Feb. 11, 1936. N. C. SCHELLENGER 2,030,657

SWITCH

Filed Nov. 24, 1933 2 Sheets-Sheet 1

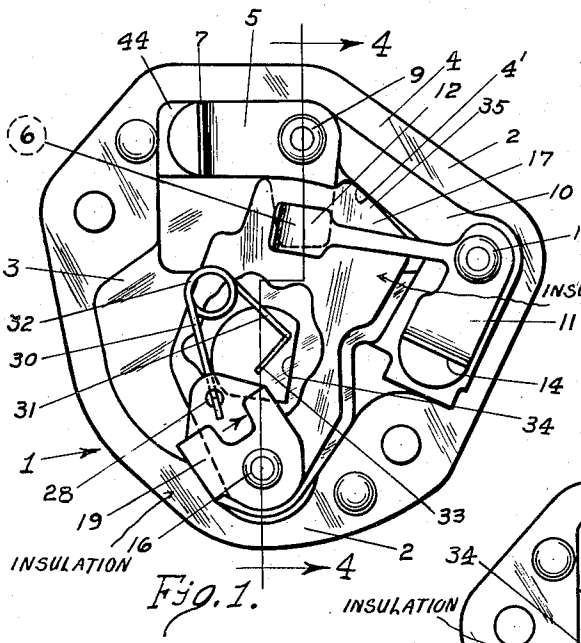

Fig. 1.

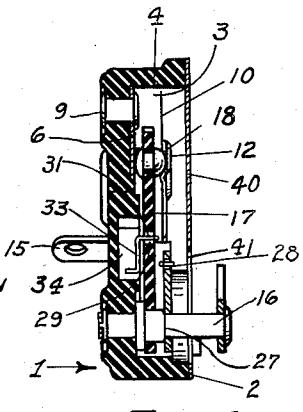

Fig. 4.

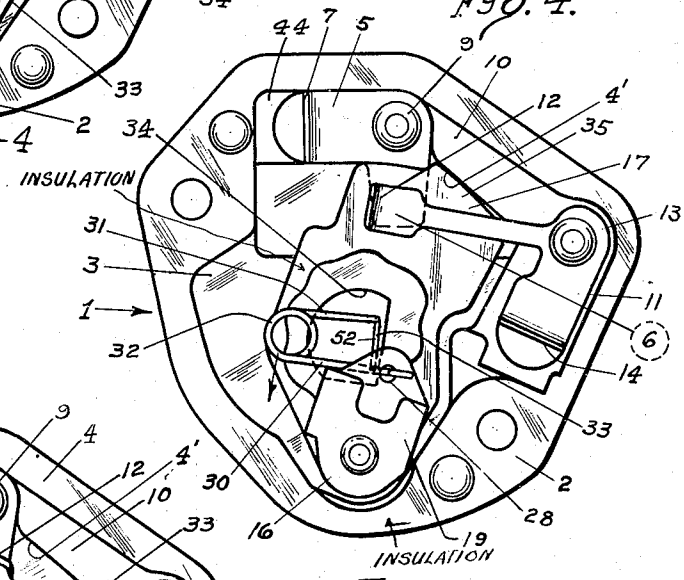

Fig. 2.

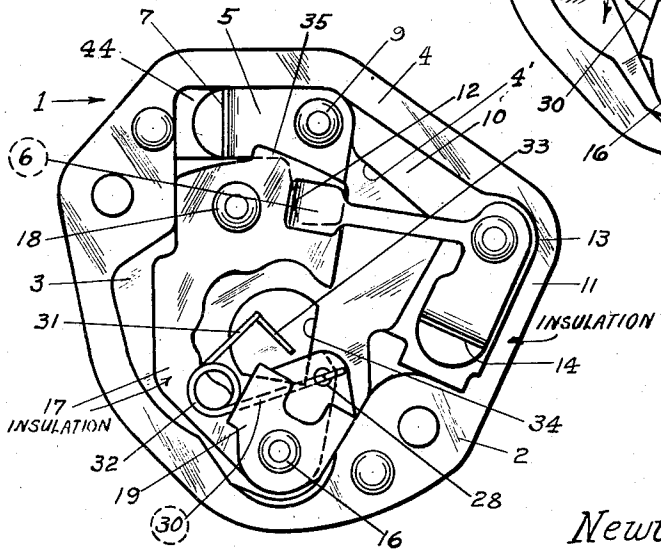

Fig. 3.

