Sept. 20, 1966 J. R. FRANCY 3,274,355

CAM OPERATED SNAP SWITCH HAVING WIRE CONTACTS

Filed Feb. 8, 1965 5 Sheets-Sheet 1

FIG. 1.

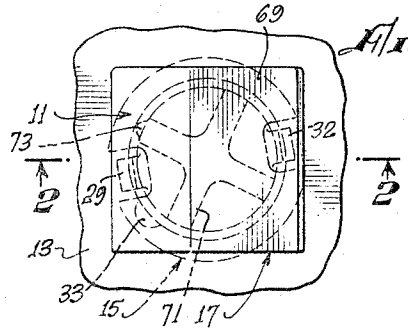


FIG. 2.

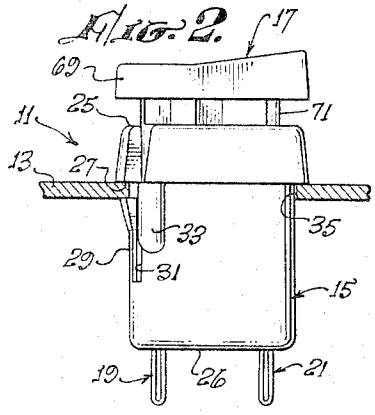


FIG. 3.

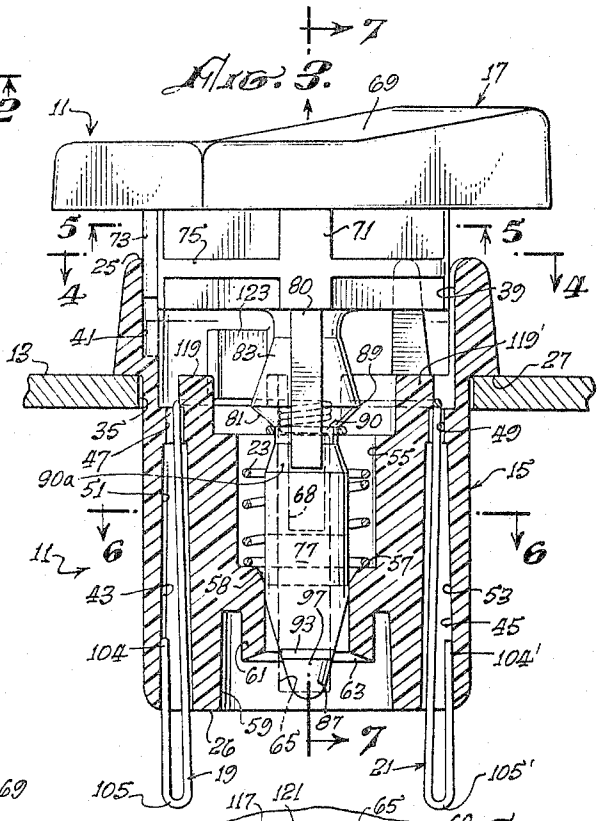


FIG. 5.

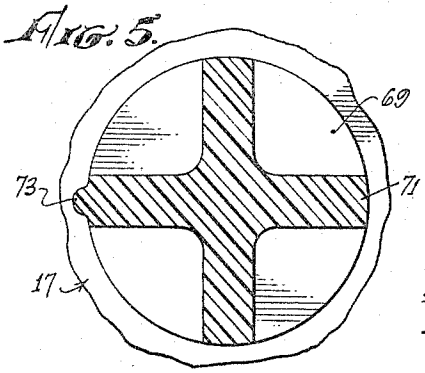


FIG. 4.

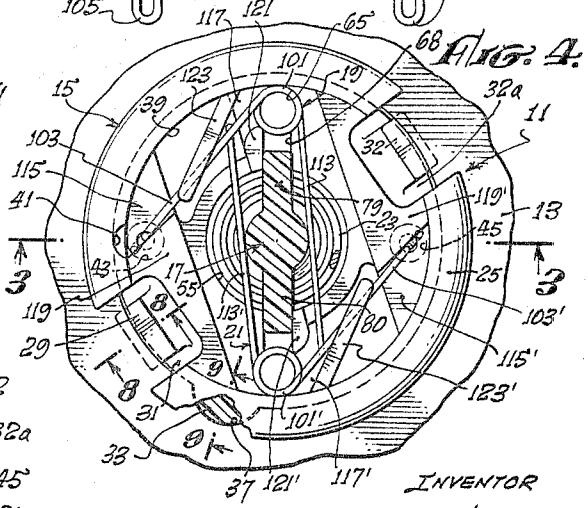
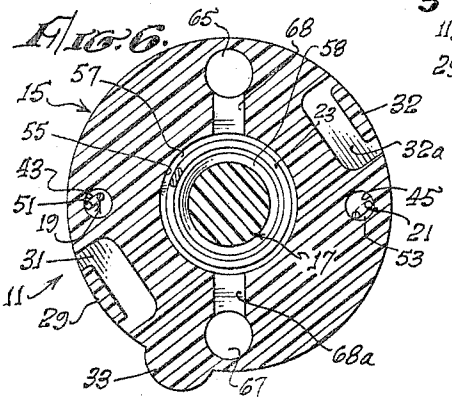


FIG. 6.



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CAM OPERATED SNAP SWITCH HAVING WIRE CONTACTS

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FIG. 11.

