Dec. 4, 1956 R. B. IMMEL ET AL 2,773,144

SNAP ACTION SWITCH

Filed April 30, 1953

Fig. 1.

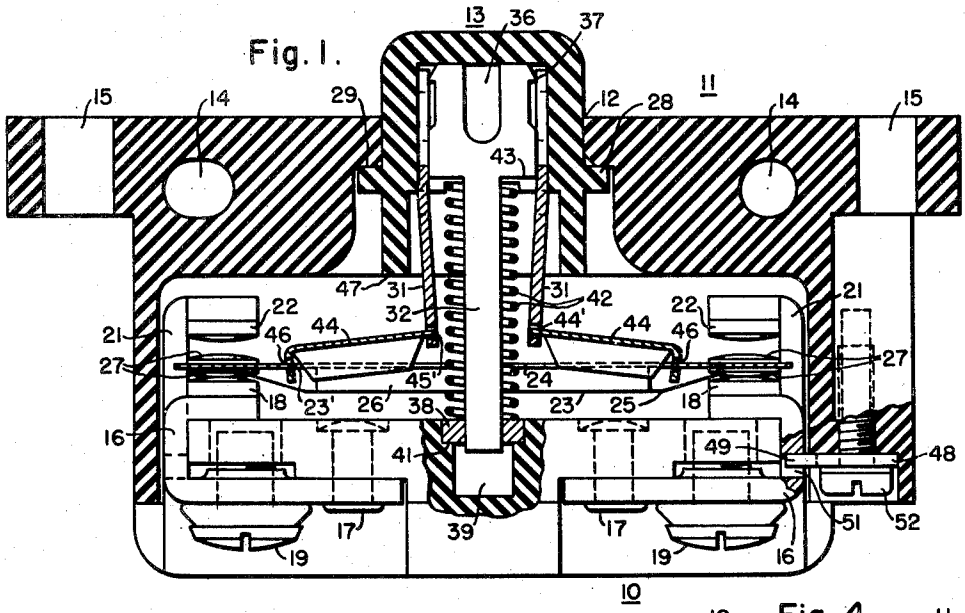


Fig. 2.

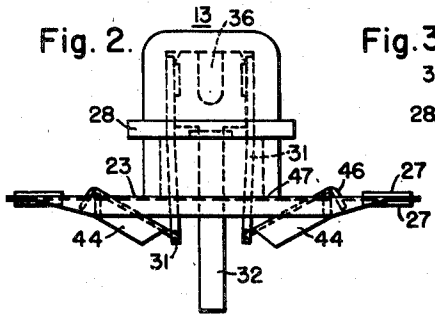


Fig. 3.

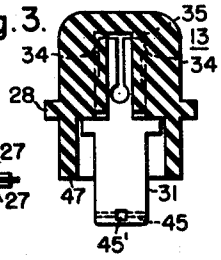


Fig. 4.

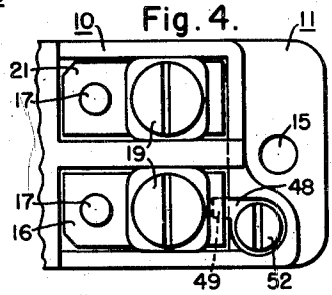


Fig. 6.

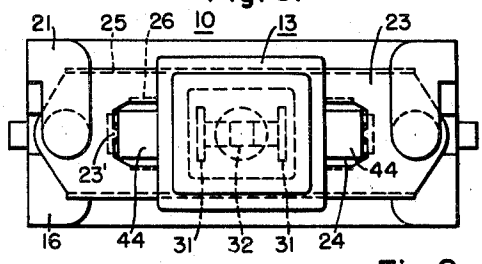


Fig. 5.

