Oct. 8, 1957 O. L. TAYLOR 2,809,246

SWITCH CONSTRUCTION

Filed Feb. 27, 1953 2 Sheets-Sheet 1

Fig. 1.

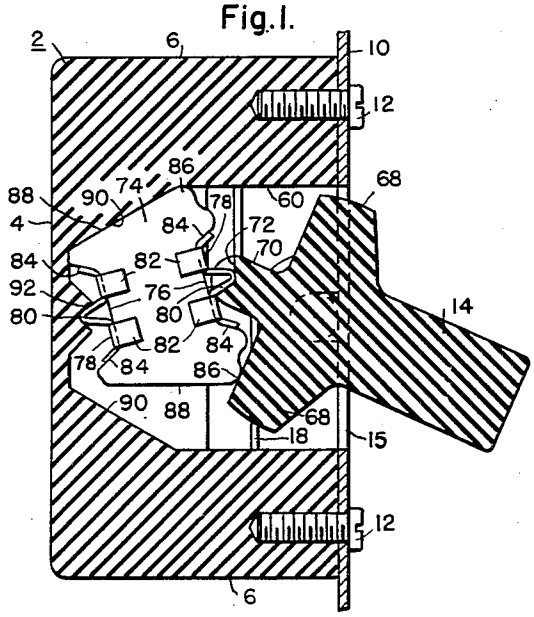


Fig. 2.

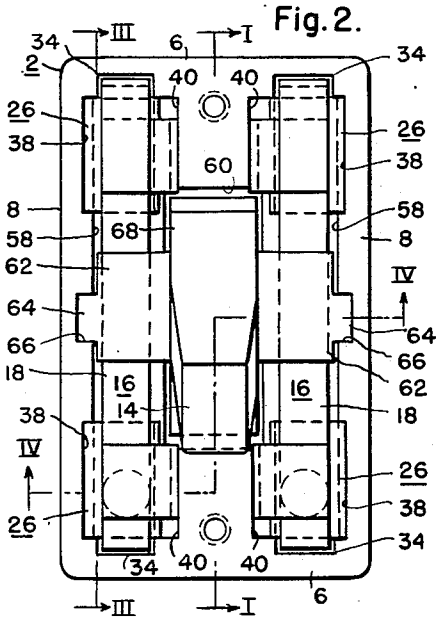


Fig. 3.

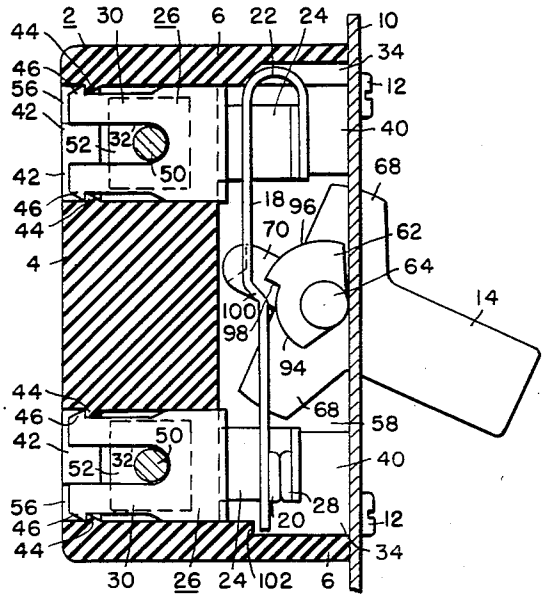
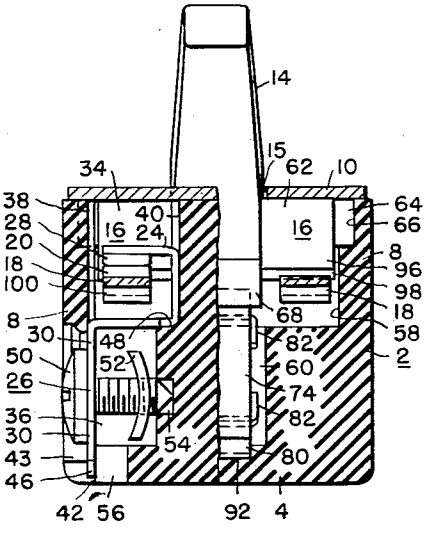


Fig. 4.



