H. A. DOUGLAS.

PUSH BUTTON SNAP SWITCH.

APPLICATION FILED APR. 4, 1917.

1,285,072.

Patented Nov. 19, 1918.

2 SHEETS—SHEET 1.

Fig. 1.

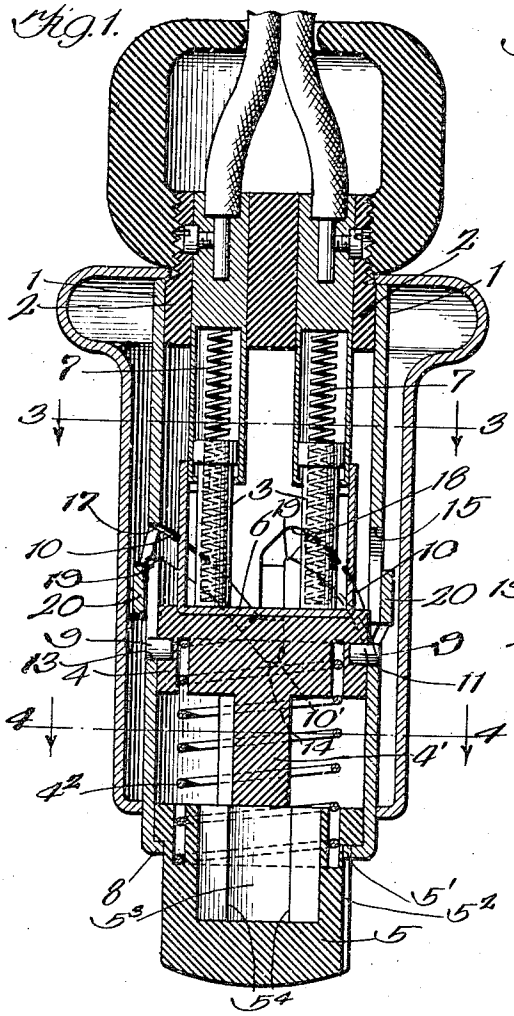


Fig. 2.

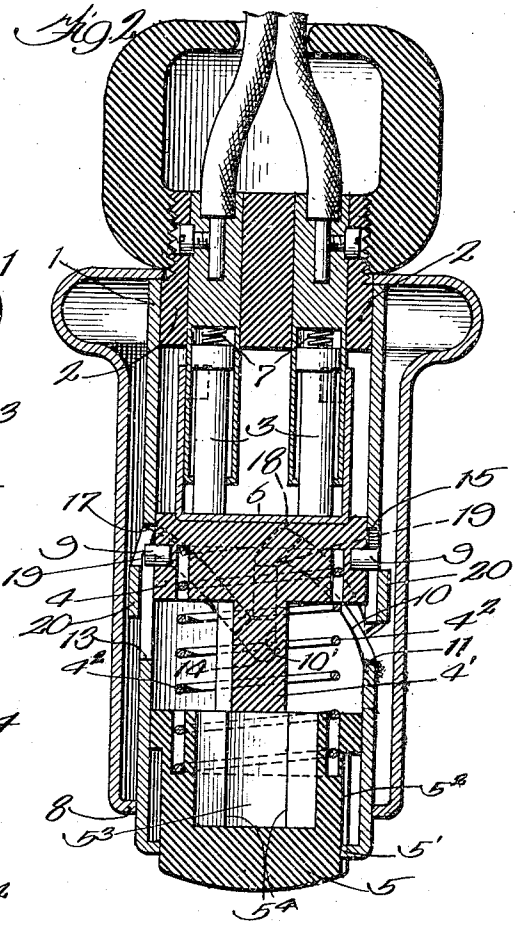


Fig. 3.