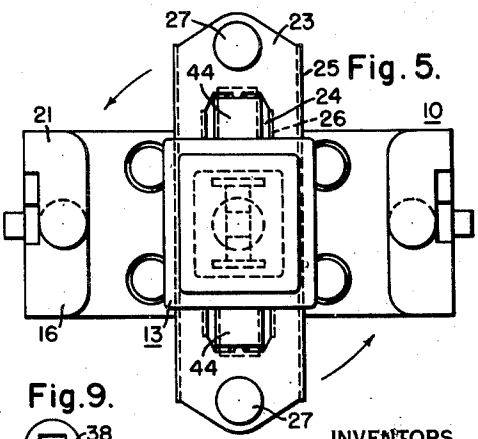


Fig. 7.

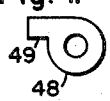


Fig. 8.

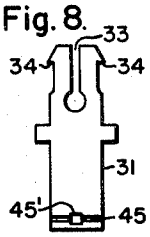


Fig. 9.



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2,773,144

SNAP ACTION SWITCH

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Application April 30, 1953, Serial No. 352,096

9 Claims. (Cl. 200—67)

Our invention relates, generally, to electric switches and, more particularly, to switches which operate with a snap action and are of the general type described in the copending application of R. B. Immel, Serial No. 222,203, filed April 21, 1951 now Patent No. 2,748,214, issued May 29, 1956 and assigned to the Westinghouse Electric Corporation.

An object of our invention is to improve the mechanical structure of a plunger-operated snap-action switch.

Another object of our invention is to simplify the assembly of a two-position, plunger-operated snap-action switch.

A further object of our invention is to provide improved operating springs for a snap-action switch.

Still another object of our invention is to provide for securing the operating springs in the operating button of a plunger-operated snap-action switch.

A still further object of our invention is to provide a simplified means for securing the contact base assembly to the cover of a snap-action switch.

Other objects of our invention will be explained fully hereinafter or will be apparent to those skilled in the art.

In accordance with one embodiment of our invention, two separate operating springs are so disposed in the molded operating button of a switch that they are the equivalent of a U-shaped spring, but since no bending is required more accurate springs can be manufactured with relatively simple tools. The moving contact system, which includes the operating button, operating springs, moving contact member and toggle links can be easily assembled with the stationary contact base by initially positioning the major axis of the moving contact system perpendicular to the longer axis of the base and then rotating the assembly through 90° into its final position. The contact base is secured to the cover by special clips which engage contact members on the base.

For a better understanding of the nature and objects of the invention, reference may be had to the following detailed description, taken in conjunction with the accompanying drawing, in which:

Figure 1 is an enlarged view, partly in section and partly in side elevation, of a switch embodying the principal features of the invention;

Fig. 2 is a view, in side elevation, of the moving contact assembly of the switch;

Fig. 3 is a view, in section, of the push button and operating spring assembly;

Fig. 4 is a bottom plan view of a portion of the contact base and switch cover;

Fig. 5 is a top plan view showing the manner of assembling the moving contact assembly with the contact base;

Fig. 6 is a top plan view of the assembled moving contact assembly and contact base;

Fig. 7 is a view, in plan, of a clip for securing the contact base to the cover;

Fig. 8 is a view, in side elevation, of one of the operating springs; and

Fig. 9 is a plan view of the bearing for the guide pin of the switch.

Referring to the drawing, and particularly to Fig. 1, the switch structure shown therein comprises a generally rectangular contact base **10**, which may be molded from a suitable insulating material, and a cover **11** which may be attached to the base in a manner more fully described hereinafter. The cover **11** may be molded from a suitable insulating material. As shown, the cover **11** has a generally rectangular opening **12** therein for receiving a reciprocating operating member **13** for actuating the switch mechanism, as will be more fully described hereinafter. The cover **11** is provided with mounting holes **14** for mounting the switch unit in one plane and mounting holes **15** for mounting the switch in another plane at right angles to the first plane.