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SWITCH CONSTRUCTION

Filed Feb. 27, 1953 2 Sheets-Sheet 2

Fig.5.

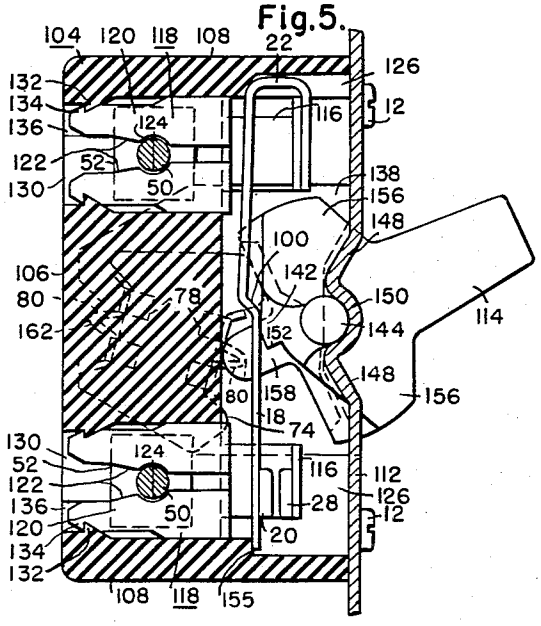


Fig.6.

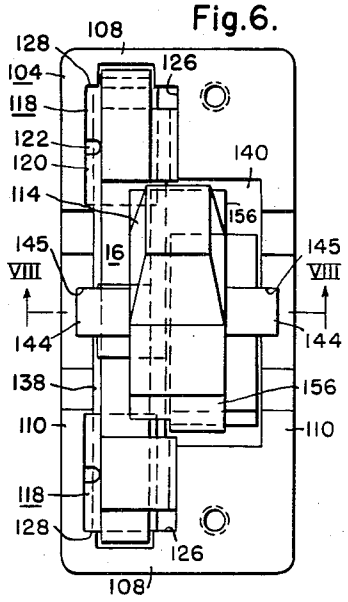


Fig.7.

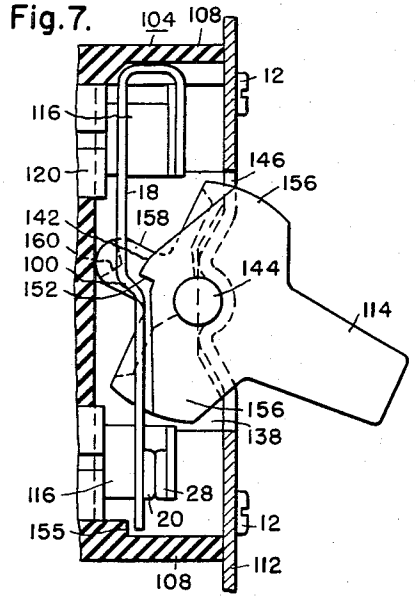
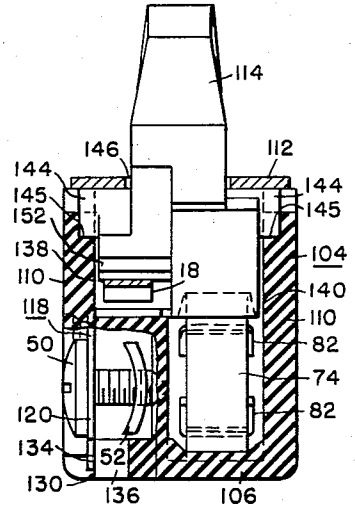


Fig.8.



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2,809,246

SWITCH CONSTRUCTION

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Application February 27, 1953, Serial No. 339,293

26 Claims. (Cl. 200—67)

This invention relates generally to electric switches, and particularly to switches for low-voltage alternating-current circuits.