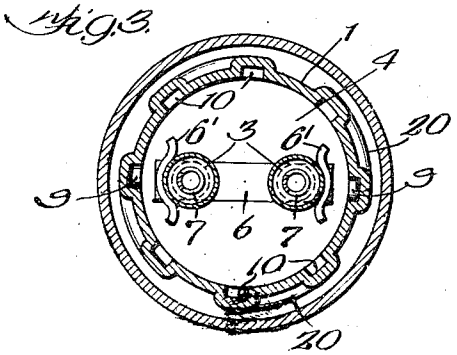
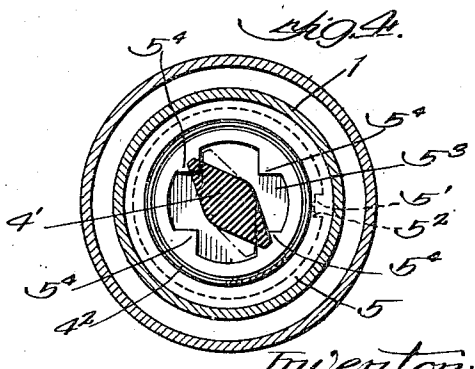


Fig. 4.



Inventor:
Harry A. Douglas
By G. L. Grogg Atty.

H. A. DOUGLAS.

PUSH BUTTON SNAP SWITCH.

APPLICATION FILED APR. 4, 1917.

1,285,072.

Patented Nov. 19, 1918.

2 SHEETS—SHEET 2.

Fig. 5.

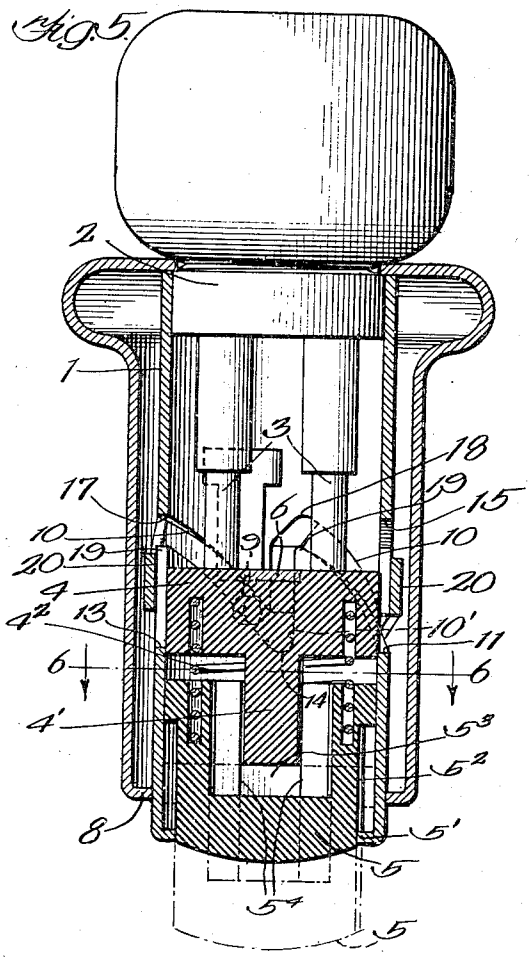


Fig. 7.

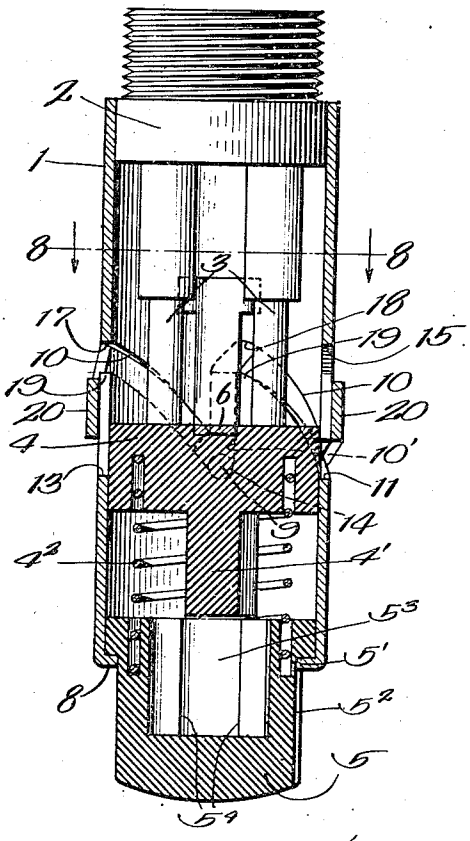


Fig. 6.

