Aug. 13, 1940. N. C. SCHELLENGER 2,211,706

SWITCH CONSTRUCTION

Filed May 2, 1938 3 Sheets-Sheet 1

Fig. 1.

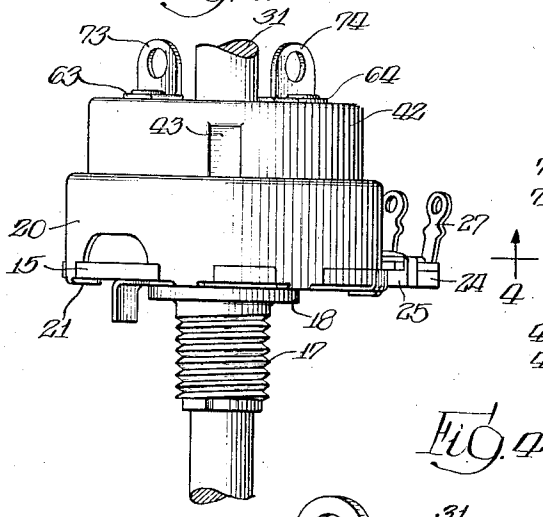


Fig. 2.

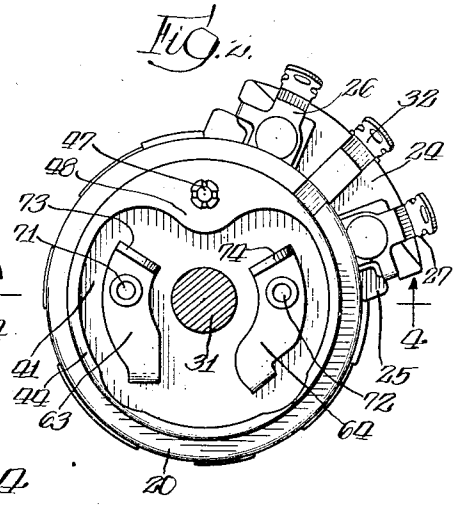


Fig. 4

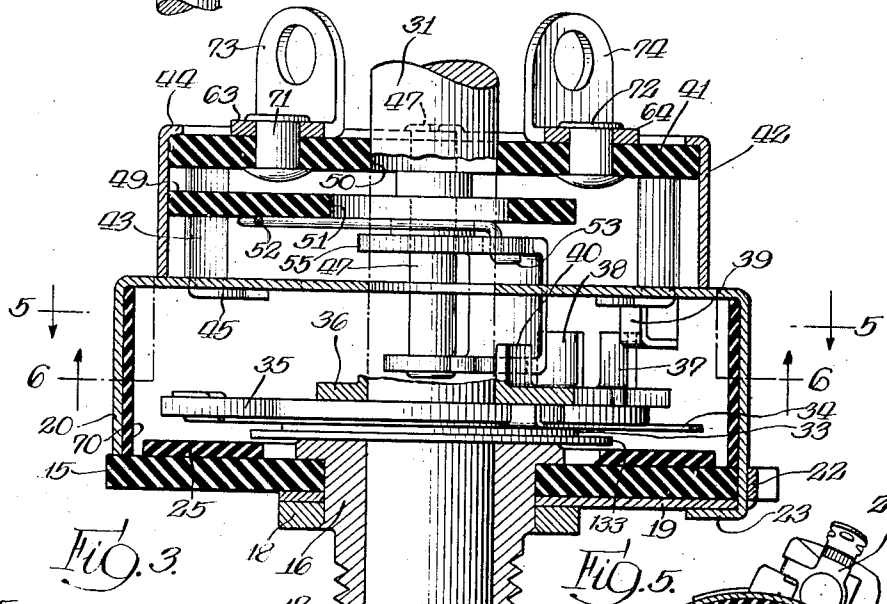


Fig. 3.