In the past it has been common practice to use switches in low-voltage circuits, such as the common 110 volt home lighting circuit which is designed for both direct and alternating-current circuits, and operate to open and close the circuit with a fast or snap movement of the switch contacts to and from an open circuit condition of the switch where the contacts are relatively widely separated, that is, on the order of at least ¼ inch of contact separation. As these switches are required to open and close the circuit under load, arcs of considerable size and duration are drawn when the switches are opened, and this causes deterioration of the contacts and has other deleterious effects on the switches, because of the relatively large amount of arc energy which must be dissipated. Such switches have also required the use of relatively heavy springs operating complex mechanisms to obtain the snap movements of the switch contacts, and have been necessarily quite noisy in operation.

While it is well known that 60 cycle alternating current passes through zero value 120 times per second, and that for low voltages, switch contacts may be quite close together before they will arc over, it has been essential with the prior switch designs to employ a very large contact separation at the open circuit position in order to insure rapid interruption of the circuit, and that the contact opening movement occur very fast so that the large contact separation is attained as rapidly as possible.

In accordance with this invention, switches are constructed to operate in a radically different fashion to have longer life and substantially quieter operation.

One of the objects of this invention is to provide a switch of the type described for controlling alternating-current circuits, with novel means limiting separation of the switch contacts to a very small amount and yet preventing restriking of the arc following a circuit opening operation.

Another important object of this invention is to provide novel simplified switch operating mechanism which is relatively quiet in operation.

Another object of this invention is to provide a switch for the control of alternating currents with a novel means for rapidly opening the switch contacts but limiting separation of the contacts to a very small amount.

A more specific object of this invention is to provide as a novel resilient overcenter operating mechanism for a switch, a movable mass of resilient material, which may also act to stop movement of the parts in a quiet manner.

Still another object of this invention is to provide a simplified form of switch wherein the switch terminals and contacts may be assembled in the switch casing by merely sliding them in place.

These and other objects of this invention will become more apparent upon consideration of the following detailed description of preferred embodiments thereof, when taken in connection with the attached drawings, in which:

Figure 1 is a substantially central longitudinal section through a switch embodying this invention taken substantially along the line I—I of Fig. 2;

Fig. 2 is a top plan view of the switch shown in Fig. 1 with the switch casing cover removed;

Fig. 3 is a longitudinal section view of the switch shown in Figs. 1 and 2 and taken substantially on the line III—III of Fig. 2;

Fig. 4 is a transverse section view of the switch shown in Figs. 1 to 3 and taken substantially on the line IV—IV of Fig. 2;

Fig. 5 is a longitudinal section view similar to Fig. 3 but illustrating a modified form of switch;

Fig. 6 is a top plan view of the switch shown in Fig. 5 with the switch casing cover removed;

Fig. 7 is a partial longitudinal section view similar to Fig. 5 but showing the switch contacts closed; and

Fig. 8 is a transverse cross-section view of the switch shown in Figs. 5 to 7 and taken substantially on the line VIII—VIII of Fig. 6, but with a portion broken away to show one of the terminals.

This invention is illustrated in Figs. 1 to 4 of the drawings as being embodied in a two-pole electric switch which may be employed for the control of two independent electric circuits, or may be used as a three-way switch for the control of a single circuit from two different points by means of a pair of these switches. This embodiment of the invention is illustrated as having a casing 2 for the switch made of insulating material, preferably a molded insulating material. The switch casing 2 is provided with a bottom wall 4, end wall 6, side walls 8, and an open front adapted to be closed by a cover 10 which may be of any desired material, such as sheet metal. The cover 10 may be secured in place by any suitable means, such for example as the screws 12 at each end thereof which are threaded into the casing 2.

An operating handle 14, preferably made of insulating material, such as a molded insulating material, is adapted to be centrally located in the casing and to project through an opening 15 in the cover 10. A switch 16 is located in the casing at each side of the operating handle 14, with each switch including a switch blade 18 of a resilient conducting material, such as a copper alloy, having a contact button 20 of a good conducting material such as silver, located adjacent to but spaced from the outer end of each switch blade 18. The inner end of each switch blade 18 is reversely bent at 22, and has the extreme inner end secured to the outer leg of the U-shaped outer end 24 of a terminal 26. The inner end of the switch blade 18 may be secured to the outer leg of U-shaped terminal portion 24 in any desired way, such for example, as by welding or the like.