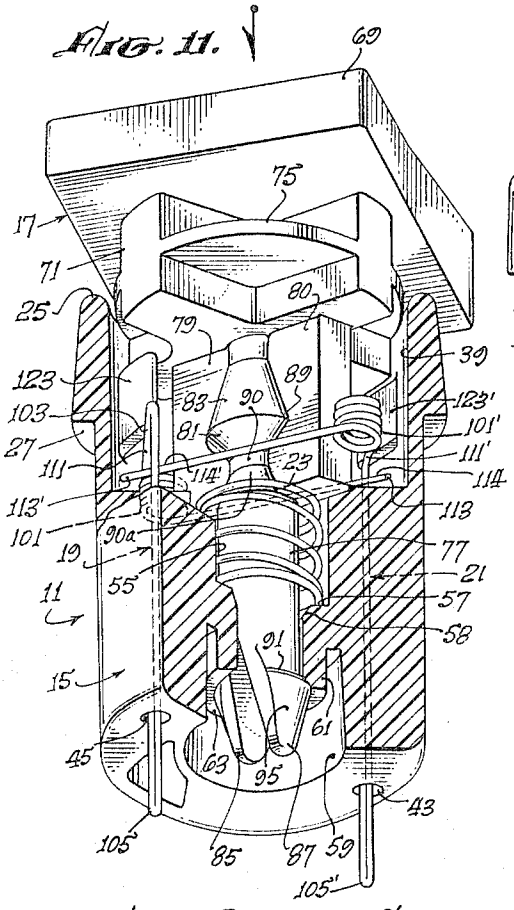


FIG. 7.

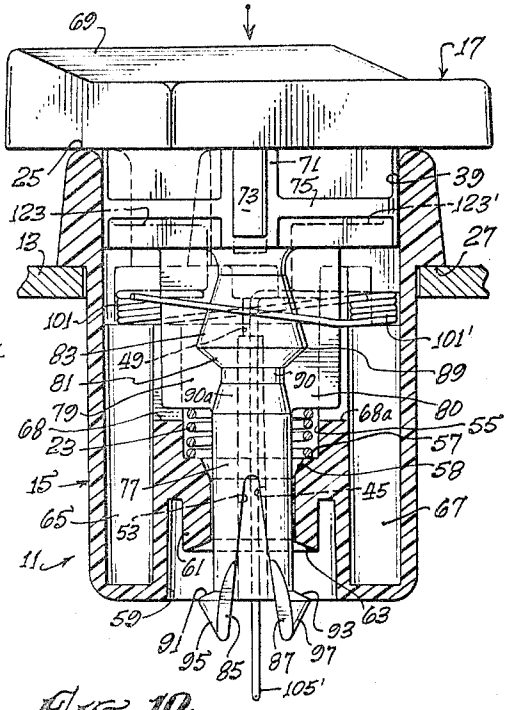


FIG. 8.

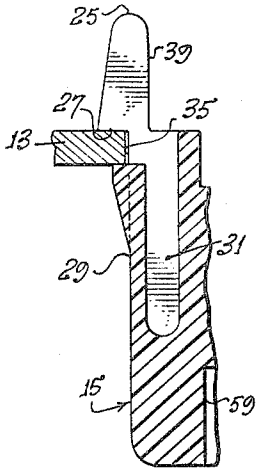


FIG. 9.

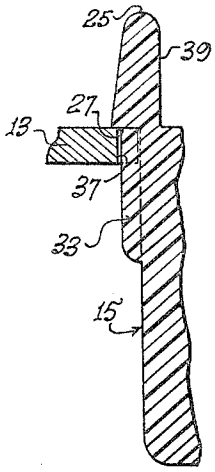
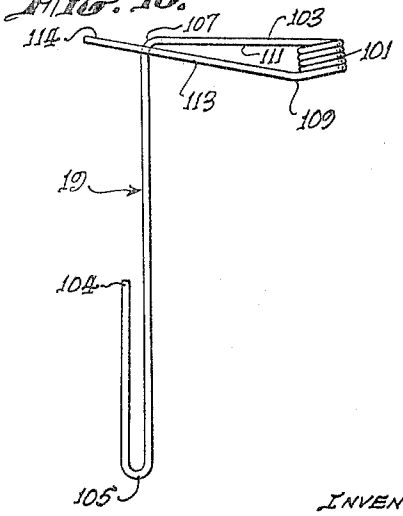


FIG. 10.



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CAM OPERATED SNAP SWITCH HAVING WIRE CONTACTS

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FIG. 13a.

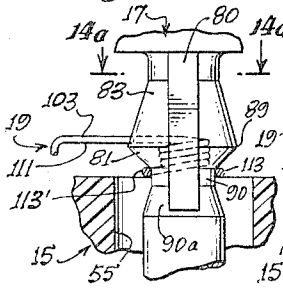


FIG. 13b.

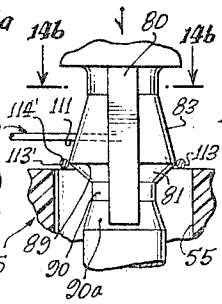


FIG. 13c.

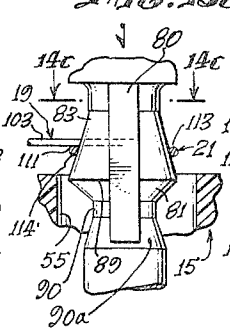


FIG. 13d.