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SWITCH

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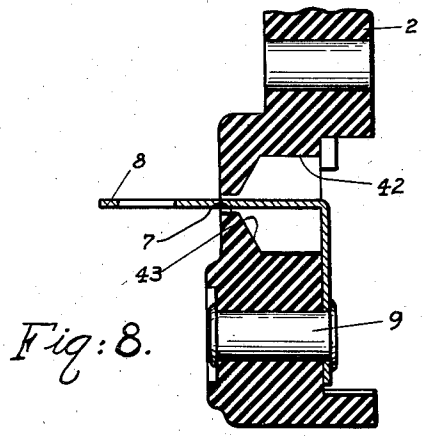

Fig: 8.

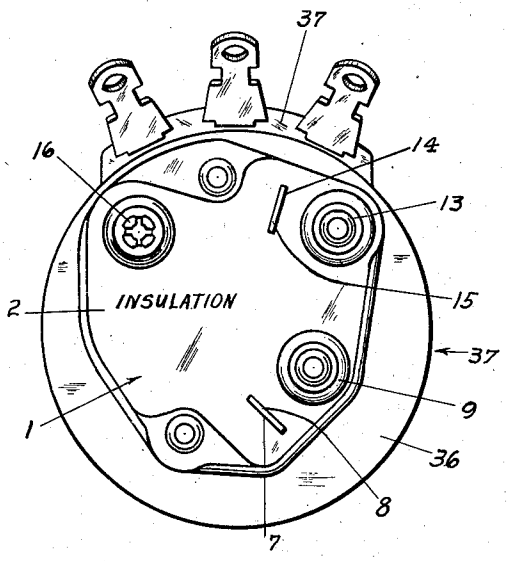

Fig: 5.

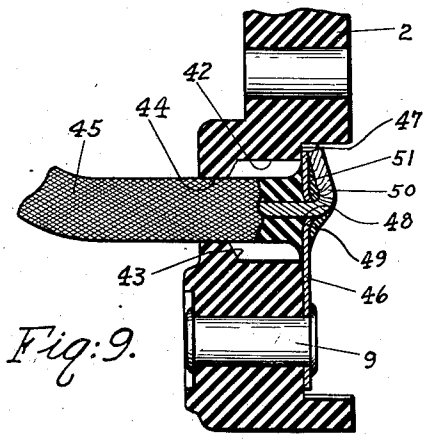

Fig: 9.

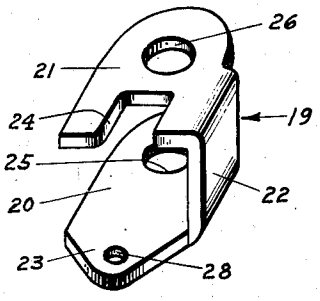

Fig: 7.

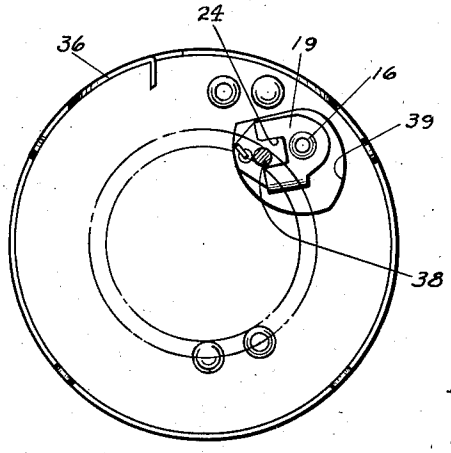

Fig: 6.

