the end of its travel, to engage and move said locking detent whereby the shiftable member is released and moved by the actuator to actuate said bridging means through the compressible member with a snap action.

9. A snap action device for an electric switch having stationary contacts and bridging means comprising in combination, a member shiftable from one position into another; an overthrow connection between said shiftable member and the bridging means, said connection comprising a compressible spring; a separate detent adapted to lock the shiftable member against movement from each of its positions respectively; normally inactive spring actuators for the shiftable member; and an operating lever movable in one direction or the other constantly to energize one or the other spring actuator increasingly to urge the shiftable member against its active, locking detent, said lever having means to move the active, locking detent to release the shiftable member and permit the energized actuator to move the said member into engagement with the inactive detent with a snap action.

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