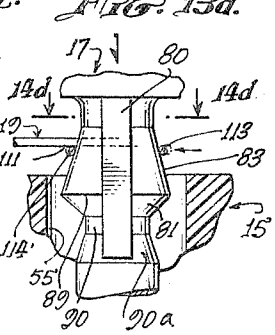


FIG. 14a.

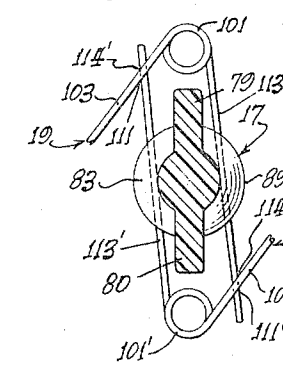


FIG. 14b.

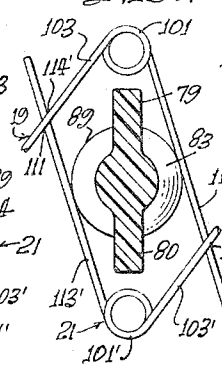


FIG. 14c.

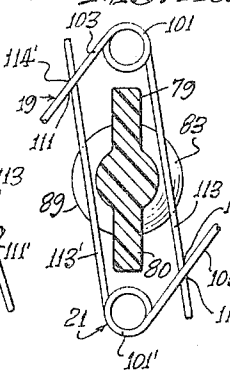


FIG. 14d.

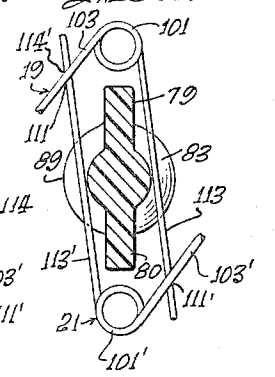
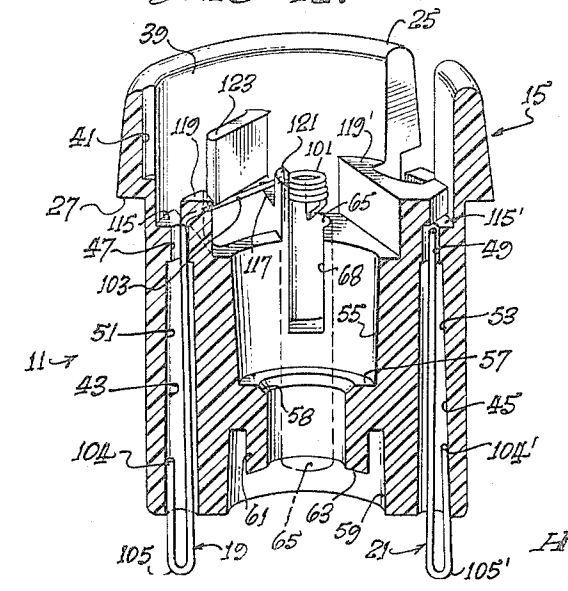


FIG. 12.



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3,274,355

CAM OPERATED SNAP SWITCH HAVING WIRE CONTACTS

James R. Francy, Los Angeles, Calif., assignor to Scantlin Electronics, Inc., Los Angeles, Calif., a corporation of Delaware

Filed Feb. 8, 1965, Ser. No. 430,954
14 Claims. (Cl. 200—77)

This invention relates to an electrical switch and more particularly to an easily constructed snap actuated switch.

The several snap actuated switches of the prior art have been found impractical primarily because of their complexity, unreliability, and relatively high cost. Many of the conventional snap actuated switches employ a large number of conductive and insulating parts which are not necessarily easily formed and are secured together by separate fastening or bonding means thereby increasing complexity and adding to the cost of manufacture. It is also conventional practice to utilize a conductive bridging member which is snapped into and out of engagement with two fixed contacts. As the bridging member must properly engage both fixed contacts, reliability is only approximately 50% of what it would be if engagement with only one fixed contact were necessary.

Accordingly, it is an object of this invention to provide a snap actuated switch which is inexpensive and reliable, and the parts of which are few and easily fabricated. More particularly, it is an object of this invention to provide a snap actuated switch which requires only four basic parts, of which two may be easily injection molded and the other two may be identically formed by shaping two pieces of conductive wire.

Another object of this invention is to provide a snap actuated switch which is quickly and easily assembled. Assembly is facilitated by securing the elements of the switch together with "snap-ins" or snap actuated means thereby obviating the need for the usual separate screws, fasteners, and bonding means.

A further object of this invention is to provide a snap actuated switch in which a wire having a movable contact thereon is acted upon by cam means to snap the movable contact between the open and closed positions.

Another object of this invention is to provide a snap actuated switch having a single, integral wire forming an arm for carrying a movable contact, a coil spring for biasing the arm, and a conductive lead for carrying a terminal.

According to another object of this invention, the reliability of a snap actuated switch is improved by utilizing two separate integral wires to form two independent parallel circuits within the switch.

Another object of this invention is to provide a snap actuated switch in which a first integral wire forms a first movable arm for carrying a first movable contact and a first conductor for carrying a first fixed contact, and a second integral wire forms a second movable arm for carrying a second movable contact and a second conductor for carrying a second fixed contact, the first and second movable contacts being snapped into and out of engagement with the second and first fixed contacts, respectively. More particularly, it is an object to form first and second coil springs intermediate the ends of said first and second wires, respectively, to bias the first and second arms. A particular object of this invention is to provide all contacts as surface portions on the first and second wires.