As shown in Fig. 1, spaced contact members **16** are disposed in the base **10** in line with the longer dimension of the base. Each contact member **16** is generally of a U-shape having one leg attached to the base by means of a rivet **17**. The contact members **16** may be composed of any suitable electrical conducting material. Each contact member **16** is provided with a contact **18** which is preferably composed of silver or a silver alloy. Terminal screws **19** are provided for making electrical connections to the contact members **16**. A contact member **21** is associated with each contact member **16** and each contact member **21** has a contact **22** disposed above and spaced from its associated contact **18**. The contact members **21** are attached to the base **10** by rivets **17** and terminal screws **19** are provided for making electrical connections to the contact members **21**.

A bridging contact member **23** is movably disposed between the upper pair of contacts **22** and the lower pair of contacts **18**. As shown most clearly in Figs. 5 and 6, the bridging contact member **23** is generally rectangular in shape and has a generally rectangular opening **24** therein. The member **23** may be formed from a relatively thin sheet of conducting material such as beryllium copper.

The rigidity of the member **23** may be increased by providing downwardly-turned flanges **25** at its outer edges and similar flanges **26** at the sides of the rectangular opening **24**. In this manner the contact member **23** may be relatively light in weight, but at the same time relatively rigid. Thus the contact member **23** has a low inertia and can be operated with a fast snap action.

The bridging contact member **23** is provided with upper and lower contacts **27** at each end which are disposed to engage either the contacts **18** when the bridging contact member is in its lowermost position, or the contacts **22** when the bridging contact member is in its uppermost position. The contacts **27** are preferably composed of the same material as the contacts **18** and **22**.

As shown, the switch operating member **13** is in the form of a push button and it may be molded from a suitable insulating material. The top of the push button is rectangular in section and the reciprocating movement of the push button is guided by the sides of the rectangular opening **12** in the cover **11**. A flange **28** is provided on the sides of the push button to engage shoulders **29** on the cover **11** to limit the upward movement of the push button **13**.

As shown in Fig. 1, two oppositely disposed operating springs **31** are inserted into the push button **13** and a guide pin **32** is inserted into the push button between the operating springs **31**. As shown most clearly in Fig. 8, each spring **31** is substantially flat and has a slot **33** at its upper end, thereby providing two spring arms. Each spring arm has a projection **34** thereon. As shown in Fig. 3, the spring **31** may be inserted in a slot **35** in the molded push button **13** and the spring is retained

in the push button by the projections 34 engaging the molded material of the push button.

As shown in Fig. 1, the upper end of the guide pin 32 has a slot 36 therein, thereby providing two arms on the end of the guide pin. Each arm has a projection 37 thereon which engages one of the springs 31, thereby holding the springs against the sides of the push button 13 and also retaining the guide pin in the push button. In this manner, the parts of the operating member 13 are securely held together.

As shown most clearly in Fig. 1, the lower end of the guide pin 32 is disposed in a bearing 38 which is rotatably mounted at the top of a recess 39 in the base 10. The bearing 38 rests on a shoulder 41 in the recess 39. A coil spring 42 surrounds the guide pin 32 and extends between the top of the bearing 38 and a shoulder 43 on the guide pin 32. In this manner, the spring 42 is compressed when the push button 13 is pressed downwardly and it returns the push button to its uppermost position when the button is released.

As shown most clearly in Figs. 1 and 2, the bridging contact member 23 is connected to the operating springs 31 by a pair of rigid toggle levers 44. Each toggle lever 44 is disposed between the lower end of one of the operating springs 31 and one end of the rectangular opening 24 in the bridging contact member 23. Each operating spring 13 has a groove 45 near its lower end for receiving one end of the toggle lever 44. An opening 45' may be provided in the spring 31 for receiving a projection 44' on the lever 44 to prevent the end of the lever from jumping out of the groove 45. The other end of the toggle lever 44 has a downwardly bent flange 46 thereon for engaging the edge of the contact member 23 at the end of the opening 24. The flange 46 may have a groove and opening therein, similar to the groove 45 and opening 45' in the spring 31, for receiving the edge of the contact member 23 and a projection 23' on the contact member.

As shown in Fig. 2, the entire moving contact system of the switch mechanism which comprises the push button 13, the operating springs 31, the guide pin 32, the bridging contact member 23 and the toggle levers 44 can be assembled as a unit prior to its installation in the switch structure. As shown, the upward movement of the bridging contact member is limited by its engaging the lower edge 47 of the push button 13.

As shown in Fig. 5, the moving contact system can be readily assembled with the stationary contact base 10 by initially positioning the major axis of the moving system at right angles to the longer axis of the contact base. The coil spring 42 is placed on the guide pin 32 and the lower end of the guide pin is inserted into the bearing 38. With the bridging contact member 23 held at the correct level, the entire moving system can be rotated 90° into the position shown in Fig 6 with the contacts 27 disposed between the contacts 18 and 22. rotated 90° into the position shown in Fig. 6 with the guide pin 32.

After the assembly of the operating mechanism in the foregoing manner, the cover 11 is placed on the base 10 with the push button 13 extending through the opening 12. As shown most clearly in Figs. 1 and 4, the cover 11 may be secured to the base by means of special clips 48. As shown in Figs. 4 and 7, each clip has a projection 49 thereon which is disposed in a slot 51 in one of the contact members 16 or 21. A self-tapping screw 52 may be threaded into the cover 11 to hold the clip 48 in position, thereby securely holding the base and the cover together.

As shown in Fig. 1, the push button 13 is normally biased to its uppermost position by the spring 42 and the bridging contact member 23 is normally biased to its lowermost position by the toggle levers 44 and the operating springs 31 which are stressed at all times when assembled in the switch mechanism. Thus the contacts

27 on the bridging member 23 are held against the lower contacts 18 with sufficient contact pressure to enable the contact members to conduct relatively heavy currents.

When the push button 13 is depressed, the operating springs 31 are stressed still further until the ends of the toggle levers 44 which engage the springs 31 pass overcenter, thereby causing the bridging contact member 23 to be actuated upwardly with a fast snap action. The upward movement of the bridging contact member 23 is limited by the upper contacts 27 engaging the contacts 22. The operating springs 31 are still under stress, thereby maintaining a good contact pressure between the upper contact members.

When the push button 13 is released, the coil spring 42 returns the push button to its uppermost position, shown in Fig. 1, thereby actuating the bridging contact member 23 downwardly by stressing the operating springs 31 until the toggle levers 44 pass overcenter. Thus a snap action is obtained during operation of the bridging contact member 23 in either direction.

From the foregoing description it is apparent that we have provided a switch structure which has numerous advantages, some of which are as follows: The operating springs may be easily and accurately manufactured with relatively simple tools, since no bending of the springs is required. The operating springs and the guide pin may be readily assembled in the push button and they are self-retaining in the push button. The moving parts of the switch mechanism may be readily assembled with the stationary contact structure, thereby facilitating the assembly of the entire switch structure. The foregoing features make it possible to manufacture and assemble the switch economically and to provide a mechanically superior switch structure.

Since numerous changes may be made in the above described construction, and different embodiments of the invention may be made without departing from the spirit and scope thereof, it is intended that all the matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

We claim as our invention:

1. In a switch, in combination, a generally rectangular contact base of insulating material, a pair of spaced contact members disposed in line with one dimension of the base and secured to the base, an additional contact member disposed above and spaced from each one of the first-named contact members, said additional contact members being secured to the base, a bridging contact member movable into and out of bridging engagement with said secured contact members, a reciprocating operating member having two oppositely disposed slots therein, a separately mounted substantially flat operating spring disposed in each slot in the operating member, substantially rigid toggle levers connecting said springs and said bridging contact member to actuate the latter, said bridging contact member having a generally rectangular opening therein for receiving the toggle levers, a guide pin disposed in the operating member between said springs, means extending from the guide pin for engaging the springs to retain them in the operating member, a cover for the switch, a recess in said base, and a bearing in said reecss for the lower end of said guide pin, said bridging contact member being rotatable about said guide pin as an axis in a plane parallel to the contact base when the lower end of the guide pin is in said bearing and prior to the installation of the cover.

2. In a switch, in combination, a generally rectangular contact base of insulating material, a pair of spaced contact members disposed in line with one dimension of the base and secured to the base, an additional contact member disposed above and spaced from each one of the first-named contact members, said additional contact members being secured to the base, a bridging contact member movable into and out of bridging engagement with said se-

cured contact members, a reciprocating operating member having two oppositely disposed slots therein, a separately mounted operating spring disposed in each slot in the operating member substantially, rigid toggle levers connecting said springs and said bridging contact member to actuate the latter, said bridging contact member having a generally rectangular opening therein for receiving the toggle levers, a guide pin having one end disposed in the operating member, a cover for the switch, a recess in said base for the other end of the guide pin, and means on the guide pin for engaging said springs to retain them in the operating member, said bridging contact member being rotatable with the operating member about the guide pin as an axis in a plane parallel to the contact base when one end of the guide pin is in said recess and prior to the installation of the cover.

3. In a switch, in combination, a generally rectangular contact base of insulating material, a pair of spaced contact members disposed in line with one dimension of the base and secured to the base, an additional contact member disposed above and spaced from each one of the first-named contact members, said additional contact members being secured to the base, a bridging contact member movable into and out of bridging engagement with said secured contact members, a reciprocating operating member having two oppositely disposed slots therein, a separately mounted substantially flat operating spring disposed in each slot in the operating member, substantially rigid toggle levers connecting said springs and said bridging contact member to actuate the latter, each spring having a groove therein for receiving one end of a toggle lever, said bridging contact member having a generally rectangular opening therein for receiving the toggle levers, a guide pin having one end disposed in the operating member, a cover for the switch, a recess in said base for the other end of the guide pin, and means on the guide pin for engaging said springs to retain them in the operating member, said bridging contact member and said toggle levers being rotatable with the operating member about the guide pin as an axis in a plane parallel to the contact base when one end of the guide pin is in said recess and prior to the installation of the cover.

4. In a switch, in combination, a generally rectangular contact base of insulating material, a pair of spaced contact members disposed in line with one dimension of the base and secured to the base, an additional contact member disposed above and spaced from each one of the first-named contact members, said additional contact members being secured to the base, a bridging contact member movable into and out of bridging engagement with said secured contact members, a reciprocating operating member having oppositely disposed slots therein, separately mounted substantially flat operating springs oppositely disposed in said slots in the operating member, substantially rigid toggle levers connecting said springs and said bridging contact member to actuate the latter, said bridging contact member having a generally rectangular opening therein for receiving the toggle levers, a guide pin having one end disposed in the operating member, a cover for the switch, a recess in said base for the other end of the guide pin, and means on the guide pin for engaging said springs to retain them in the operating member, said bridging contact member and toggle levers and operating springs and operating member being rotatable about the guide pin as an axis when assembled together on the contact base with one end of the guide pin in said recess and prior to the installation of the cover.

5. In a switch, in combination, a generally rectangular contact base of insulating material, a pair of spaced contact members disposed in line with one dimension of the base an additional contact member disposed above and spaced from each one of the first-named contact members, a bridging contact member movable into and out of bridging engagement with said spaced contact members, a

reciprocating operating member having oppositely disposed slots therein, separately mounted operating springs oppositely disposed in the slots in the operating member with less than one-half the length of each spring extending below the bottom of the operating member, rigid toggle levers connecting said springs and said bridging contact member to actuate the latter, said bridging contact member having a generally rectangular opening therein for receiving the toggle levers, each toggle lever having a flange on one end for engaging one end of the opening in the bridging contact member, said bridging contact member and toggle levers being retained with the operating member by the operating springs as a preassembled unit when the other ends of the toggle levers have pased through the opening in the bridging contact member causing the bridging contact member to engage the lower edge of the operating member prior to the installation of the preassembled unit in the switch.