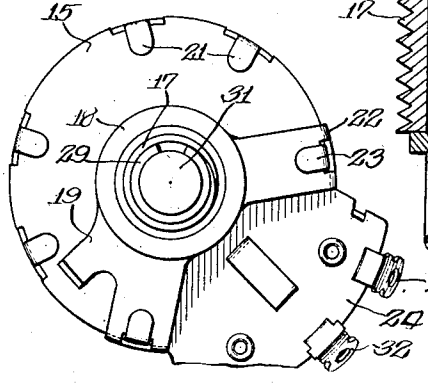
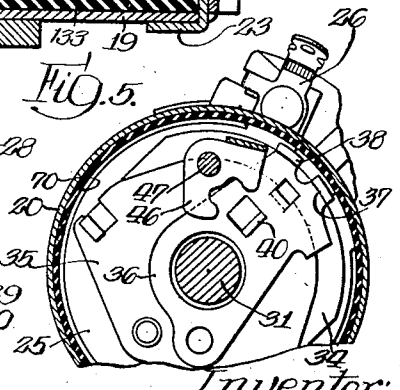


Fig. 5.



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SWITCH CONSTRUCTION

Filed May 2, 1938 3 Sheets-Sheet 2

Fig. 6.

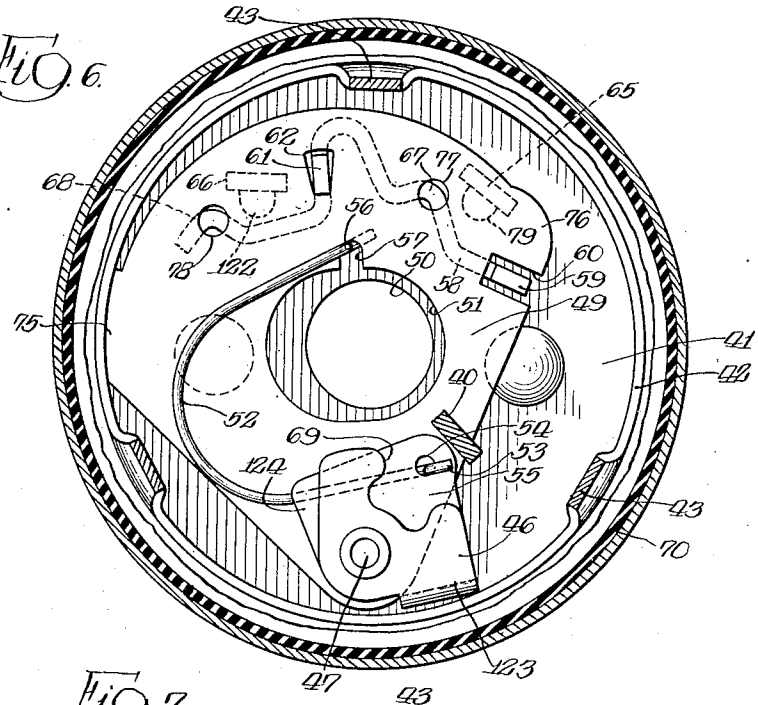
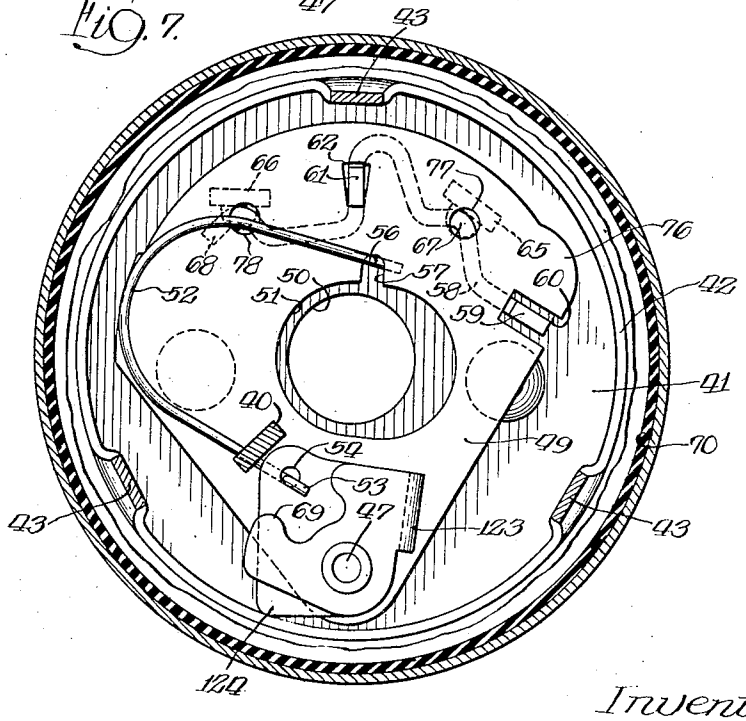


Fig. 7.