Still another object of this invention is to provide a snap actuated switch in which a circuit is closed by snapping two wires together and in which a wiping action between such wires is produced to clean the contacts carried thereby.

Another object of this invention is to provide a snap actuated switch in which contact "bounce" and sensitivity to shock and vibration are maintained at a minimum.

Briefly stated, the objects of this invention may be accomplished by providing a switch housing having an actuator shaft mounted for movement therein and snap actuated means for releasably retaining the actuator shaft in the switch housing. A conductive wire is substantially rigidly mounted at one portion of its length within the housing, the wire between the mounted portion and one end thereof defining a movable arm which is engageable with the actuator shaft. A fixed contact is mounted in the housing adjacent the actuator shaft and a movable contact is carried on the movable arm. Cam means are provided on the actuator shaft engageable with the movable arm and responsive to movement of the actuator shaft for snapping the movable contact into and out of engagement with the fixed contact. To bias the moving contact toward the actuator shaft and to facilitate movement of the movable arm, the wire may form at least one coil intermediate its ends. When it is desired to provide two independent parallel circuits within the housing, two identical wires each having a coil intermediate its ends and each also carrying one fixed and one movable contact are provided with the fixed and movable contacts of one wire being engageable with the movable and fixed contacts, respectively, of the other wire.

The invention, both as to its organization and method of operation, together with further objects and advantages thereof may best be understood by reference to the following description taken in connection with the accompanying drawings.

In the drawings:

FIG. 1 is a plan view of a switch constructed in accordance with the teachings of the present invention mounted in a supporting body;

FIG. 2 is an elevational view partially in section taken along line **2—2** in FIG. 1;

FIG. 3 is a partial sectional view taken along line **3—3** in FIG. 4 and showing the components of the switch in the open position;

FIG. 4 is a plan view partially in section taken along line **4—4** in FIG. 3 and shows the positions of the first and second wires;

FIG. 5 is a sectional view of the actuator shaft taken along line **5—5** in FIG. 3;

FIG. 6 is a sectional view taken along line **6—6** in FIG. 3;

FIG. 7 is a view partially in section taken along line **7—7** in FIG. 3 showing the components of the switch in the closed position;

FIG. 8 is a sectional view taken along line **8—8** in FIG. 4 and showing the manner in which the switch is secured to the supporting body;

FIG. 9 is a sectional view taken along line **9—9** in FIG. 4 and showing the positioning tongue of the switch housing;

FIG. 10 is a side elevational view of one of the conductive wires employed in the switch;

FIG. 11 is a perspective view of the switch in the open position with portions of the switch housing broken away;

FIG. 12 is a perspective view partially in section of the switch housing showing how the wires are secured thereto;

FIGS. 13*a*–13*d* are elevational views partially in section showing how the cam means on the actuator shaft moves the movable arm between the open and closed positions; and

FIGS. 14*a*–14*b* are sectional views taken along the lines **14*a*—14*a***, **14*b*—14*b***, **14*c*—14*c***, and **14*d*—14*d*** in FIGS. 13*a*, 13*b*, 13*c* and 13*d*, respectively.

Referring to FIGS. 1 and 2 of the drawings, reference numeral **11** designates a snap actuated switch constructed in accordance with the teachings of this invention and mounted in a supporting body **13**. The snap actuated switch **11** may be constructed from as few as four or five basic parts including a housing **15**, an actuator shaft **17** slidably received with the housing, two integral conductive wires **19** and **21** and, if desired, a return spring **23** (FIG. 3).

The switch housing **15** is integrally formed by injection molding of an insulating material such as a thermoplastic. The switch housing **15** is generally cylindrical, has an annular abutment surface **25** at the upper end thereof, a lower end **26**, and a radially extending annular flange **27** adjacent its upper end. The expressions "upper" and "lower" are used herein only for convenience, it being understood that the switch **11** will function without regard to the orientation of the switch housing **15**. An upwardly extending locking finger **29** (FIGS. 2, 6, and 8) having a longitudinal recess **31** extending radially inwardly therein extends upwardly from adjacent the lower end **26** toward the annular flange **27**. An identical locking finger **32** (FIG. 6) and recess **32***a* are similarly formed on the other side of the switch housing. A longitudinally extending positioning tongue **33** (FIGS. 2, 4, 6 and 9) extends a short distance downwardly from the annular flange **27**.

The switch housing **15** is received by an opening **35** formed in the supporting body **13** and having a vertically extending groove **37** formed in a portion of the periphery of the opening. By aligning the positioning tongue **33** with the peripheral groove **37**, the switch housing **15** may be forced downwardly through the opening **35** in the supporting body **13** thereby camming the resilient locking fingers **29** and **32** inwardly until they snap into a locking position as shown in FIG. 8. By bending the resilient locking fingers **29** and **32** into their respective longitudinal recesses **31** and **32***a*, the snap actuated switch **11** may be withdrawn from the supporting body **13**. Thus, no conventional separate fastening or bonding member is required to secure the snap actuated switch **11** to the supporting body **13**.