There is a similar terminal for each switch at the other end of casing 2 having a stationary contact button 28, similar to the button 20, mounted on the inner side of the outer leg of the U-shaped terminal portion 24, for cooperation with the contact button 20 mounted on the switch blade 18. Each terminal 26 is provided with an inner terminal portion 30 integral with the outer U-shaped portion 24, but wider than the U-shaped portion 24, and with the inner end of the terminal portion 30 being split, as at 32, to provide a pair of legs which have some flexibility and resilience.

Each terminal 26 is adapted to be mounted in a recess 34 provided in each corner of the casing and extending inwardly from the open side thereof, with the inner end 36 of each of these recesses being somewhat reduced in width. A shallow groove 38 is formed in the outer wall of each terminal recess 34 to closely slidably receive the terminal end 30 of each terminal 26, so that each terminal 26 may be mounted in the casing simply by sliding it into its respective casing recess 34 from the open side

of the casing, and it will be observed that the bight portion of the U-shaped outer end 24 of each terminal 26 will slidably engage the inner wall 40 of each recess 34 when the terminal is being moved into the recess. The outer end of at least one of the legs formed on the terminal portion 30 of each terminal 26 will slide onto a ledge 42 formed by the outside edge of bottom wall 4, as it will be noted that the side wall 8 is cut away at 43 in the vicinity of the inner terminal portion 30 of each terminal 26. During sliding movement of each terminal 26 into the casing, locking projections 46 formed on the outer edge of each leg of the inner terminal portion 30 will be cammed over cooperating locking projections 44 which are integral with the casing, while causing the legs of inner terminal portion 30 to flex inwardly, until the locking projections 46 on the legs slip behind the locking projections 44 on the casing, to thus prevent withdrawal of the terminal 26 and securely hold it in place. At the same time this locking action occurs, the U-shaped outer portion 24 of the terminal will engage the ledge 48 on the inner wall of casing recess 34.

A terminal screw 50 is provided for each terminal 26 adapted to threadedly engage a curved nut 52 located in the inner narrow portion 36 of each terminal recess 34, and the inner end of the screw may seat in a side recess 54 provided in the inner wall of the inner portion 36 of each recess 34. A wire channel 56 is provided in ledge 42 at one end thereof, for a purpose which will be described.

In actually assembling each terminal 26 in its casing recess 34, the terminal screw 50, preferably with its nut 52 threaded thereon, is first placed in position with the inner end of the screw seated in the inner portion 36 of each terminal recess 34. The terminal 26 is then simply slid into the open side of the casing into its casing recess 34, as described above, and it will be observed that the shank of the terminal screw 50 will be received in the split portion 32 of the inner terminal portion 30 of each terminal 26, during this sliding movement of the terminal into the casing. As soon as the terminal 26 attains the position illustrated in Figs. 3 and 4 of the drawings, it will be securely locked in position in predetermined relation to the casing by the locking projections 44 and 46 as described above. It will be observed that a wire may be secured by terminal screw 50, either from the side by insertion under the head of the terminal screw, or from the back by insertion through the wire channel 56, to be clamped between the outer terminal portion 30 of each terminal and the nut 52 for the terminal screw.

It is thus apparent that the terminal and the switch contact carried thereby may thus not only be positively secured in predetermined relation in the switch casing merely by sliding it into place in the casing, but this same act also serves to locate and hold the terminal screws 50 and their nuts 52 in place. Of course, if desired, the terminal screw 50 may have its outer end deformed to retain the nut 52 captive thereon.

The switches 16 at each side of the operating handle are mounted in longitudinally extending side recesses 58 formed in the outer part of the casing, and these recesses open into the upper ends of terminal recesses 34. The operating handle 14 has its inner end located in a central recess 60 provided in the casing for the handle and for a resilient overcenter toggle mechanism, which will be hereinafter described. The handle has at each side thereof operating cams 62, illustrated as being integral with the handle, but which may be made as separate parts secured to each side of the handle. Likewise, the handle is provided at each side beyond the operating cams 62 with integral trunnions 64 adapted to be seated in pivot recesses 66 formed in each side wall 8 of the casing, with the trunnions being held in their pivot recesses by the cover 10 when it is secured over the open side of the casing. The operating handle 14 has oppositely extending stop projections 68, and an inwardly extending

operating projection 70 having a substantially V-shaped pivot recess 72 formed in the outer end thereof.