6. In a switch, in combination, a generally rectangular contact base of insulating material, a pair of spaced contact members disposed in line with one dimension of the base and secured to the base, an additional pair of contact members having one contact member disposed above and spaced from each one of the first-named contact members, said additional contact members being secured to the base, an elongated bridging contact member movable into and out of bridging engagement with said secured contact members, a reciprocating operating member, separately mounted operating springs oppositely disposed in the operating member, rigid toggle levers conecting said springs and said bridging contact member to actuate the latter, a guide pin having one end disposed in the operating member, a recess in said base for the other end of the guide pin, said guide pin being perpendicular to the contact base, and a cover for the switch, said cover having an opening therein for the operating member, said bridging contact member being rotatable between said pairs of contact members in a plane parallel to the contact base about the guide pin as an axis prior to the installation of the cover.

7. In a switch, in combination, a generally rectangular contact base of insulating material, a pair of spaced contact members disposed in line with one dimension of the base and secured to the base, an additional pair of contact members having one contact member disposed above and spaced from each one of the first-named contact members, said additional contact members being secured to the base, an elongated bridging contact member movable into and out of bridging engagement with said secured contact members, a reciprocating operating member, separately mounted substantially flat operating springs oppositely disposed in the operating member, rigid toggle levers connecting said springs and said bridging contact member to actuate the latter, said bridging contact member having a generally rectangular opening therein for receiving the toggle levers, a guide pin having one end disposed in the operating member, a recess in said base for the other end of the guide pin, said guide pin being perpendicular to the contact base, and a cover for the switch, said cover having an opening therein for the operating member, said bridging contact member being rotatable between said pairs of contact members in a plane parallel to the contact base about the guide pin as an axis prior to the installation of the cover, said cover and said operating member cooperating to prevent rotation of the operating member and the bridging-contact member when the cover is in position on the switch.

8. In a switch, in combination, a generally rectangular contact base of insulating material, a pair of spaced contact members disposed in line with one dimension of the base and secured to the base, an additional pair of contact members having one contact member disposed above and spaced from each one of the first-named contact members, said additional contact members being secured to the

base, an elongated bridging contact member movable into and out of bridging engagement with said secured contact members, a reciprocating operating member, separately mounted substantially flat operating springs oppositely disposed in the operating member, rigid toggle levers connecting said springs and said bridging contact member to actuate the latter, said bridging contact member having a generally rectangular opening therein for receiving the toggle levers, a guide pin having one end disposed in the operating member, a recess in said base for the other end of the guide pin, said guide pin being perpendicular to the contact base, and a cover for the switch, said cover having an opening therein for the operating member, said operating member and said bridging contact member being rotatable about the guide pin as an axis prior to the installation of the cover, said bridging contact member rotating in a plane parallel to the base between said pairs of contact members, and clip means attached to the cover and engaging the contact base to secure the contact base to the cover.

9. In a switch, in combination, a generally rectangular contact base of insulating material, a pair of spaced contact members disposed in line with one dimension of the base and secured to the base, an additional pair of contact members having one contact member disposed above and spaced from each one of the first-named contact members, said additional contact members being secured to the base, an elongated bridging contact member movable into and out of bridging engagement with said secured

contact members, a reciprocating operating member, separately mounted operating springs oppositely disposed in the operating member, rigid toggle levers connecting said springs and said bridging contact member to actuate the latter, a guide pin having one end disposed in the operating member, a recess in said base for the other end of the guide pin, said guide pin being perpendicular to the contact base, and a cover for the switch, said cover having an opening therein for the operating member, said operating member and said bridging contact member being rotatable about the guide pin as an axis prior to the installation of the cover, said bridging contact member rotating in a plane parallel to the base between said pairs of contact members, said cover and said operating member cooperating to prevent rotation of the operating member and the bridging contact member when the cover is in position on the switch, and clip means attached to the cover and engaging contact members on the contact base to secure the base to the cover.

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