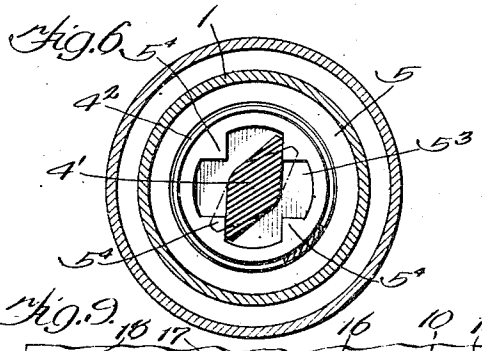


Fig. 8.

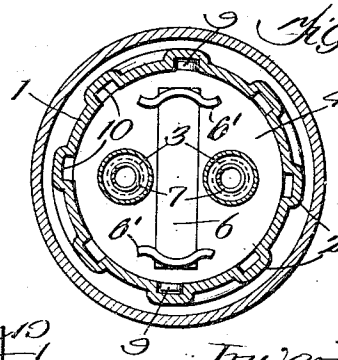
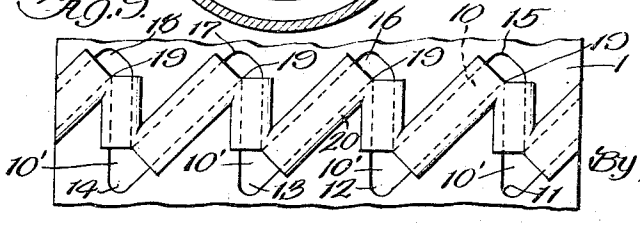


Fig. 9.



Inventor:
Harry A. Douglas.
By G. H. Bragg Atty.

UNITED STATES PATENT OFFICE.

HARRY A. DOUGLAS, OF BRONSON, MICHIGAN.

PUSH-BUTTON SNAP-SWITCH.

1,285,072. Specification of Letters Patent. Patented Nov. 19, 1918.

Application filed April 4, 1917. Serial No. 159,733.

To all whom it may concern:

Be it known that I, HARRY A. DOUGLAS, citizen of the United States, residing at Bronson, in the county of Branch and State of Michigan, have invented a certain new and useful Improvement in Push-Button Snap-Switches, of which the following is a full, clear, concise, and exact description.

My invention relates to push button snap switches and has for its general object an improved and simplified construction of such a switch.

The push button snap switch of my invention, as it is preferably constructed, is inclusive of a contact carrier, a push button having an element that has connection with said contact carrier that causes relative rotation between said push button element and said contact carrier when the push button is operated; complemental switching contacts carried by said contact carrier and push button element that is also a contact carrier, these contacts being engageable or separable upon relative rotation between said contact carriers, one of these contacts being longitudinally movable with respect to its carrier, spring means for engaging said contact with its complemental contact, when the switch is adjusted to close circuit and for restoring the push button to its outer position, and mechanism whereby the switch is "snapped" or quickly moved to position. In the preferred embodiment of the invention the first contact carrier is a shell which is mechanically connected with the contact or contacts it carries by means of a plug of insulating material that is secured to the shell. The aforesaid longitudinally movable contact is desirably directly carried by this plug, as is the spring means for engaging this contact with its complemental contact when the circuit is closed, and which spring means desirably also forces the longitudinally movable contact against the contact carrying push button element when the circuit is opened. This spring means also has the additional function of restoring the push button, preferably through the agency of the contact or contacts the spring means moves. Each circuit changing rotary movement of this push button element with reference to the shell is desirably accomplished in two steps of similar rotary direction, both occurring as a result of pushing the button in, the second step movement of the push button being its restoring movement that is accompanied by the snapping of the switch to a new position.