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SWITCH CONSTRUCTION

Filed May 2, 1938 3 Sheets-Sheet 3

Fig. 8.

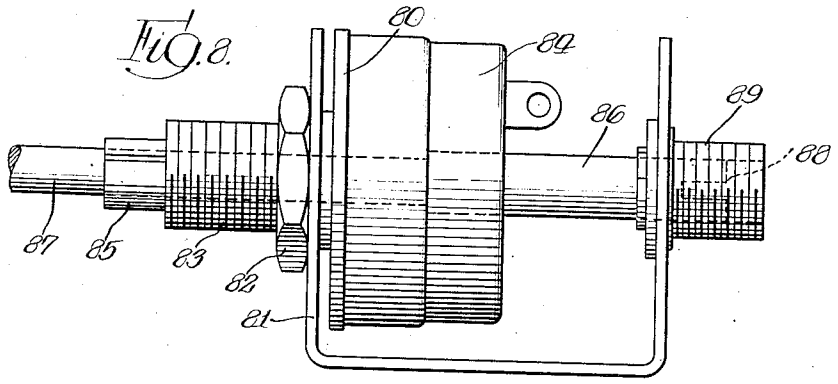


Fig. 9.

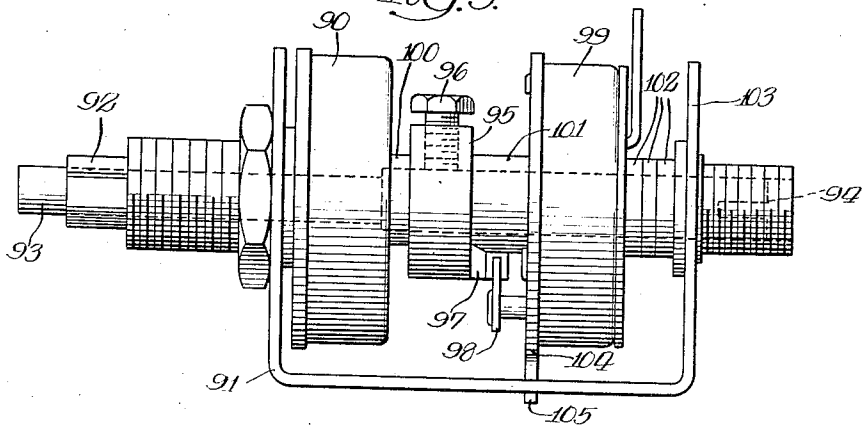
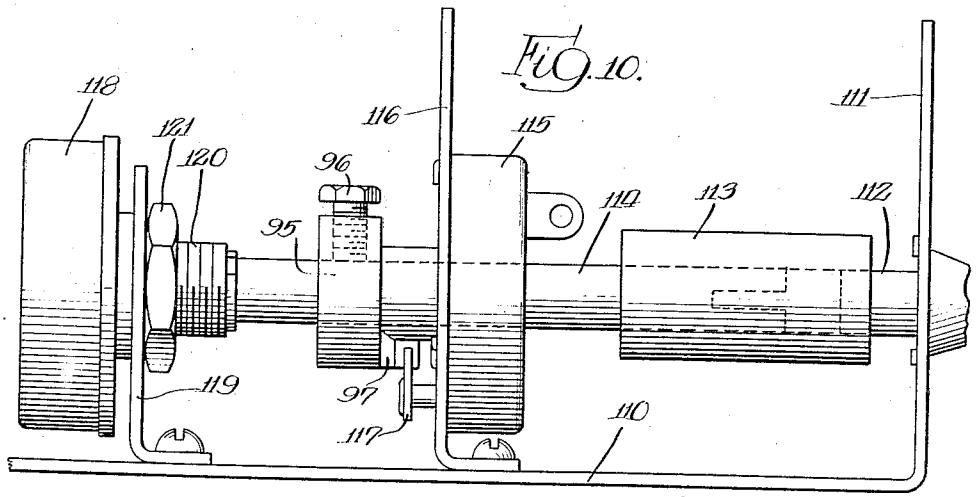


Fig. 10.