In accordance with this invention, the operating mechanism includes a resilient overcenter toggle, and in the illustrative embodiment of the invention shown in Figs. 1 to 4, one of the toggle levers is constituted by the operating handle 14, while the other comprises a pivoted block 74 of a flexible and resilient rubber-like material, preferably formed of a synthetic rubber or other compound having like characteristics. The block 74 is provided with opposed inner and outer surfaces 76 having keeper plates 78 mounted thereon, with each of the keeper plates having a reversely bent intermediate pivot portion 80, and side tabs 82 for embracing opposite sides of the block 74, as well as end tabs 84 engaging portions of the block adjacent each end of the keeper plates 78. The keeper plates 78 may be secured to the resilient block 74 either by being bonded thereto as could be done during the molding of the block, or may be merely frictionally secured to the block by means of the side tabs 82 engaging the sides of the block under some pressure. As illustrated, the resilient toggle block 74 has tapered end walls 88 which may cooperate with the tapered end walls 90 of the central recess 60 of the casing to limit pivotal movement of the toggle block 74 about the pivot portion of its keeper plate 78 which engages the substantially V-shaped pivot recess 92 formed in the bottom wall 4 of the casing.

It will be apparent from Fig. 1 of the drawing that the resilient toggle block 74 is assembled intermediate the bottom wall 4 of the casing and the inner operating projection 70 of the operating handle, with the pivot portions 80 of the keeper plates being pivotally received in the bearing recesses 72 and 92 provided in the handle operating projection 70 and bottom wall 4 of the casing, respectively, and with the block compressed a certain extent. In Fig. 1 of the drawing, the resilient overcenter toggle arrangement is shown in one extreme position where the handle is held at its lowermost position, and it will be observed that the upper end of resilient toggle block 74 has its upper tapered wall 88 in engagement with the upper tapered wall 90 of the central casing recess 60, and that any attempt to move the operating handle 14 a further amount downwardly would result in the lower stop projection 68 of the handle engaging the lower outer corner 86 of the resilient toggle block 74, and could only produce further compression of the block.

Now assuming the handle 14 is moved upwardly, the resilient toggle block 74 is compressed until the handle passes a position wherein the pivot between the handle and block 74 passes below a line connecting the pivot axis of handle trunnion 64 and the pivot point of the block on the bottom wall of the casing at 80, 92, whereupon the material comprising resilient toggle block 74 may expand to force the handle to its upper limit of movement. This movement will continue until the tapered lower end wall 88 of the block 74 engages the lower tapered end wall 90 of the central casing recess 60, and since the block is of a flexible and resilient material, there is substantially no noise when it engages the wall 90 formed in the casing.

It will be noted that the particular formation of the pivot portions 80 of the keeper plates 78, as well as the formation of the bearing recesses 72 and 92, with which they cooperate, respectively, makes it exceedingly difficult to stop the handle at a dead-center position. While a solid block is shown to comprise the resilient toggle block 74, this invention comprehends that the force required to move this toggle block overcenter may be varied by utilizing different materials for the block, and by forming the block with one or more apertures to decrease the force required to operate it overcenter.

The switches 16 are operated upon movement of the handle by the operating cams 62, previously referred to. Each operating cam 62 is provided with a circular por-

tion 94 having a relatively short radius from the pivot axis of handle trunnions 64, and an adjacent circular portion 96 having a relatively longer radius, with these two circular portions being joined by an abrupt radial abutment 98 which is adapted when the switch is in closed position and the handle is operated, to engage the offset portion 100 of each switch blade 18 to operate it to open position, where it is held by the cam portion 96. The cam portion 94 is ineffective, except to provide clearance to its switch blade 18 at the closed circuit position of the blade. Each of the switch blades are biased to engage the stationary contacts 28 and are operated to open position by the cam abutment 98 upon appropriate movement of the operating handle 14. It will be noted that the lower end wall 6 of the casing is provided with an inner stop shoulder 102 engageable with the outer free end of each switch blade to limit opening movement of the switch blade to a small amount, for a purpose to be described.