The details of construction of the interior of the switch housing **15** may best be understood by reference to FIGS. 3, 4, 7, and 12. A relatively large diameter axial bore **39** having a vertically extending groove **41** is formed at the upper end of the switch housing **15**, the bore **39** communicating with two diametrically opposed wire-receiving passages **43** and **45**. The wire-receiving passages **43** and **45** have small diameter generally cylindrical portions **47** and **49**, respectively, at their upper ends and frusto-conical portions **51** and **53**, respectively, diverging outwardly to a maximum diameter at the lower end of the switch housing **15**. A stepped axial bore **55** of circular cross section having an annular shoulder **57** and a tapered guiding surface **58** connects the large diameter bore **39** with an axial recess **59** formed in the lower end of the housing **15**. An annular boss **61** having a tapered conical end wall **63** extends axially downwardly through a portion of the recess **59**. Two cylindrical diametrically opposed longitudinally extending passageways **65** and **67** spaced approximately 90° from the passages **43** and **45** extend downwardly from the bore **39** (FIGS. 6 and 7) and are placed in communication with the bore **55** by slots **68** and **68***a*, respectively.

The actuator shaft, like the housing **15**, is preferably an integral unit formed by injecting molding of insulating thermoplastic material. The actuator shaft **17** is slidably received by the bore **39** and the stepped bore **55** in the switch housing **15** and has an enlarged end portion or push button **69** exposed at the upper end of the switch housing. Integral with the lower side of the push button **69** is a cross portion **71** (FIGS. 5 and 11) having a longitudinally extending peripheral rib **73** slidably received in the peripheral groove **41**.

Integral with the cross portion **71** is a disc portion **75** which is substantially parallel with the push button **69** and a stem portion **77** extending axially downwardly into the stepped bore **55**. The stem portion **77** includes plates **79** and **80**, a lower conical camming surface **81**, an upper conical camming surface **83**, and downwardly extending spaced resilient tabs **85** and **87** forming a fork (FIG. 11). The camming surfaces **81** and **83** are polished and intersect to form a sharp circular edge **89**. Diametrically opposed elements, i.e., in the geometrical sense, of the upper camming surface **83** will intersect to form a smaller angle than diametrically opposed elements of the lower conical camming surface **81**. In one instance, the former angle was 40° and the latter angle was approximately 100°. The camming surfaces **81** and **83** and the switch housing **15** preferably have a common longitudinal axis. The plates **79** and **80** are diametrically disposed on and cover two longitudinal segments of the camming surfaces **81** and **83**, but leave large areas thereof exposed within the housing. The plates **79** and **80** extend beneath the lower camming surface **81** and over a cylindrical section **90** and conical section **90***a* of the stem portion **77**.

Snap actuated means for releasably retaining the actuator shaft **17** in the switch housing **15** are provided. Such means include the conical end wall **63** and the resilient tabs **85** and **87** (FIG. 7) which have upper conical surfaces **91** and **93**, respectively, and lower conical surfaces **95** and **97**, respectively. To insert the actuator shaft **17**, the resilient tabs **85** and **87** are inserted through the bore **39** until the lower conical surfaces **95** and **97** engage the tapered guiding surface **58**. By applying force to the actuator shaft **17**, the tapered guiding surface **58** cams the resilient tabs **85** and **87** toward each other and allows them to slide through the annular boss **61** to the position shown in FIG. 7 in which downward movement of the switch actuator **17** is limited by the abutment surface **25** on the switch housing, upward movement of the actuator shaft is limited by engagement of the upper conical surfaces **91** and **93** with the tapered conical end wall **63**, and rotation of the actuator shaft relative to the housing **15** is prevented by the meshing of the peripheral rib **73** with the peripheral groove **41** (FIG. 3). Thus, without the use of separate conventional fasteners, the actuator shaft is retained within the switch housing **15** for limited axial reciprocation.

The shape of the wire **19**, which is identical to the wire **21**, is shown in detail in FIG. 10. Corresponding portions of the wire **21** are indicated by corresponding primed reference characters. The wire **19** is integral, resilient, conductive, has a generally circular cross section and forms a coil spring **101** having at least a portion of one but preferably four or five coils intermediate the ends thereof. A generally straight section **103** of the wire lying between the spring **101** and the end of the wire most remote from the spring is adapted to be substantially rigidly mounted in the switch housing **15** by means which are hereinafter described. The wire **19** also includes an end **104**, a reverse bend or terminal **105**, a 90° bend **107**, and a relatively gradual bend **109** adjacent the spring **101**. The lower side of the section **103** defines a fixed contact **111**, and the wire between the spring **101** and the end adjacent the spring **101** defines a movable arm **113**, an upper surface area of which defines a movable contact **114**.

In one instance the wires **19** and **21** were formed from Phosphor bronze spring wire preplated with .000035 inch to .000050 inch hard, mirror-bright, gold electroplating and the spring **101** consisted of four and one-half closely wound right-hand coils without any initial tension. In the unstressed condition shown in FIG. 10, vertical planes containing the section **103** and the portion of the arm **113** between the spring **101** and the wire end adjacent the movable contact **114** are parallel, the last mentioned portion forming an angle of about 10° with the section **103**.