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Patented Aug. 13, 1940 2,211,706

UNITED STATES PATENT OFFICE

2,211,706

SWITCH CONSTRUCTION

Newton C. Schellenger, Elkhart, Ind., assignor to Chicago Telephone Supply Company, Elkhart, Ind., a corporation of Indiana

Application May 2, 1938, Serial No. 205,399

11 Claims. (Cl. 200—67)

This invention relates to a new and improved switch construction and more particularly to a switch adapted to be associated with other control units and to be actuated by a shaft extending through the structure of the switch.

In present day radio sets and test instruments it is a common practice to connect two or more controls, as for example, switches and variable high resistances, to a common shaft for joint or successive operation by a single knob. It is also a practice to use a hollow shaft for similar purposes and to have a second shaft pass through the first shaft for operation of one or more additional control devices. These methods of control operation are used in small house sets and also have particular application to automobile radio sets. In such sets it is desirable to have a compact control head with but few and closely associated knobs or dials for manual actuation. Also in cases where the control units are located on the chassis, it is desirable to minimize the number of flexible shafts running from the control head to the chassis.

It is an object of the present invention to provide a new and improved switch construction.

It is a further object to provide a switch adapted to be actuated from a shaft extending through the switch structure.

It is also an object to provide a snap switch with a perforated switch arm and with contacts and actuating mechanism located out of alignment with the perforation.

It is an additional object to provide a switch of this character which is compact and efficent.

It is another object to provide a switch composed of but few parts and adapted for commercial production and use.

Other and further objects will appear as the description proceeds.

I have shown certain preferred embodiments of my invention in the accompanying drawings in which—

Figure 1 is an elevation of the switch assembled with a variable high resistance;

Figure 2 is a plan view of the device shown in Figure 1;

Figure 3 is a view, partly broken away, of the device of Figure 1 as seen from below;

Figure 4 is a vertical section taken on line 4—4 of Figure 2, and shown on an enlarged scale;

Figure 5 is a section taken on line 5—5 of Figure 4, but shown on the scale of Figures 1 to 3;

Figure 6 is a section taken on line 6—6 of Figure 4 and showing the switch in open position;

Figure 7 is a view similar to Figure 6 but showing the switch in closed circuit position;

Figure 8 is an elevation showing one method of mounting the switch and combined variable resistance unit;

Figure 9 is a view similar to Figure 8, but showing a modified form of mounting; and

Figure 10 is a view showing a further modified form of mounting.

In the drawings, the variable resistance device comprises a base 15 to which is secured a metal thimble 16 having a threaded portion 17 for use in securing the device in place upon any supporting structure. A washer 18 and a shield plate 19 are secured in place on the outer face of the base by the thimble 16. The metal cover 20 is secured upon the base 15 by means of a plurality of ears 21 which fit in notches on the periphery of the base and have their lower ends bent over against the under face of the base. The metal shield plate 19 has portions bent up as shown at 22 and provided with openings to receive the ears 23 which are similar to the ears 21 but are located upon each side of the extended portion 24 of the base, as shown in Figures 1 and 2.

The resistance strip 25 is secured upon the base 15 by means of end terminals 26 and 27 which are riveted to the extended portion 24 of the base 15. It will be understood that the strip 25 may consist of any insulating material, such as fibre or Bakelite, with a resistance film located upon its upper face. The shaft 28 passes through the thimble or bushing 16 and its inner movement is limited by split washer 29 fitting in groove 30 in the shaft and engaging the outer end of the thimble 16. As shown in Figure 4, this shaft extends all the way through the variable resistance device and the switch. The upper end 31 which is shown as broken away, may be connected to any additional device which it is desired to operate by rotation of the shaft.

The center terminal 32 shown in Figure 2 is connected to a slip ring 33 shown in Figure 4, and this ring is engaged by a rotatable metal contact member 34 which is driven by means of the insulating drive member 35. The insulating washer 133 prevents contact between the ring 33 and the thimble 16. The metal stop member 36 is secured to the shaft 28 above the member 35 and is provided with a downturned lug engaging in a notch in the member 35 to cause that member to rotate with the shaft. The member 36 also carries the upturned lugs 37 and 38 which are adapted to alternately engage the opposite sides of the stop projection 39 which is struck-in

from the upper corner of the housing 20. The metal member 36 is also provided with the struck-up lug 40 which serves to actuate the switch.