I will explain my invention more fully by reference to the accompanying drawings showing the preferred embodiment thereof and in which Figure 1 is a view in longitudinal section illustrating the parts in a normal position; Fig. 2 is a view similar to Fig. 1 but showing the push button in a depressed position; Fig. 3 is a view on line 3—3 of Fig. 1; Fig. 4 is a view on line 4—4 of Fig. 1; Fig. 5 is a view similar to Figs. 1 and 2 but showing the push button contact carrying element swung nearly a quarter turn; Fig. 6 is a view on line 6—6 of Fig. 5; Fig. 7 illustrates the push button contact element of Fig. 5 with its quarter turn completed; Fig. 8 is a view on line 8—8 of Fig. 7; and Fig. 9 is a development of a cam groove that enters into the construction.

Like parts are indicated by similar characters of reference throughout the different figures.

One of the contact carriers is preferably composed of a metallic shell 1 and an insulating plug 2 that is secured to the shell. The switch shown being a double pole switch, the plug 2 carries two switching contacts 3. The other contact carrier is the rotatable and reciprocable base portion or element 4 of the push button that is provided with a reciprocable actuating element 5. The contact carrying element 4 carries a contact 6 which is complemental to each of the contacts 3 and common thereto, contact 6 being provided with circuit closing contact spring fingers 6^1 engageable with contacts 3 and slidable along the same, when the push button is positioned to close circuit. Element 4 and the contact 6 carried thereby are turned ninety degrees either from an "on" or circuit closing position in which contact 6 engages contacts 3 (Figs. 1 and 3) to an "off" or circuit opening position in which contact 6 is swung clear of contacts 3 (Figs. 7 and 8), or vice versa.

The spring means that press the contacts 3 against their common complemental contact 6 are the coil springs 7 which also desirably function to restore the push button to its outer position when it is released, the inturned flange 8 upon the shell limiting the extent to which the spring means 7 may push the button outwardly. In restoring

the push button the spring pressed contacts 3 engage the base of contact 6 when the circuit is closed and the carrier 4 when the circuit is opened.

The interconnection between the contact carrying push button element 4 and the contact carrier or shell 1 whereby step by step rotary movement of said push button element 4 with respect to said shell is effected, is desirably in the form of cam mechanism comprising two diametrically opposite cam pins 9 upon the push button element 4 and a zigzag cam groove 10 whereby said push button element 4 is the element that is itself rotated.

As illustrated there are two complete cycles of switching operation for each complete rotation of the push button element 4. That is, the circuit is closed twice and opened twice in each revolution of the push button part 4.

Referring more particularly to the development of the cam groove illustrated in Fig. 9, the apices 11, 12, 13 and 14 thereof are the home seats for the pins 9, the seats that are engaged by said pins when the push button is restored to its outer and circuit opening or circuit closing position. Diametrically opposite home seats are in the same pair and seats adjacent thereto are in another pair. Adjacent home seats are separated ninety degrees and respectively define circuit opening and circuit closing positions of the contact carrying element 4 of the push button. Temporary seats for the pins 9 are at the bottom turns of the cam groove, adjacent ones of these seats being also separated ninety degrees and each being but slightly angularly displaced from or out of longitudinal alinement with the nearest home seat.

Each time the push button is depressed its pins 9 leave a pair of home seats 11 and 13 or 12 and 14 as the case may be, and are directed by the engaging longitudinal branches 10^1 of the cam groove into temporary engagement with an ensuing pair of temporary seats 15 and 17 or 16 and 18 that direct said pins toward the sloping portions of the cam groove that completes their movement into engagement with the ensuing pair of home seats. The circuit consequently is changed (opened or closed as the case may be). When the pins are in a pair of their temporary seats they have cleared the horns 19 (that do not fully underlie said temporary seats, but trail somewhat behind them). As the invention is illustrated, the movement of the pair of pins 9 from a pair of home seats (11 and 13 or 12 and 14) to an ensuing pair of temporary seats (15 and 17 or 16 and 18) is first accompanied by the very small rotary step movement of the push button element 4 that occurs when pins 9 escape horns 19 and pass into the ensuing temporary seats 15 and 17 or 16 and 18 and is followed by a second but large rotary step movement to complete the greater turn of contact 6, whereupon the ensuing pair of home seats receives pins 9. The parts of the shell 1 upon opposite sides of the groove 10 are maintained in assembly by the bridges 20 that span the cam groove at suitable intervals. The step by step rotary movements of the contact carrying push button element 4 are desirably all in the same direction, but I do not limit myself to this characteristic.