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Patented Feb. 11, 1936

2,030,657

UNITED STATES PATENT OFFICE

2,030,657

SWITCH

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Application November 24, 1933, Serial No. 699,490

7 Claims. (Cl. 200—67)

This invention relates to switches and particularly to switches of the so-called "snap" type wherein an actuator is moved through predetermined movement to compress a spring and, upon continued movement of the actuator, the spring is released and urges a movable contact element rapidly toward or away from a stationary contact element with which the movable contact element cooperates to complete a circuit.

More particularly, the invention relates to a snap switch adapted for use in radio and the like apparatus and particularly for use in combination with other control devices such as variable resistance devices.

One of the objects of the present invention is the provision of a snap switch which is simple and rugged in construction, easy and inexpensive to fabricate and assemble, and which is positive and efficient in operation.

Another object of the invention is the provision of a snap switch of the type wherein a contact element is movable into a position between and engaging two stationary contact elements to complete the circuit therebetween in which switch, the movable contact element is brought to a halt in the engaging position without rebounding or vibration by the provision of a slight wedging action between rigid mutually impinging surfaces.

Another object of the invention is the provision of a switch of the type aforesaid wherein a light actuating spring is employed and the action of the compressed spring in setting the movable contact element in motion is assisted by a leverage action of the spring.

Another object of the invention is the provision of a switch of the type aforesaid wherein two stationary contact elements are arranged in spaced opposition and a third contact element is arranged for movement into a position between and electrically connecting the stationary contact elements, and wherein an insulating barrier is provided between the stationary contact elements and the contact elements are efficiently and effectively insulated from all other metal portions of the switch.

Still another object of the invention is the provision in a switch of the type aforesaid of a novel actuating element adapted for transient engagement with an actuating member carried by a movable portion of another device, such as the actuator of a variable resistance device, for energizing the spring element of the switch.

Other objects of the invention will appear from the appended specification taken in connection with the accompanying drawings wherein:

Figs. 1, 2 and 3 are plan views partially broken away showing the switch with the elements in three different positions which they assume during the operation of the switch, namely "closed", "kick-off" and "open";

Fig. 4 is a sectional view on a reduced scale taken along line 4—4 of Fig. 1;

Fig. 5 is a plan view showing the switch combined with a variable resistance device;

Fig. 6 is a bottom view of the cover of the variable resistance device housing with the switch mounted thereon;

Fig. 7 is an enlarged perspective view showing the actuating element; and

Figs. 8 and 9 are enlarged fragmentary, sectional views showing two arrangements respectively for connecting a conductor to a stationary contact element.

Referring more in detail to the drawings, the switch 1 includes a cupped polygonal casing member 2, formed of molded insulating material, such as phenolic condensate, and provided with a recess 3 shaped to accommodate the switch elements, as will hereinafter be described, and a side wall portion 4 for surrounding the switch elements.

Set in the floor of the casing 2 and having its top surface substantially co-planar therewith, is an L-shaped metallic contact member 5, one leg of which extends toward the center of the casing and constitutes a contact element 6, and the other leg of which extends along the side wall and extends out through a slot 7 in the bottom wall of the casing 2 to constitute a terminal element 8 for the switch. The contact member is secured to the casing by a rivet 9.

Seated on a ledge 10 raised substantially above the floor of the casing 2 and extending adjacent the side wall 4 is a second metallic contact member 11 having a contact portion lying directly over and spaced from the contact portion of the other contact member and constituting a second contact element 12. The contact portion 12 is rolled up at one edge for a purpose to be hereinafter set forth and is connected by a resilient narrow shank portion to a principal portion which is secured to the casing 2 by a rivet 13 and which extends through a slot 14 in the casing 2 to constitute a second terminal 15.

Set in the casing at a point substantially diametrically opposite the contact elements 6, 12 is a pivot pin 16 having rotatably carried thereon a flat arm 17 formed of insulating material, preferably fibrous. The arm 17 has secured thereto, at the end opposite the pivoted end, a

metallic rivet serving as a contact element 18 and positioned to move into a position between and engaging the contact portions of the contact elements 6, 12 as the arm 17 rotates (clockwise as viewed in Fig. 1) about the pivot pin 16.