The switch mechanism is mounted on a base 41 which is secured to the top of the variable resistance housing 20 by means of the metal switch housing 42. This housing 42 is provided with spaced portions 43 which are pressed inwardly, their upper ends engaging the under face of the base 41 to maintain it against the inturned edge 44 of the housing 42. At the lower ends of the inwardly formed portions 43 are located the ears 45 which pass through slots in the top of the housing 20 and are bent over to secure the switch in place.

The switch, as best shown in Figures 6 and 7, comprises an operating cam 46 mounted on pivot 47. As shown in Figure 2, this pivot 47 also assists in securing the switch base 41 in place in the housing 42 as it passes through both the base 41 and an inwardly extending portion 48 of the inturned edge 44 of the housing 42. The switch arm 49 is formed of sheet insulating material, such as Bakelite, and is mounted on the pivot 47 between the operating cam 46 and the base 41. The base 41 is provided with a central opening 50 to permit passage of the shaft 31. The switch arm 49 is provided with an elongated opening 51 of such a size as to register with and clear the base opening 50 throughout the range of movement of the arm 49.

The switch operating spring 52 is formed of a single U-shaped piece with one end 53 offset to engage in an opening 54 in the lower arm 55 of the cam 46. The other end 56 of the spring 52 is offset in the opposite direction to fit in a notch 57 formed in the side of the opening 51. The serpentine movable contact member 58 is formed of a flat strip of metal and is carried on edge between the switch arm 49 and the base 41. This member 58 has an upwardly extending lug 59 at one end fitting in a notch 60 in the edge of the switch arm 49. It has an intermediate upwardly extending portion 61 fitting through an opening 62 formed in the switch arm 49. It will be noted that the opening 62 is so formed as to permit a limited swinging movement of the contact 58 about the upturned portion 61 as a pivot. The notch 60 is also large enough to permit this limited play.

The fixed contacts 63 and 64 have portions 65 and 66 extending through the base 41 to serve as contacts for engagement by the rounded portions 67 and 68, respectively, of the member 58. The upper arm of the cam 46 is provided with the rounded portions 69 and 70 adapted to be engaged by the switch operating lug 40, which has been indicated in cross-section on Figures 6 and 7. The fixed contacts 63 and 64 are secured to the switch base 41 by means of rivets 71 and 72 which are located closely adjacent the upturned solder lug ends 73 and 74 of the fixed contact members. This location of the rivets relative to the solder lugs affords a minimum leverage for a pull on the lugs against the rivets when wires are connected to the solder lug portions. The length of the contact members assures that no solder or flux from the soldering operation will run down on the contact portions. The fact that the solder lugs are integrally formed on the fixed contacts themselves insures that there is no resistance introduced into the circuit by high contact resistance between rivets, solder lugs and contacts as may occur in a multiple unit construction.

The switch arm 49, as best shown in Figure 6, is provided with an extended portion 75 which serves to engage the housing 42 to limit switch movement in the off direction. Similarly the rounded stop portion 76 is provided on the opposite side of the switch arm 49 to prevent the arm from moving so far in the clockwise or switch closing direction that the rounded portions 67 and 68 of the movable contact member 58 slip off the fixed contacts 65 and 66. As shown in Figure 7, this stop portion 76 does not normally engage the housing 42 when the switch is new. The stop is then made by the resilience of the movable contact member 58. The stop 76 is provided as a safety factor to prevent over-run of the movable contact when the contacts have become worn with use.

The perforations 77 and 78 are provided in the arm 49, these perforations opening adjacent the contact portions 67 and 68 of the movable contact 58. These perforations may be filled with a lubricant, such as vaseline, before assembly of the parts and this lubricant will work down over the contacts as the lubricant thereon is burned off in operation of the switch. Openings 79 and 122 are provided in the switch base 41 adjacent the contact portions 65 and 66 of the fixed contacts 63 and 64 and these may also be filled with lubricant in the same manner and for the same purpose. These openings 79 and 122 are covered by the portions of the fixed contacts 63 and 64 which are located against the outer face of the switch base 41.

Several ways in which the switch can be installed have been shown in Figures 8, 9 and 10. In Figure 8 the variable resistance 80 is mounted on the U-shaped support 81 by the nut 82 threaded on the thimble 83. The switch 84 is secured upon the variable resistance 80 in the manner shown in the other drawings already described. The hollow sleeve 85 extending through the variable resistance 80 may serve to operate that resistance and also the switch 84. The shaft 86 may extend through the two units and have an outer end 87 to which may be secured an operating knob to rotate the shaft independently of the sleeve 85. This shaft 86 is shown as having the notch 88 inside of thimble 89 to which may be connected a flexible shaft construction to operate any other desired control unit.

The form of construction shown in Figure 9 is generally similar to that shown in Figure 8, with the exception of the method of mounting and operating the switch. The variable resistance 90 is secured to the U-shaped support 91 and may be operated by the sleeve 92. The shaft 93 extends through sleeve 92 and is operable independently of the sleeve. The opposite end is provided with a notch 94 for connection to other control devices. The collar 95 is secured to the shaft 93 by means of set screw 96. This collar has a lug 97 adapted to engage the switch operating cam 98 extending from the face of the switch 99. Spacers 100 and 101 are provided to keep the parts in proper location and similar spacers and washers 102 are shown between the switch 99 and the second leg 103 of the support 91. It will be noted that the switch 99 has its face closed by a plate 104 which has a lug 105 extending down into the support 91 to prevent the switch itself from rotating.

It will be apparent that while in the construction shown in Figure 8 the switch and variable resistance device are jointly operated by the

sleeve, in the form of construction shown in Figure 9 the variable resistance device is operated by the sleeve while the switch and such other mechanism as may be connected to the shaft are operated by the shaft.

In the form of construction shown in Figure 10, the base 110 has an upturned portion 111 forming a support for the shaft 112. The shaft 112 is coupled by means of members 113 to the variable resistance shaft 114. This shaft passes through the switch mechanism 115 which is secured to the mounting bracket 116. This bracket 116 is secured to the supporting base 110. The shaft 114 carries the collar 95 secured by set screw 96 to the shaft. This has a lug 97 adapted to engage the switch operating cam 117. The variable resistance device 118 is secured to the second supporting bracket 119 by its thimble 120 and nut 121.

The forms of assembly shown in Figures 8, 9 and 10 are to be understood to be illustrative only. It will be obvious that the switch with the opening permitting a shaft to pass therethrough, may be used in a variety of other applications to meet different conditions and requirements.

The inwardly formed portions 43 of the switch housing have an important function in retaining the switch base 41 against the inturned edge 44 of the housing. These portions also have an important function in carrying the ears 45 which are thus located within the circumference of the housing. Because of this location it is possible to assemble the switch upon a variable resistance housing of approximately the same diameter as the switch housing.

The operation of the switch will be apparent from a consideration of the drawing and description. With the parts in the position shown in Figure 6, the portion 123 of the switch operating cam 46 engages the inner face of the switch housing 42. The stop extension 75 on the switch arm 49 also engages the inner face of the housing 42. The cam and the switch arm are held in engagement due to the resilience of the spring 52. When the switch operating lug 40 engages the rounded portion 69 of the cam 46 it moves the cam in the counterclockwise direction about the pivot 47. As soon as the end 53 of the spring 52 passes the dead center position, the spring snaps the switch arm 49 to the right to the position shown in Figure 7. At the same time the force of the spring continues the counterclockwise movement of the cam 46 to bring the portion 124 of the cam 46 against the inner face of the switch housing. The clockwise movement of the switch arm 49 is normally stopped by engagement of the rounded portions 67 and 68 with the fixed contacts 65 and 66. It will be noted that the arc of movement of the rounded portions of the movable contact 58 makes only a slight angle with the engaging faces of the fixed contacts so that it affords a wiping engagement between the contacts. As has been explained above, the stop portion 76 of the switch arm 49 does not normally engage the wall 42 of the switch housing until the switch has become worn in use. When the operating lug 40 engages the rounded portion 70 of the switch cam 46 when moving in the opposite direction, the parts are again snapped to the off position.

The U-shaped spring 52 is efficient in operation and clears the central openings in the switch arm and switch base. This formation of the spring avoids breakage troubles which occur in conventional multi-coil torsion springs unless special means are used to prevent the coils from shifting and twisting the end sections of the spring. With the large loop of the present spring the likelihood of breakage is greatly reduced as the strain on the spring is distributed throughout a substantial portion of the spring.

While I have shown certain preferred embodiments of my invention, it is to be understood that it may be modified and changed to meet differing conditions and requirements and I contemplate such variations as come within the spirit and scope of the appended claims.

I claim:

1. In a switch adapted to have an operating shaft pass completely therethrough so that the switch may be used in conjunction with another instrumentality operable by the shaft, a base having a hole to receive the shaft, a switch arm overlying the base and having a hole therethrough registering with the hole in the base to accommodate the shaft, means at one side of the holes for pivotally mounting the switch arm from the base so that the arm may swing between switch open and switch closed positions, the hole in the switch arm being larger than the hole in the base so that the two holes register unobstructedly throughout the range of movement of the switch arm and the shaft may be as large as the hole in the base will permit, cooperating contact means carried by the base and switch arm at the opposite side of the holes, and means for actuating the switch arm from one position to the other including a spring having its ends located at opposite sides of the registering openings and its medial portion shaped to circumvent the space occupied by the operating shaft.

2. In a switch, a flat base member having an unobstructed opening therethrough, a flat switch arm overlying the base member, a pivotal connection between the base member and switch arm constraining the switch arm to pivotal motion across the base member about an axis spaced from the edge of the opening, fixed contact means carried by the base member at the side of the opening opposite the pivotal connection, the switch arm having an unobstructed opening therethrough registering with the opening in the base member and large enough to accommodate an actuating shaft passed through the opening in the base member and allow pivotal switch opening and closing movement of the switch arm, movable contact means movable by the switch arm into and out of engagement with the fixed contact means, a switch actuating element pivoted to swing between defined limits about an axis substantially normal to the plane of the switch arm motion and spaced from the openings, and a spring connected with the switch actuating element at one side of the openings and to the switch arm at the other side of the openings, said spring being under tension to yieldingly hold the switch arm in either of its two positions and to snap the switch arm from one position to the other as the actuating element is swung from one position to the other, and being so shaped that no part thereof obstructs the space defined by the registering openings.

3. In a switch, a flat base member, the base member having an unobstructed opening therethrough, a pivot member carried by the base spaced from the opening, a flat switch arm mounted on the pivot substantially parallel to the base, fixed contact means carried by the base upon the opposite side of the opening from the pivot, the switch arm having an unobstructed

opening therethrough registering with the base opening, movable contact means moved by the arm into and out of engagement with the fixed contact means, a pivoted switch actuating cam, and a bowed spring connecting the cam and the switch arm, the spring being connected to the arm upon the opposite side of the arm and base openings from its point of connection to the cam and circumventing at least a substantial part of the space defined by the registering openings in all positions of the switch arm to enable the passage of an operating shaft completely through the switch.

4. In a switch, a base, a switch arm overlying the base, a pivotal connection between the switch arm and the base guiding the switch arm for arcuate motion across the base, a movable contactor of substantially resilient spring metal, said movable contactor having spaced apart convex contact portions, a loose driving connection between a portion of the movable contactor substantially equispaced from its convex contact portions and a portion of the switch arm spaced substantially from its pivotal mounting so that the movable contactor is movable by the switch arm in a defined arc, spaced stationary contacts on the base spaced apart substantially the distance between the convex contact portions, each of said stationary contacts having a flat contact face crossing the arcuate path of the convex contact portions at such an angle as to effect a wedging action which places the movable contactor under tension as the contacts engage, and means for snapping the switch arm from switch open to switch closed position and vice versa.

5. A switch comprising a flat base, a pivot on said base, a flat switch arm rotatably mounted on the pivot parallel to the base and spaced therefrom, fixed contact members extending from the base toward the switch arm, a movable contact between the arm and base, the arm having spaced openings therein, a lug extending from an intermediate portion of the movable contact and fitting in one of the arm openings, a lug on an end of the movable contact extending into the other arm opening, said lugs having play in the openings whereby the movable contact has a limited pivotal movement relative to the switch arm, and convex faces on the movable contact adapted to engage the fixed contacts.

6. A switch comprising a flat base, a pivot on said base, a flat switch arm rotatably mounted on the pivot parallel to the base and spaced therefrom, fixed contact members extending from the base toward the switch arm, a resilient movable contact between the arm and base, the arm having spaced openings therein, a lug extending from an intermediate portion of the movable contact and fitting in one of the arm openings, a lug on an end of the movable contact extending into the other arm opening, said lugs having play in the openings whereby the movable contact has a limited pivotal movement relative to the switch arm, convex faces on the movable contact adapted to engage the fixed contacts, stop means secured to the switch base, and a stop portion on the switch arm adapted to engage the stop means to limit switch closing movement of the arm.