The wires **19** and **21** are received by the wire receiving

passages 43 and 45, respectively, the terminals 105 and 105' extending to the exterior of the switch housing. The springs 101 and 101' are positioned above the longtiudinal pasageways 65 and 67 (FIG. 7), the outer surfaces of the springs bearing against the wall of the bore 39 (FIG. 4). The springs 101 and 101' are diametrically disposed within the switch housing 15 and the plates 79 and 80 lie between the fixed and movable contacts on the wires 19 and 21, respectively (FIG. 4). The movable contacts 114 and 114' lie beneath the fixed contacts 111' and 111, respectively.

Snap actuated means are provided for securing the wires 19 and 21 to the switch housing 15. The wires 19 and 21 are firmly held in the wire-receiving passages 43 and 45, respectively, by the reverse bends or terminals 105 and 105' and the 90° bends 107, and the springs 101 and 101' are restrained against movement radially outwardly by their engagement or near engagement with the wall of the bore 39. The reverse bend 105 urges the end 104 against the frusto-conical portion 51 and the bend 107 against the small diameter cylindrical portion 47.

FIGS. 4 and 12 illustrate the means for releasably connecting the sections 103 and 103' of the wires 19 and 21 to the switch housing 15. The switch housing 15 provides supporting surfaces 115 and 117 adjacent the small diameter portion 47 and the spring 101, respectively, to prevent downward movement of the wire 19. Restraining members 119 and 121 extending upwardly from the supporting surfaces 115 and 117, respectively, prevent the section 103 from moving radially inwardly, the restraining member 119 also covering about one-half of the upper end of the small diameter portion 47. A flexible resilient locking finger 123 is integral with and extends inwardly from the wall of the bore 39 so that it frictionally engages and holds the section 103 firmly against the suporting surfaces 115 and 117. Thus, by flexing the locking finger 123 outwardly, the wire 19 may be positioned as shown in FIG. 12 and releasing the locking finger allows it to snap inwardly to the position shown in the drawings to releasably hold the wire in the switch housing. Identical means retain the section 103' within the switch housing, corresponding elements of which have been designated by corresponding primed reference numerals.

The operation of the device may best be understood by reference to FIGS. 13*a*–13*d* and 14*a*–14*d*. FIGS. 3, 11, 13*a*, and 14*a* show the switch in the off or open position. In such position, the springs 101 and 101' bias the movable arms 113 and 113', respectively, against the actuator shaft 17 and the lower portion of the lower camming surface 81, and the movable arms 113 and 113' are spaced downwardly from the sections 103' and 103, respectively, which provide the two fixed contacts 111' and 111.

When it is desired to close the switch, the actuator shaft 17 is urged downwardly, thereby causing the lower camming surface 81 to cam the movable arms 113 and 113' outwardly to the position shown in FIGS. 13*b* and 14*b* in which the movable arms engage the sharp circular line 89. In this position, the movable arms 113 and 113' are unstable and when the actuator shaft 17 is moved slightly downwardly from this position, the resilient biasing force of the springs 101 and 101' causes the movable arms to quickly snap upwardly along the camming surface 83 to the position shown in FIGS. 13*c* and 14*c* in which the movable contact arms 113 and 113' firmly engage the lower surfaces of the sections 103' and 103, respectively, to close the switch, the surfaces of the wires beneath the sections 103 and 103' providing the fixed contacts 111 and 111' and the surfaces of the movable arms 113 and 113' which engage such fixed contacts defining the movable contacts 114 and 114', respectively.

The circuit between the terminals 105 and 105' may be completed through either or both of the movable arms 113 and 113' thereby substantially increasing reliability of the snap actuated switch. Of course, by moving the actuator shaft 17 upwardly the snap action described above will reverse and the elements will return to the position shown in FIGS. 13*a* and 14*a*.

If it is desired to have the switch return automatically from the closed to the opened position, the return spring 23 may be employed. As shown in FIGS. 3, 7, and 11, the return spring 23 engages the annular shoulder 57 at one end and the undersides of the plates 79 and 80 at the other to urge the actuator shaft upwardly to the opened position. Thus, when the return spring 23 is employed, the switch will automatically return to the opened position.

An important feature of this invention is the wiping or rubbing action between the areas of the wires 19 and 21 which define the fixed and movable contacts. This wiping action occurs every time the switch is moved from the closed to the opened position. Thus, by moving the actuator shaft 17 upwardly from the position shown in FIGS. 13*c* and 14*c*, the movable arms 113 and 113' are cammed outwardly by the upper cam surface 83 while the engagement between the movable arms 113 and 113' and the sections 103' and 103, respectively, is maintained thereby providing a wiping action on the surface areas of the wires which define the fixed and movable contacts. Additional wiping action may be obtained by reciprocating the actuator shaft 17 so that the movable contacts 113 and 113' are caused to slide back and forth along the camming surface 83 (FIGS. 13*d* and 14*d*) and, hence, also along the underside of the sections 103' and 103, respectively.

Another very important feature of this invention is the integral resilient wires 19 and 21. Each of the wires provides a terminal, a coil spring, a fixed contact, a movable contact, a conductive path electrically connecting these items, and sufficient resilience to allow snap action. The springs 101 and 101' bias the moving contact arms 113 and 113', respectively, into engagement with the actuator shaft 17 and facilitate movement of the movable arms longitudinally of the actuator shaft, i.e., along the camming surfaces 81 and 83. In order that the springs 101 and 101' may perform this latter function, it is preferred that they not be rigidly confined within the switch housing 15. Although for simplicity, it is preferred to use surface areas of the wires 19 and 21 for the contacts, it is within the scope of this invention to utilize separate elements such as special deposits of conductor along the wires to form the contacts. Because the wires are of low mass and specially designed, contact bounce is minimized.