The push button element 5 is limited to reciprocal movement by means of the engagement of pins 5^1 (carried by element 5) and the longitudinal slots 5^2 in the shell 1. This element 5 is provided with a bore 5^3 having the shape, in cross section, of a maltese cross. The push button element 4 has a stem 4^1 which is receivable in the cross shaped bore 5^2 after passing by corners 5^4. Normally the stem 4 rests upon diagonally opposite corners 5^4 on the element 5 and cannot turn to enter the bore 5^3 until the button has been pushed in a little farther than is illustrated in Fig. 2, enough to clear the contiguous horns 19 and turn stem 4^1 into register with the bore 5^3 as indicated by dotted lines in Fig. 4. During the continuing inward straight line movement of the pushing element 5 that proceeds while the pins 9 remain in the slot portions 10^1 receiving them, the stem 4^1 will engage shoulders 5^4 and springs 7 will be placed under high compression or otherwise have operating power stored therein. After the push button has been fully inwardly pressed stem 4^1 turns to the dotted position shown in Fig. 4 (during the movement of the pins 9 past horns 19 into temporary seats) and enters bore 5^3 whereupon pins 9 will be forced by the distending springs 7 to travel along the contiguous spiral portions of groove 10 until the ensuing home seats nearly receive said pins. This distending action of the springs is rapid, causing the contact carrier 4 rapidly to turn (and to move longitudinally) owing to the action of the sloping portions of the cam slot or groove upon the pins 9 and the carrier 4 on which these pins are fixed. The rotary movement of the carrier 4 that approximates ninety degrees rapidly occurs due to the pins 9 (that are forced to travel through slanting portions of groove 10 as the springs 7 spread parts 4 and 2 apart) seeking permanent pin receiving seats. By this arrangement the push button part 4 and the switch contact 6 are rapidly shifted or snapped substantially a quarter turn to a new and circuit modifying position, a circuit opening or circuit closing position. The push button element 4 is permitted to turn just as soon as the stem 4^1 enters the bore 5^3, this stem assuming the position shown by full lines in Fig. 6 when the contact 6 has been turned nearly ninety degrees (Figs. 5

and 6). The push button element 4, in moving away from the contact carrier 2 also brings the stem 4^1 near the closed end of the bore 5^3 and in so doing the light spring 4^2 is placed under compression (Fig. 5). When the push button element 5 is released the spring 4^2 distends and separates the push button element 5 from the push button element 4 (Fig. 7) whereupon the stem 4^1 is withdrawn from the bore 5^3 to occupy the position shown by dotted lines in Fig. 6, and the pins 9 (which were held from finally reaching home seats by the stem 4^1 in the position shown by full lines in Fig. 6) finally reach home seats. The switch is now adjusted to permit it to go through another circuit changing cycle of operations, when the circuit is again to be changed or opened and closed as the case may be, since the stem 4^1 overlies another pair of shoulders or corners 5^4 as indicated by dotted lines in Fig. 6.

While I have herein shown and particularly described the preferred embodiment of my invention I do not wish to be limited to the precise details of construction shown as changes may readily be made without departing from the spirit of my invention, but having thus described my invention I claim as new and desire to secure by Letters Patent the following:—

1. A push button snap switch including a contact carrier; a push button having an element that has zigzag cam groove and pin interconnection with said contact carrier that causes relative rotation between said push button element and said contact carrier when the push button is operated; complemental switching contacts carried by said contact carrier and push button element that is also a contact carrier, these contacts being engageable or separable upon relative rotation between said contact carriers, one of these contacts being longitudinally movable with respect to its carrier, said push button having an actuating element that is reciprocable with respect to said first push button element; and spring means for pushing the first element outwardly and coöperating with said cam groove to cause the circuit changing rotation of said first element.