Also mounted on the pivot pin 16 is an actuating element 19, of which Fig. 7 is an enlarged view. The actuating element 19 constitutes the female gear portion of an intermittent motion mechanism and is formed of a single piece of sheet metal by a die pressing operation and comprises a base portion 20, a gear portion 21 parallel to the base portion 20 and spaced therefrom by a side wall portion 22 joining a side edge of the base portion 20 and a side edge of the other portion 21. The base portion 20 has a perforated tongue 23 extending therefrom and the gear portion 21 is provided with an open slot 24. The base portion 20 and gear portion 21 have alined perforations 25, 26 which receive the pivot pin 16, the actuating element 19 being seated on a shoulder 27 formed on the pivot pin 16 which positions the actuating element 19 and maintains it out of engagement with the arm 17.

Entering perforations 28, 29 (see Fig. 4) in the actuating member 19 and the arm 17 respectively are two end portions 30, 31 of a coiled torsion spring 32 which spring is constituted by approximately one and one-half turns of light spring wire. As will be seen from Figs. 1 and 3, the spring 32 is at all times compressed and tends to bias the arm 17 in a direction opposite to that of the actuating element 19. The end 31 of the spring 32 which extends through the arm 17 is formed as a crank 33 which enters a sector shaped recess 34 in the floor of the casing member 2.

The operation of the switch is as follows:

When the switch 1 is in the "closed" position the actuating element 19 is in the left hand (as viewed in Fig. 1) position of its seat and the arm 17 is biased in the opposite direction with an inclined edge portion 35 bearing upon the lower side wall of the ledge 10, the movable contact element 19 being in position between and engaging the stationary contact elements 6, 12 to complete the circuit therebetween.

When the actuating element 19 is rotated clockwise (as viewed in Fig. 2) toward its other position, the end 30 of the spring 32 which engages the actuating element 19 is brought closer to the end 31 which engages the arm 17, thus compressing the spring 32. As the end 30 of the spring 32 engaging the actuating element 19 is moved, the direction of an imaginary line, along which the force is exerted by the spring 32, swings in the opposite direction (counter-clockwise) through a position wherein the force is directed along a line including the pivot pin 16 and the point of attachment of the spring 32 to the arm 17, which position is substantially a "dead center" position, and into the "kick-off" position wherein the force is applied in a direction to spread the ends 30, 31 of the spring, thus rotating the arm 17 counter-clockwise. The arm 17 then is urged rapidly, by the release of the energy stored in the spring 32, to the position shown in Fig. 3.

The edge of the lower contact element 6 which is last engaged by the movable contact element 18 extends beyond the flat portion of the upper stationary contact element 12 whereby, when the switch is opened, the movable contact element 18 is disengaged first from the upper contact element 12 thus any arcing which occurs between the movable contact element 18 and the top contact element 12 does not cause any burning of the casing or other portions of the switch since the upper contact is spaced from all other portions of the switch.

In this position the arm 17 abuts the left hand portion of the side wall 4 of the casing member 2 and the movable contact element 19 is spaced away from the stationary contact elements 6, 12, and the circuit is opened between the stationary contact elements 6, 12.

Referring again to the movement of the arm 17, when the arm 17 reaches the "kick-off" position, the crank arm 33 of the spring 32 abuts the side wall of the sector shaped recess 34 and, as the actuating element 19 is rotated still further, the spring as a whole rotates about the free end of the crank 33 as a pivot. The portion of the crank 33 which extends through the arm 17 thus rotates counter-clockwise to force the arm 17 in the same direction, the crank 33 serving in this manner as a lever to assist the spring 32 in actuating the arm 17, thus the latter is set rapidly in motion or "kicked-off" and carries the movable contact element 18 rapidly away from the stationary contact elements 6, 12 to break the circuit with a minimum of arcing.

The closing of the switch is accomplished in an analogous but reverse manner, except however, in that the crank 33, as shown, does not assist the spring 32 in actuating the arm 17. A "kick-off" when the arm 17 is moved from open to closed position can be provided by forming the recess 34 with its side wall formed to be engaged by the crank 33 when the actuator is rotated in a counter-clockwise direction. During the closing movement, the rolled-up edge of the contact element 12 serves to lift the latter onto the movable contact element 18 without stubbing and with a minimum of friction.

Inasmuch as the movable contact element 18 rides along the floor of the casing member and onto the bottom stationary contact element 6, the top surface of which is co-planar with the floor, and since the upper stationary contact element 12 resiliently bears against the movable contact element 18 when the latter is in engagement with the lower stationary contact element 6, the movable contact element 18 moves into closed position without change in its plane of motion so that there is no bouncing or vibrating and hence no arcing occurs between the contact elements during the closing of the switch.

The side wall 4 of the casing member 2 has an inclined portion 4' and the inclined edge 35 of the arm 17 which engages it when the switch is in closed position is so shaped that, as the arm 17 moves into closed position, the arm 17 does not strike the wall 4' squarely but slides along the wall 4', such sliding being permitted by the arm 17 being forced inwardly on the pivot pin 16 on which the arm 17 is loosely mounted. This sliding engagement between the inclined portion 4' of the wall and the inclined edge 35 produces a slight wedging action between these surfaces, thus preventing a rebound from the impact of the two impinging surfaces as well as preventing vibration of the arm 17 due to the spring drive connection. The chance of objectionable electric arcing between the contact members is thereby materially reduced. It will be seen that as the arm 17 approaches the closed position, its momentum is arrested by the frictional engagement between the inclined edge 35 of the arm 17 and the wall 4 and also by the compression of

the spring 32 effected by the inward movement of the arm 17 on the pivot 16.

Obviously the wedging action between the arm 17 and the wall 4' must not be so strong as to cause a sticking or clinging of the arm to the wall 4'. It is for this reason that a certain amount of play or looseness is provided between the arm 17 and the pin 16. To further prevent objectionable fastening of the wedging members, the torsion spring 30 is positioned to exert a force normal to the wedging surfaces and tending to prevent the play between arm 17 and pin 16 from being taken up too rapidly.

In Fig. 5 is illustrated one of the applications of the present invention, the switch 1 being shown mounted on a cover member 36 constituting a housing for a variable resistance device 37 of the type having a resistance element and a movable assembly including a contactor movable circularly over the surface of the resistance element.

Fig. 6 is a bottom view of the cover member 36 of the variable resistance device, showing a switch actuating pin 38, constituting the male portion of the intermittent gear mechanism, carried by the movable assembly (not shown) of the variable resistance device 37 cooperating with the actuating element of the switch 1, which extends through a perforation 39 in the cover 36. As the pin 38 of the variable resistance device 37 is moved in a circle, by the rotation of the movable assembly (not shown) of the variable resistance device 37, the pin moves into the slot 24 of the actuating element 19 to move the latter and thus throw the switch 1. Interposed between the switch casing member 2 and the cover 36 of the variable resistance device is an insulating member 40 having a perforation 41 overlying the perforation 39 in the cover.

Fig. 8 shows the manner in which the terminal element 8 is brought out of the casing member 2 for connection to a conductor (not shown). There is provided in the casing member 2 a slotted perforation 7 of such size as will just accommodate the terminal element 8 thereby making a tight fit excluding dust and other foreign matter from the casing, thus minimizing arcing and also deterioration of the switch such as is caused by the entry of foreign matter. Formed in the casing member 2 is a circular recess 42 having a diameter approximately equal to the length of the slotted perforation 7 and having its bottom wall 43 inclined toward the longer sides of the slotted perforation 7. The enlarged recess 42 permits of easier molding of the casing member 2 and the inclined wall portions serve to guide the end of the terminal element 8 into the slotted perforation 7 thus the terminal element 8 may easily be assembled in the casing member 2.

Another form of terminal arrangement is shown in Fig. 9 wherein the end wall 43 of the recess 42 has a perforation 44 adapted to receive an insulated lead 45. A terminal element 46 extends in a plane from the attaching rivet 9 and the free end finds a seat on a ledge 47 of the casing member 2. The terminal element 46 has a perforation 48 formed therein by piercing which provides a bead 49 surrounding the perforation 48. The conductor proper 50 is extended through the perforation 45 and bent over against the terminal element 46 and a quantity of solder 51 locks the conductor 50 in place and provides a positive electrical connection between the conductor 50 and the terminal 46.

It will now be seen that the invention provides a simple, rugged and efficient switch of the snap type, in which the "live" parts are securely insulated, a strong snap action is provided by a relatively light spring, the moving contact element is brought to a stop in engagement with the stationary contact elements without bouncing or vibration and in which a beneficial wiping engagement between the contact elements is provided.

It should be obvious that the switch disclosed herein is not limited to use with a variable resistance device or with any particular type of other device and it may be employed in any application wherein it is desired to employ a snap switch which is to be actuated by an actuating element adapted to engage the actuating element of the switch herein disclosed.

I claim:

1. A snap switch comprising an insulating housing member, a stationary spring contact element comprising a contact portion and a shank portion, means securing said shank portion to said housing, an insulating actuator arm, a movable contact element carried on said actuator arm, means pivotally mounting said actuator arm on said housing, actuating means including a one piece actuator element, said pivotal mounting means pivotally mounting said actuator element on said housing, and spring means interposed between said actuator element and said arm, said actuator element being U-shaped and having provided in one of the legs thereof an open slot for engagement with an actuating member.

2. A snap switch comprising a housing member, a stationary contact element, a movable contact element, an insulating arm carrying said movable contact element, a pivot element, means mounting said arm on said pivot element, an actuating element mounted on said pivot element, means including a spring element interposed between said actuating element and said arm for effecting snap action of said arm upon rotation of said actuating element, said spring being provided with an extension projecting into a recess in said housing and engageable with a wall thereof to constitute a lever for assisting the snap action of said spring.

3. A snap switch comprising a housing member, a stationary contact element on said housing, a movable contact, an arm carrying said movable contact, a pivot element, means loosely mounting said arm on said pivot element, an actuator, spring means interposed between said actuator and said arm and constituting with said actuator and said arm a spring toggle for rotating said arm to move said movable contact element into engagement with said stationary contact element and means wedgingly engaging said arm as said movable contact approaches its position engaging said stationary contact, said means being effective to urge the arm on said pivot in a direction transversely of the direction of the rotational movement of said arm.

4. A snap switch comprising a housing member, having an inclined side wall, a stationary contact element in said housing, a movable contact element, an arm carrying said movable contact element for movement of the latter into engagement with said stationary contact element, means including a pivot mounting said arm for rotation on said housing member, actuating means including a spring for imparting a snap action to said arm and means including said inclined side wall for wedgingly engaging said arm at the end portion of its movement to halt the

movement of said arm, said means being effective to urge said arm transversely of its direction of rotational movement to compress said spring.

5. In a switch, a stationary contact, a movable contact for coaction with said stationary contact, a movable arm carrying said movable contact, and actuating means for said arm including an actuating element comprising a flat base portion, a flat portion spaced from and parallel to said base portion and having an open slot therein, said parallel portions having aligned bearings for pivotally mounting said actuating means and an integral flat side portion joining an edge of said base portion and a corresponding edge of said flat portion.

6. A snap switch comprising an insulating housing member, a stationary spring contact element comprising a contact portion and a shank portion, means securing said shank portion to the housing, a second stationary contact fixed to the housing adjacent the contact portion of the spring contact element, an insulating actuator arm, a contact element carried by the arm and extending beyond the faces of the arm to engage both contacts in closed position, means pivotally mounting the actuator arm on said housing, actuating means comprising an actuator element, said pivotal mounting means pivotally mounting said actuator arm on said housing, and spring means interposed between said actuator element and said arm, said actuator element being an integral U-shaped member with an open slot in one of the legs thereof for engagement with an actuating member.

7. In a switch, a stationary contact portion, a movable contact for coaction with said stationary contact, a movable arm carrying said movable contact portion, an integral U-shaped actuating element, aligned bearing openings in the parallel legs of the U, means extending through said bearing openings for pivotally mounting the actuating member, one leg of said actuating element having an open slot for engagement by operating means, and actuating means connecting the actuating member and the movable arm, the other leg of the actuating element being provided with means for the connection of the actuating means.

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