It is within the scope of this invention to provide additional separate fixed contacts for engagement by each of the movable contacts in the position shown in FIGS. 13*a* and 14*a* and described hereinabove as the "open position." These fixed contacts are in addition to the fixed contacts 111 and 111' and hence, when these additional contacts are used, a double throw switch results. Other configurations providing multiple fixed contacts arranged radially about the camming surfaces 81 and 83 may be also provided. Other camming surfaces may be employed on the actuator shaft 17 in axial spaced relation with additional movable and fixed contacts to provide a plurality of switches actuable sequentially or simultaneously.

Thus, the snap actuated switch 11 of the present invention requires only four parts, i.e., the integral molded housing 15, the integral molded actuator shaft 17, and the two wires 19 and 21, the return spring 23 being optional. These parts may be quickly and easily assembled by snap-in devices which obviate the need for the usual screws or other separate fastening elements. The resulting switch provides two parallel paths for current flow therethrough thereby substantially improving reliability.

Many changes, modifications, and substitutions may be made by those having ordinary skill in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. A switch comprising:
a switch housing;
an actuator shaft mounted for movement in said housing;
a fixed contact mounted in said housing adjacent said actuator shaft, said fixed contact being free of physical integration with said actuator shaft;
a conductive wire in said housing substantially rigidly mounted at one section of its length, at least a portion of said wire between said section and one end thereof defining a movable arm which extends generally transversely of said actuator shaft, said arm being engageable with said actuator shaft and carrying a movable contact, said fixed contact being mounted in the path of movement of said movable contact, said movable contact being engageable with said fixed contact;
means for biasing said arm toward said actuator shaft; and
cam means on said actuator shaft engageable with said arm and responsive to said movement of said actuator shaft for snapping said movable contact into and out of engagement with said fixed contact.

2. A switch as defined in claim 1 wherein said cam means includes a first cam surface diverging outwardly along said actuator shaft in one direction and a second cam surface diverging outwardly along said actuator shaft in the opposite direction, said first and second cam surfaces intersecting to form a line.

3. A switch comprising:
a switch housing;
an actuator shaft mounted for movement in said housing;
a fixed contact mounted in said housing adjacent said actuator shaft, said fixed contact being free of physical integration with said actuator shaft;
an elongated integral conductive wire within said housing having a substantially rigidly mounted section intermediate the ends thereof, at least a portion of said wire between said substantially rigidly mounted section and one end thereof defining a movable arm which extends generally transversely of said actuator shaft, said arm being engageable with said actuator shaft and carrying a movable contact, said fixed contact being mounted in the path of movement of said movable contact and being engageable therewith, and said wire between said rigidly mounted section and the other end thereof defining a conductive lead;
means for biasing said arm toward said actuator shaft; and
cam means on said actuator shaft engageable with said arm and responsive to the movement of said actuator shaft for snapping said movable contact into and out of engagement with said fixed contact.

4. A switch comprising:
a switch housing;
an actuator shaft mounted for movement in said housing;
a fixed contact mounted in said housing adjacent said actuator shaft, said fixed contact being free of physical integration with said actuator shaft;
an elongated integral conductive wire forming at least a portion of one coil, said wire having a substantially rigidly mounted section in said housing adjacent said coil, said wire between said coil and one end of said wire defining an arm which extends generally transversely of said actuator shaft and is engageable with said actuator shaft, said coil resiliently biasing said arm toward said actuator shaft, and said arm carrying a movable contact, said fixed contact being mounted in the path of movement of said movable contact and being engageable therewith; and
cam means on said actuator shaft engageable with said arm and responsive to the movement of said actuator shaft for snapping said movable contact into and out of engagement with said fixed contact.

5. A switch comprising:
a switch housing;
an actuator shaft mounted for generally linear movement in said housing;
a fixed contact mounted in said housing adjacent said actuator shaft, said fixed contact being free of physical integration with said actuator shaft;
an elongated integral conductive wire forming at least one coil intermediate the ends thereof, a section of said wire between said coil and one of said ends being substantially rigidly mounted in said housing, said wire between said coil and the other end thereof defining an arm which extends generally transversely of and is engageable with said actuator shaft, said coil resiliently biasing said arm toward said actuator shaft, a surface portion of said arm defining a movable contact, said fixed contact being mounted in the path of movement of said movable contact and being engageable therewith, and the length of wire between said section and said one end defining a conductive lead; and
cam means on said actuator shaft engageable with said arm and responsive to the movement of said actuator shaft for snapping said movable contact into and out of engagement with said fixed contact.