2. A push button snap switch including a contact carrier; a push button having an element that has zigzag cam groove and pin interconnection with said contact carrier that causes relative rotation between said push button element and said contact carrier when the push button is operated; complemental switching contacts carried by said contact carrier and push button element that is also a contact carrier, these contacts being engageable or separable upon relative rotation between said contact carriers, said push button having an actuating element that is reciprocable with respect to said first push button element; and spring means for pushing the first element outwardly and coöperating with said cam groove to cause the circuit changing rotation of said first element.

3. A push button snap switch including a contact carrier; a push button having an element that has zigzag cam groove and pin interconnection with said contact carrier that causes relative rotation between said push button element and said contact carrier when the push button is operated; complemental switching contacts carried by said contact carrier and push button element that is also a contact carrier, these contacts being engageable or separable upon relative rotation between said contact carriers, one of these contacts being longitudinally movable with respect to its carrier, said push button having an actuating element that is reciprocable with respect to said first push button element; spring means for pushing the first element outwardly and coöperating with said cam groove to cause the circuit changing rotation of said first element; and means for relatively positioning said push button elements to permit the first push button element to move outwardly and turn with respect to the second push button element at the conclusion of the inward movement of the first push button element.

4. A push button snap switch including a contact carrier; a push button having an element that has zigzag cam groove and pin interconnection with said contact carrier that causes relative rotation between said push button element and said contact carrier when the push button is operated; complemental switching contacts carried by said contact carrier and push button element that is also a contact carrier, these contacts being engageable or separable upon relative rotation between said contact carriers, said push button having an actuating element that is reciprocable with respect to said first push button element; spring means for pushing the first element outwardly and coöperating with said cam groove to cause the circuit changing rotation of said first element; and means for relatively positioning said push button elements to permit the first push button element to move outwardly and turn with respect to the second push button element at the conclusion of the inward movement of the first push button element.

5. A push button snap switch including a contact carrier; a push button having an element that has zigzag cam groove and pin interconnection with said contact carrier that causes relative rotation between said push button element and said contact carrier when the push button is operated; complemental switching contacts carried by said contact carrier and push button element that is also a contact carrier, these contacts being engageable or separable upon relative

rotation between said contact carriers, one of these contacts being longitudinally movable with respect to its carrier, said push button having an actuating element that is reciprocable with respect to said first push button element; spring means for pushing the first element outwardly and coöperating with said cam groove to cause the circuit changing rotation of said first element; and means for relatively positioning said push button elements to permit the first push button element to move outwardly with respect to the second push button element at the conclusion of the inward movement of the first push button element.

6. A push button snap switch including a contact carrier; a push button having an element that has zigzag cam groove and pin interconnection with said contact carrier that causes relative rotation between said push button element and said contact carrier when the push button is operated; complemental switching contacts carried by said contact carrier and push button element that is also a contact carrier, these contacts being engageable or separable upon relative rotation between said contact carriers, said push button having an actuating element that is reciprocable with respect to said first push button element; spring means for pushing the first element outwardly and coöperating with said cam groove to cause the circuit changing rotation of said first element; and means for relatively positioning said push button elements to permit the first push button element to move outwardly with respect to the second push button element at the conclusion of the inward movement of the first push button element.

7. A push button snap switch including switching contacts; a push button for controlling the relation of said contacts, this push button having inner and outer portions, the outer portion being in pushing relation to the inner portion and the inner portion being movable outwardly and with respect to the outer portion; and means for effecting rapid circuit changing rotation of the inner portion of the push button when it moves outwardly.

8. A push button snap switch including switching contacts; a push button for controlling the relation of said contacts, this push button having inner and outer portions, the outer portion being in pushing relation to the inner portion and the inner portion being movable outwardly and with respect to the outer portion; means for relatively positioning said portions of the push button to permit the inner portion to move outwardly and means for effecting rapid circuit changing rotation of the inner portion of the push button when it moves outwardly.

In witness whereof, I hereunto subscribe my name this 3rd day of March, A. D., 1917.

HARRY A. DOUGLAS.