7. In an electric switch adapted for use in conjunction with another control instrumentality operable by a rotatable shaft, a flat base having a substantially central opening therethrough to accommodate the shaft of a control instrumentality with which the switch is associated, a pivot member carried by the base and spaced from the opening, a substantially flat switch arm mounted on the pivot member for oscillatory motion across the flat base, stationary contact means carried by the base on the side of the opening opposite the pivot member, movable contact means carried by the arm for engagement with the stationary contact means, said switch arm having an opening located between its connection with the pivot member and the movable contact means to register with the opening in the base, said opening in the switch arm being of a size to accommodate the shaft in all positions of the switch arm and the movable contact means being so shaped that no portion thereof overlies the opening in the arm, and means for moving the switch arm about the pivot member including an actuating element pivoted at one side of the openings and a bowed spring having one leg connected to the actuating element and its other leg connected to the switch arm at the opposite side of the opening therein, said spring circumventing at least enough of the space defined by the openings to accommodate the shaft in all positions of the switch arm.

8. In an electric switch adapted for use in conjunction with another control instrumentality operable by a rotatable shaft, a base having an opening therethrough to accommodate the shaft of a control instrumentality with which the switch may be associated, a movable switch arm overlying the base, a pivotal connection between the switch arm and the base whereby the switch arm is oscillatable across the base, said switch arm having an opening registering with the opening in the base, a pivoted actuating cam mounted on the base, and a toggle spring connecting the actuating cam and the switch arm so that actuation of the cam snaps the switch arm from one position to another, said toggle spring being so shaped that no portion thereof overlies the opening in the switch arm.

9. In an electric switch adapted for use in conjunction with another control instrumentality operable by a rotatable shaft, a base having an opening therethrough to accommodate the shaft of a control instrumentality with which the switch may be associated, a movable switch arm overlying the base, a pivotal connection between the switch arm and the base whereby the switch arm is oscillatable across the base, said switch arm having an opening registering with the opening in the base, a pivoted actuating cam mounted on the base, a substantially U-shaped bowed spring connecting the cam and the switch arm to snap the switch arm from one position to the other as the actuating cam is operated, said spring having the legs thereof at opposite sides of the opening in the switch arm and so proportioned as to clear the shaft in all positions of the switch arm.

10. In a switch, a base, spaced stationary contacts on the base projecting therefrom, a switch arm overlying the base and said stationary contacts, means pivotally connecting the switch arm with the base at a point substantially equi-spaced from the stationary contacts whereby the switch arm is oscillatable across the base, a movable contactor of substantially resilient spring metal located between the base and the switch arm, said movable contactor having convex contact portions spaced apart substantially the distance between the stationary contacts, a loose driving connection between the movable contactor and the switch arm substantially equi-spaced from said contact portions whereby the movable contactor is carried along by the switch arm while

being free to adjust itself to the stationary contacts, and said stationary contacts having substantially flat contact faces disposed at an angle to the arcuate paths of the contact portions on the movable contactor so that engagement between the contacts and the movable contactor places the movabe contactor under spring tension.

11. In a switch, a base, spaced stationary contacts on the base projecting therefrom, a switch arm overlying the base, means movably mounting the switch arm for motion across the base, a substantially resilient movable contactor having convex contact portions spaced apart substantially the distance between the stationary contacts, a loose driving connection between the movable contactor and the switch arm whereby the movable contactor is carried along by the switch arm toward and from engagement with the stationary contacts while being permitted a degree of pivotal motion by said loose driving connection for adjusting itself to the stationary contacts, said stationary contacts having substantially flat contact faces disposed at an angle to the paths of the contact portions on the movable contactor, and said loose driving connection between the switch arm and the movable contactor being equi-spaced from and on a line with said contact portions so that the points of engagement between the contact portions of the movable contactor and the flat faces of the stationary contacts are at all times equi-spaced from said loose connection between the movable contactor and the switch arm whereby contact pressure between each stationary contact and the contact portions of the movable contactor is equally divided during engagement thereof.

NEWTON C. SCHELLENGER.