6. A switch comprising:
a switch housing;
an actuator shaft mounted for movement in said housing;
first and second fixed contacts mounted in said housing adjacent said actuator shaft;
a first conductive wire in said housing having a substantially rigidly mounted section in said housing, at least a portion of said first wire between said section thereof and one end thereof defining a first arm which extends generally transversely of and is engageable with said actuator shaft, said first arm carrying a first movable contact engageable with said first fixed contact;
a second conductive wire in said housing having a substantially rigidly mounted section, at least a portion of said second conductive wire between said section thereof and one end thereof defining a second arm which extends generally transversely of and is engageable with said actuator shaft, said second arm carrying a second movable contact engageable with said second fixed contact;
means for biasing said first and second arms toward said actuator shaft; and
cam means on said actuator shaft engageable with said first and second arms for snapping said first and second movable contacts into and out of engagement with said first and second fixed contacts, respectively.

7. A switch as defined in claim 6 wherein said sections of said first and second conductive wires are intermediate the ends of said first and second conductive wires respectively, said first conductive wire carrying said second fixed contact, and said second conductive wire carrying said first fixed contact.

8. A switch as defined in claim 6 wherein said cam means simultaneously snaps said first and second movable contacts into engagement with said first and second fixed contacts respectively.

9. A switch comprising:
a switch housing;
an actuator shaft mounted for reciprocation in said housing;
a first elongated integral conductive wire forming substantially at least one first wire coil intermediate the ends thereof, a section of said first wire between one of said ends and said first wire coil being substantially rigidly mounted in said housing, said first wire between said first wire coil and the other of said ends

of said first wire defining a first arm which extends generally transversely of and is engageable with said actuator shaft, said first wire coil resiliently biasing said first arm toward said actuator shaft, said first arm carrying a first movable contact, and a portion of said first wire between said first wire coil and said one end of said first wire defining a first fixed contact;

a second elongated integral conductive wire forming substantially at least one second wire coil intermediate the ends thereof, a section of said second wire between one of said ends and said second wire coil being substantially rigidly mounted in said housing, said second wire between said second wire coil and the other of said ends of said second wire defining a second arm which extends generally transversely of and is engageable with said actuator shaft, said second wire coil resiliently biasing said second arm toward said actuator shaft, said second arm carrying a second movable contact, and a portion of said second wire between said second wire coil and said one end of said second wire defining a second fixed contact; and

cam means on said actuator shaft engageable with said first and second arms for snapping said first and second movable contacts into and out of engagement with said second and first fixed contacts, respectively.

10. A switch comprising:

a switch housing;

an actuator shaft mounted for movement in said housing;

a fixed contact mounted in said housing adjacent said actuator shaft;

an elongated integral conductor forming at least a portion of one resilient coil intermediate its ends, a section of said conductor between one of said ends and said coil being substantially rigidly mounted in said housing, said conductor between the other of said ends and said coil defining an arm which extends generally transversely of and is engageable with said actuator shaft, said coil resiliently biasing said arm toward said actuator shaft, said arm carrying a movable contact, and said conductor between said section and said one end defining a conductive lead; and

cam means on said actuator shaft engageable with said arm and responsive to the movement of said actuator shaft for snapping said movable contact into and out of engagement with said fixed contact.

11. A switch comprising:

a hollow switch housing of insulating material;

an actuating shaft of insulating material mounted for reciprocation in said housing, one end of said actuating shaft being exposed at the exterior of said switch housing to define a push-button;

snap actuated means for releasably retaining said actuating shaft in said switch housing, said snap actuated means including a resilient fork on said actuating shaft;

a first conductive wire having a section intermediate the ends thereof fixed to said switch housing, a length of said first wire adjacent one of said ends carrying

a terminal communicable with the exterior of said switch housing, a portion of said first wire adjacent the other of said ends engaging said actuating shaft and carrying a movable contact;

a second conductive wire within said housing and having a fixed portion defining a fixed contact engageable with said movable contact, a portion of said second wire adjacent one end thereof carrying a terminal communicable with the exterior of said switch housing; and

means responsive to movement of said actuating shaft for moving said movable contact into engagement with said fixed contact.

12. A switch comprising:

a hollow switch housing of insulating material;

an actuating shaft of insulating material mounted for reciprocation in said housing, one end of said actuating shaft being exposed at the exterior of said switch housing to define a push-button;

first snap actuated means for releasably retaining said actuating shaft in said switch housing;

a first conductive wire having a section intermediate the ends thereof fixed to said switch housing, a length of said first wire adjacent one of said ends carrying a terminal communicable with the exterior of said switch housing, a portion of said first wire adjacent the other of said ends engaging said actuating shaft and carrying a movable contact;

a second conductive wire within said housing and having a fixed portion defining a fixed contact engageable with said movable contact, a portion of said second wire adjacent one end thereof carrying a terminal communicable with the exterior of said switch housing;

means responsive to movement of said actuating shaft for moving said movable contact into engagement with said fixed contact; and

second snap actuated means for securing said first and second wires to said switch housing.

13. A switch as defined in claim **1** wherein an elongated conductor is provided within said housing for carrying said fixed contact, a portion of said elongated conductor carrying a terminal communicable with the exterior of said switch housing; and

snap actuated means are provided for releasably retaining said actuator shaft in said switch housing.

14. A switch as defined in claim **1** wherein said actuator shaft is mounted for movement in both directions along a predetermined path and a return spring is provided for biasing said actuator shaft in one of said directions along said path.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,274,355 September 20, 1966

James R. Francy

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 70, for "14a-14b" read -- 14a-14d --;
column 3, line 67, for "injecting" read -- injection --;
column 6, line 23, for "providing" read -- producing --.

Signed and sealed this 22nd day of August 1967.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents