Jan. 31, 1950 I. M. SEDWITZ 2,496,135

ELECTRIC MOMENTARY SWITCH

Filed Aug. 7, 1945

Fig. 1.

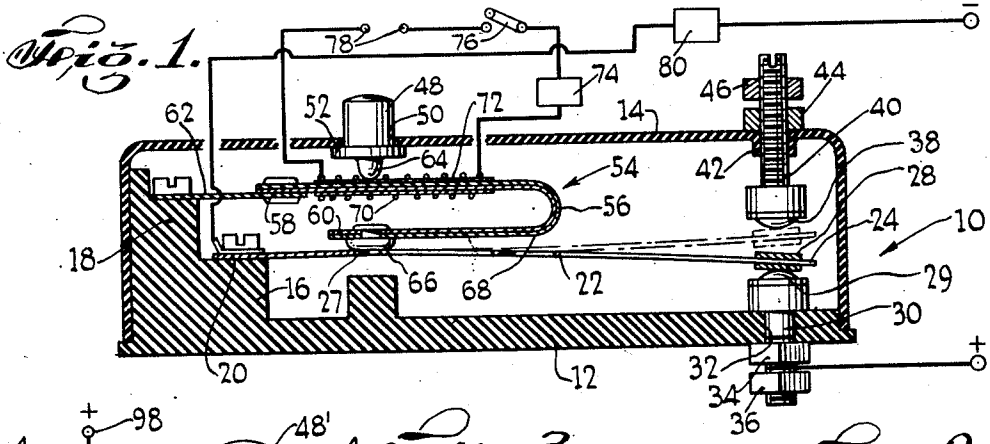


Fig. 3.

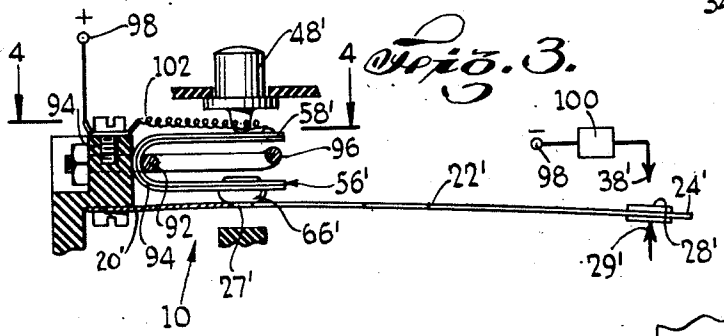


Fig. 2.

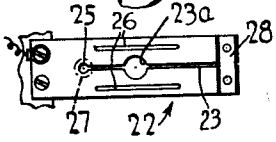


Fig. 4.

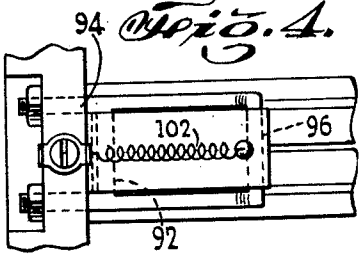


Fig. 5.

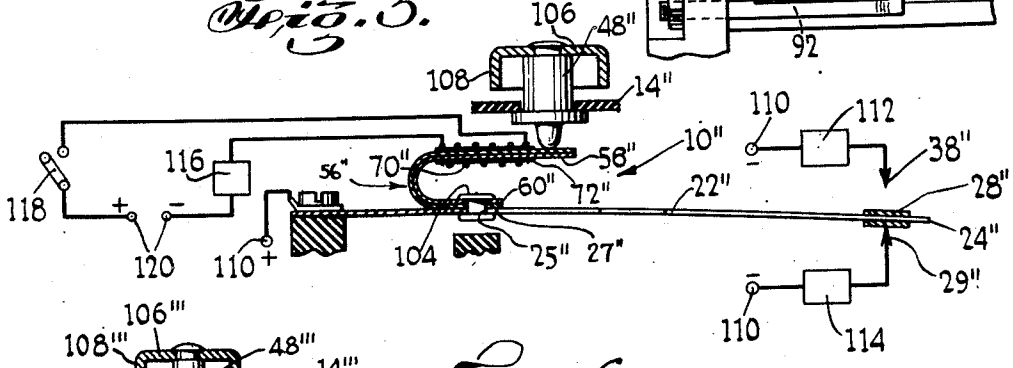
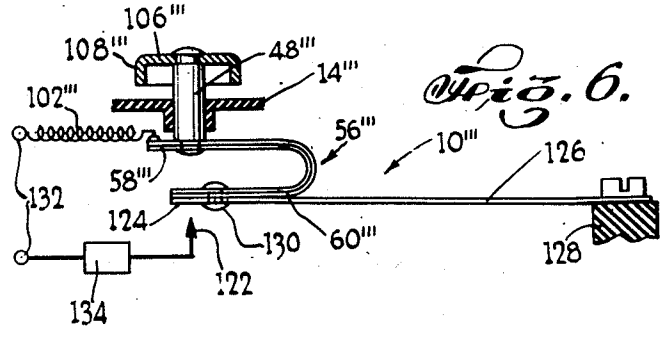


Fig. 6.



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ELECTRIC MOMENTARY SWITCH

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2 Claims. (Cl. 200—122)

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This invention relates to electric momentary switches, the term momentary, as applied to switches, denoting that a switch must be continuously manipulated for operation as it has a restoring bias which, as soon as the switch is released, will cause the switch contacts to resume their idle position.

In its preferred form, my invention pertains to an electric momentary snap switch, that is, a momentary electric switch which at a certain point of manipulation will change suddenly from idle to operated positions or vice versa.

It is an object of my invention to provide a momentary electric switch having a cut-out novelly incorporated therein.

It is another object of my invention to provide in a momentary electric switch a built-in cut-out of simple, durable and inexpensive construction.

Other objects of the invention will in part be obvious and in part hereinafter pointed out.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts which will be exemplified in the constructions hereinafter described, and of which the scope of application will be indicated in the claims.

In the accompanying drawings, in which are shown various possible embodiments of this invention, and wherein like numbers refer to like parts throughout,

Fig. 1 is a sectional view in elevation of an electric momentary snap switch embodying my invention;

Fig. 2 is a detail plan view of a snap strip;

Fig. 3 is a fragmentary sectional view in elevation of another switch embodying a modified form of my invention;

Fig. 4 is an enlarged sectional view taken substantially along the line 4—4 of Fig. 3; and

Figs. 5 and 6 are views similar to Fig. 3 of switches embodying other modified forms of my invention.

Essentially, a momentary switch comprises a pair of contacts adapted to be electrically connected in a circuit, means to mount said contacts for movement toward and away from each other, an actuator for effecting relative movement of the contacts to operated position, and biasing means for urging said contacts to relatively move in the opposite direction toward idle position. In one position of the momentary switch the contacts are engaged and in the other disengaged. However, quite commonly in the disengaged position one of the contacts engages a third contact so that by proper connections in circuit the switch may be normally open or normally closed, or may serve as a double throw switch.

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A momentary snap switch additionally includes a snap action means.

As is well known, many of the foregoing switch elements may be combined into a single part of the switch. For example, a contact, its mounting means, the biasing means and the snap acting means may all be part of a resilient electrically conductive strip so bowed or tensioned that when a portion thereof is transversely shifted, another portion thereof will snap from one position to another.

In general, the several objects of my invention are carried out by providing in a momentary switch such as described above a contractile member such as a bellows or bimetallic element through which the actuator relatively moves the contacts. The size of said contractile member is responsive to the value of a controlling condition (temperature, pressure, voltage, current, etc.), the occurrence of a predetermined value of the condition causing the contractile member to shorten to such an extent that the actuator in its operating position cannot operate the contacts or maintain the same operated. If said condition does not reach such value the contractile member is long enough to permit the actuator to operate the contacts through said member when the actuator is in its operating position.

In addition means may be provided to limit the operative movement of the actuator member to its normal operating position.

Referring now to the drawings, and more particularly to Figs. 1 and 2, 10 denotes a momentary snap switch embodying my invention. Said switch comprises a base block 12 of electrically non-conductive material which forms the bottom closure for a casing 14 of like material. The base 12 has a series of steps 16, 18 at one end thereof. On the lower step 16, I firmly mount one end 20 of a generally flat snap strip 22 of electrically conductive resilient material such, for example, as phosphor bronze. Said strip is slightly longitudinally upwardly bowed, as illustrated in full lines in Fig. 1, and is weakened longitudinally and centrally by a slit 23 running from adjacent the free end 24 of the strip to an aperture 25 near the end 20 attached to the step 16. The slit is enlarged intermediate its ends to form an opening 23a and stiffening ribs 26 extend along the side edges of the strip. This type of strip is well known to the art, being that conventionally employed in many momentary snap switches.

A strip of this type is characterized by its ability to snap the free end 24 thereof when transversely shifted in the area 27 defined by the dotted circle surrounding the aperture 25. The full line position of the strip 22, illustrated in Fig. 1, illustrates the normal or idle condition of said strip, i. e., the position when no force is applied thereto. As said strip is depressed in the area 27, a point will be reached at which the free end 24 will fly or snap upwardly to operated position, regardless of the speed with which said area 27 is depressed. Such position is shown by dotted lines in Fig. 1. Subsequently, as the area 27 is allowed to move up, a point will be reached at which the free end 24 will snap downwardly to idle position.

The strip 22 carries one of the switch contacts 28. In idle position of the strip 22, the contact 28 engages another switch contact 29 secured to an end of a screw 30 passed through an aperture 32 in the base 12. On the other end of the screw 30 I provide a clamping nut 34 and a terminal nut 36. A third contact 38 is disposed in position to be engaged by the contact 28 when the free end 24 of the strip is snapped to its operated position. Said third contact is secured to one end of a screw 40 which is threaded in a tapped aperture 42 of the shell 14 and whose other end carries a clamping nut 44 and a terminal nut 46.

The actuator comprises a push button 48 of electrically nonconductive material which is slidably mounted in an aperture 50 directly above the area 27. A flange 52 on the lower end of the button prevents the same from falling out of the aperture.

As thus far described, all the elements of the momentary snap switch 10 are wholly conventional although the same or equivalent elements are necessary parts of a momentary snap switch embodying the instant invention, it being noted that the button 48 would rest upon the area 27, if the switch were not modified according to my invention.

Pursuant to my invention, I provide a contractile member 54 intermediate the button 48 and the area 27 which latter may be considered to comprise the actuating portion of a snap acting means. Said contractile member comprises a U-shaped bimetallic element 56, the layer with the lesser coefficient of thermal expansion being disposed innermost so that when the element is heated it will warp and cause the legs 58, 60 thereof to approach each other.

The bimetallic element is suitably supported, as by a flat spring 62 riveted to the upper leg 58 of said element. Said spring is secured to the top step 18 and holds the element 56 with its upper leg 58 against a nub 64 depending from the lower end of the push button and with its lower leg 60 directly above the area 27. If desired, a button 66 may be carried on the lower leg 60, said button being adapted to engage the contact strip 22 at the area 27.

Under normal conditions depressing the push button 48 to its operating position will move the bimetallic element 56 and its button 66 down to press against the area 27. At a certain point of travel of said area the free end 24 of the switch will snap up causing the contact 28 to disengage from the contact 29 and engage the contact 38. If the bimetallic element 56 is heated sufficiently when in operated position the button 66 will move and, at a certain point, allow the free end 24 of the strip 22 to snap back to idle position, provided the button 48 is not depressed further beyond its operating position.

In many uses of the switch the push button is actuated by a positive positioning member, such as a cam, and in such cases said button will not be moved beyond its operating position. However, the switch might also be actuated by a spring pressed element which upon contraction of the contractile member would further depress the push button. Accordingly, I may provide means to prevent depression of the push button 48 beyond its operating position, or, if it is further depressed, to prevent said button from operating the contacts through the contractile member 54 if the controlling condition reaches a predetermined value. Such means may operate in any one of several fashions. For example, it may limit movement of the push button 48 by abutment of said button against a stop, or by abutment of an element carried by said button against a stop, or by abutment of the contractile member against a stop, or it may cause the contractile member to abut against a portion of the strip 22, depression of which will not snap the strip from idle to operated position.

The switch shown in Fig. 1 is constructed to operate in the last named manner. In this switch when a predetermined value of a condition is reached which is to cut-out the switch (return the switch to idle position) the bimetallic element 56 will warp to such an extent that two things occur. Firstly, if the push button 48 is in its operating position the lower leg 60 of the bimetallic strip will shift upwardly to such an extent that the button 66 will allow the area 27 to move up sufficiently to cause the free end 24 of the strip 22 to snap back to its idle position. Secondly, the button 66 will move up above the lower part 68 of the return bend of the U-shaped bimetallic element. This part 68 is located over a portion of the strip 22 remote from the area 27 and such that depression thereof will not cause snap action of the strip. Thus if the push button is further depressed it can not operate the switch.

Suitable means also may be provided to cause warping of the bimetallic element in response to the value of the condition which is to cut out the switch 10. In Fig. 1 said means comprises an electric resistance wire 70 wound around an insulating sheath 72 covering a portion of the upper leg 58 of the bimetallic element. Said resistance wire is adapted to be connected in a circuit whose condition is to control operation of the switch.

As illustrated the resistance is connected in series with an electric power consuming apparatus 74, a switch 76 and a source 78 of electric energy. It will be apparent that in the event of a short circuit or overload in the apparatus 74 an abnormal current will flow through the resistance wire 70. This will raise the temperature of the bimetallic element 56 and warp the same to such an extent that the strip 22 will snap from operated to idle position if operated, or, if idle, said strip cannot be snapped to operated position. A normal current flowing through said resistance will not warp the bimetallic element to the same degree. By way of example, I have shown the contacts 28, 29 of the switch 10 series connected in the solenoid circuit of a relay 80 in such manner that when the strip 22 is in idle position the relay is energized.

In Figs. 3 and 4 I have shown a modified form of switch 10' which is basically similar to the switch 10 but which differs therefrom in the mounting of the bimetallic contractile member,

the manner in which said member is heated and the type of push button stop employed. Said switch includes a snap acting strip 22' identical in all respects to the strip 22. The switch also includes a U-shaped bimetallic element 56' whose return bend is disposed above the cantilever mounted end 20' of the strip 22' and is pivotally held in such position by a shackle bolt 92 mounted on an insulating block 94.

If the controlling condition has not reached a cut-out value, pressing the push button 48' to operating position will depress the strip 22' in the area 27' sufficiently to cause the free end 24' of said strip to spring up, leave the lower contact 29' and engage the upper contact 38'. If subsequently, with the push button in the same position, the bimetallic element 56' is heated to a predetermined temperature, its two free ends will move towards each other enough to permit the area 27' to move up to such an extent as to permit the free end 24' of the strip 22' to snap back to its idle position, illustrated in Fig. 3. A stop 96, carried by the shackle bolt 92, is provided to prevent the push button from moving beyond its operating position. Said stop is positioned to arrest downward movement of the upper leg of the bimetallic element when it reaches a position which will operate the switch 10' if said element is not at cut-out temperature.

By way of example, I have shown the switch 10' arranged to be controlled by the current of a circuit in which its contacts are disposed. One terminal of a source of supply 98 is connected through an electric power consuming apparatus 100 to the contact 38' and the other terminal of said source is connected to a pigtail 102, which is brazed to the upper leg 58' of the bimetallic element. Upon actuation of the switch a circuit is completed through the pigtail 102, bimetallic element 56', snap acting strip 22', contact 38' and power consuming apparatus 100. The current passing through the bimetallic element heats the same and said element is so designed in a manner well known to the art, that when the current passing therethrough attains a certain predetermined value the bimetallic element will warp to the extent necessary to return the snap acting strip 22' to or maintain the same in idle position.

The switch 10'' shown in Fig. 5 is another modified form of my invention. It differs from the switches 10, 10' mainly in that the contractile member, which in switches 10, 10' is attached to neither the actuator nor the snap acting means, is in the switch 10'', permanently secured to the snap acting strip 22'. Said snap acting strip 22'' is identical in all respects to the strip 22. The bimetallic element 56'' is in the shape of a J with the shorter leg 60'' secured by a rivet 104 to the strip 22''. Said rivet extends through the aperture 25''. When the push button 48'' is pressed it will depress the strip 22'' in the area 27'' and will rotate the rivet 104 in a clockwise direction about a horizontal axis. Due to this action the button in its operative position will cause the free end 24'' of the strip 22'' to snap from the contact 29'' to the contact 38''. If, after the push button is moved to operative position, the bimetallic element is heated to a certain temperature it will warp to such extent as to cause the strip 22'' to snap back to the idle position shown in Fig. 5.

In the switch 10'', the means for limiting movement of the actuator comprises a cap 106 secured to the top of the push button 48''. Said cap has a skirt 108 which in idle position of the push button 48'' clears the top of the switch casing 14'' by a distance equal to the movement of the push button from idle to operative position.

I have illustrated the switch 10'' arranged to operate as a double throw switch, the strip 22'' being connected to one side of a source 110 of power supply, the other side of said source being connected in parallel to the solenoids 112, 114 of two relays. One of the solenoids is series-connected to the contact 29'' and the other to the contact 38''. The bimetallic element is heated by a coil of resistance wire 70'' wrapped about a sheath 72'' on the long leg 58'' of the J-shaped element. Said coil is series connected through an electric power consuming apparatus 116 and switch 118 to a source 120 of electric energy. The bimetallic member is so designed that if more than a certain current flows through the apparatus 116 the heat generated in the wire 70'' will distort the J-shaped element to the temperature required to open or prevent closing of the contacts 28'', 38''.

Thus far all of the switches described have been of the snap acting type. In Fig. 6 I have shown my invention applied to a momentary non-snap switch 10'''. Said switch comprises a stationary contact 122 and a movable contact 124, the latter of which is mounted at the end of a flat resilient strip 126 of electrically conductive material such as phosphor bronze. Said strip is permanently secured to a stationary non-conductive post 128 at an end thereof remote from the contact 124. A U-shaped bi-metallic element 568'' has a lower leg 60''' thereof secured by a rivet 130 to the strip 126 adjacent the contact 124. The upper leg 58''' of said element is located beneath the lower end of a push button 48'''. Said push button carries a cap 106''' having a skirt 108''' which, when the button is unoperated, clears the upper wall 14''' of the switch casing. The strip 126 normally maintains the contact 124 spaced from the contact 122 and urges the button 48''' to its raised, idle position. Under normal operating conditions, when the button 48''' is depressed as far as the skirt 108''' will allow it to be, it will cause the two contacts 122, 124 to engage. However, if, with the push button 48''' in operative position, the bimetallic element 56''' is heated above a certain temperature it will warp to such an extent as to raise the contact 124 out of engagement with the contact 122. At such time the push button cannot be further depressed to restore contact because of abutment of the skirt 108''' against the casing wall 14'''.

As illustrated, the bimetallic element is heated by the same current as that which traverses the contacts, a pigtail 102''' being brazed to the upper leg 58''' thereof. Said pigtail is connected to one terminal of a source 132 of electric energy. The other terminal of said source is connected to an electric power consuming apparatus 134 which is series connected to the stationary contact 122'''.

It will be seen that if the switch 10''' is actuated upon depression of the push button 48''' so as to energize the apparatus 134, the occurrence of a short circuit therein will cause a large current to flow through the bimetallic element. Said element is so designed that upon the flow of a short circuiting or overload current therethrough the element will warp to an extent sufficient to break engagement between the contacts 122, 124.

It may be mentioned that in the instances where the bimetallic element is heated by the same current as that which traverses the switch

contacts, any cut-out caused by warpage of said element will not be permanent and under such circumstances the switch will act as a repeating cut-out. That is, the cut-out will occur upon the occurrence of a given condition, but will be maintained only for a short period of time, say thirty seconds, whereupon the switch will reclose. If the improper condition is still present the switch will open again and this action will continue indefinitely unless corrected.

It is desired particularly to point out that, as will now be apparent from the foregoing detailed description of my invention, many of the elements of the switch have multiple functions. Thus, in Fig. 1 the snap acting strip **22** serves (*a*) as a means to mount one of the contacts so that it can move toward and away from the other contact; (*b*) as a biasing means to urge the contacts towards idle position; (*c*) as a snap action means; and (*d*) as part of a means to prevent the actuator from operating the switch if the contractile manner is shortened upon the occurrence of a certain cut-out condition.

It will thus be seen that there is provided a device in which the several objects of this invention are achieved, and which are well adapted to meet the conditions of practical use.

As various possible embodiments might be made of the above invention, and as various changes might be made in the embodiments above set forth, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. An electric momentary switch comprising a stationary contact, an electrically conductive snap strip which, when a certain area thereof is transversely shifted to a sufficient extent, will suddenly change the disposition of a portion of the strip from idle to operated position or vice versa, said strip being constructed and arranged to bias said portion to idle position, a second contact carried by said strip at said portion, said contacts being engaged in one said position of the strip and disengaged in the other said position, an actuator, a U-shaped bimetallic member movable by said actuator and disposed to press against said area when the actuator is moved from idle to operative position, said member having a leg beneath and in contact with the actuator and a leg over and in contact with the said area, said member being so constructed that it will warp to reduce the distance between its two legs upon being heated, the distance between the two legs of said member being so short at a certain temperature that when the actuator is moved to its operating position it cannot push said area through said member far enough to operate said snap strip, the distance between the two legs of said member being great enough if its temperature does not reach said certain value to permit said actuator to push said area through said member far enough to operate said snap strip when said actuator is moved to operating position.

2. An electric momentary switch comprising a stationary contact, an electrically conductive snap strip which, when a certain area thereof is transversely shifted to a sufficient extent, will suddenly change the disposition of a portion of the strip from idle to operated position or vice versa, said strip being constructed and arranged to bias said portion to idle position, a second contact carried by said strip at said portion, said contacts being engaged in one said position of the strip and disengaged in the other said position, an actuator, a bimetallic member movable by said actuator and disposed to press against said area when the actuator is moved from idle to operative position, said member constituting a pair of parallel legs joined by a return bend, one of said legs being beneath and in contact with the actuator and the other of said legs being over and in contact with said area, said member being so constructed that it will warp to reduce the distance between its two legs upon being heated, the distance between the two legs of said member being so short at a certain temperature that when the actuator is moved to its operating position it cannot push said area through said member far enough to operate said snap strip, the distance between the two legs of said member being great enough if its temperature does not reach said certain value to permit said actuator to push said area through said member far enough to operate said snap strip when said actuator is moved to operating position.

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