It will now be apparent that with the switch at the closed circuit position illustrated in Figs. 1 to 4, that upward movement of the operating handle will cause the resilient toggle block 74 to be stressed and to move overcenter as previously described, and the radial cam abutment 98 is designed to engage the offset portion 100 of the switch blades just after the resilient toggle block 74 has moved below center, to thus quickly separate the contacts with a fast action.

The contacts of both switches are arranged to be operated simultaneously, and when opened to have the opening movement of the switch blade limited to a very small amount. As previously stated, one feature of this invention consists of restricting the separation of the contacts to a very small amount, as it has been found that not only will a very small separation effect efficient interruption of the circuit, but that if the contacts are rapidly separated, as is provided in this switch, interruption of the circuit will nearly always occur at the first occurrence of current zero of the alternating current flowing in the circuit, and that all this can be accomplished while at the same time achieving greater contact life, and consequently a longer overall life of the switch. This seeming paradox may be explained by the fact that it has been known that a contact separation of as little as .007 of an inch is sufficient to prevent ionization of the air between the contacts. However, in actually opening a loaded electric circuit the arc which is established when the contacts separate ionizes the air, and it had been considered necessary to achieve a wide separation of the contacts to prevent restriking of the arc through this ionized or partly ionized atmosphere, and that this wide contact separation should be achieved as rapidly as possible. However, in accordance with this invention, the contact separation is purposely kept to a very small value, preferably between .007 and .050 of an inch, and in no case in excess of .1 of an inch, which means that the arc is limited to a corresponding length and the arc energy is held to a corresponding low level. By the same token, the amount of ionization of the atmosphere between the contacts is kept at a low level, and by making the contacts with relatively large flat surfaces in proximity to the arc, as well as constituting relatively large masses of good heat conducting material, the small amount of ionization which occurs in the atmosphere between the contacts is rapidly deionized by conduction of heat generated by the arc away from the terminals of the arc, and by contact of the ionized particles with the relatively extensive cool contacting surfaces. It has been found that ideally, the contact separation should be maintained as small as possible, so that the ideal separation would be on the order of .007 to .010 of an inch. However, it is not entirely practical to maintain such close tolerances in switches of this type, and it has been found that good results may be obtained with contact separations up to .050 of an inch as a practical matter, and in some cases up to .1 of an inch. However, contact separations greater than .1 of an inch are not desirable unless the contact separation is made to be a much greater amount comparable to that which has been heretofore used in switches of this type, namely at least ¼ of an inch or more.

The invention is illustrated in Figs. 5 to 8 as being embodied in a single-pole type of switch which has many parts identical with those specifically described as included in the two-pole embodiment of the invention previously described, and accordingly like reference numerals have been applied to such parts, and a detailed description thereof will not be repeated. In this embodiment of the invention, a casing 104 is provided for the switch which is similar in many respects to the casing 2 previously described, in that it has a bottom wall 106, end walls 108, side walls 110 and an open side adapted to be closed by a cover 112 which may be secured to the casing by screws 12.

An operating handle 114 is centrally located in the casing and is adapted to project through an opening 146 in the cover 112. But one switch 16 is provided for this embodiment of the invention and it is located in the casing at one side of and partly beneath the operating handle 114. As in the previously described embodiment of the invention, the switch blade 18 is mounted on the outer leg of the U-shaped outer end 116 of a terminal 118, and the terminal 118 has an integral inner terminal strip 120 which is wider than the outer U-shaped end 116 thereof. The inner terminal portion 120 of each of the terminals 118 is split as at 122, and differs from the terminals 26 previously described in that the outer end of the split 122 diverges outwardly from intermediate arcuate recesses in each side of the legs of the inner terminal portion 120, to form in effect a keyhole 124 to which access may be had through the outer flared end of the split at 122 between the legs of the outer terminal portion 120.

As in the previously described embodiment of this invention, the stationary contact 28 is mounted on an identical terminal 118 at the same side but at the opposite end of casing 104. Each of the terminals 118 is mounted in a casing recess 126 which is similar to the casing recesses 34 previously described, in that a shallow groove 128 is provided in the outer wall of each casing recess 126 for receiving the inner wide terminal portion 120 when each terminal is slid into its recess in mounting it in the casing, and at its operative position the outer ends of the legs of the outer terminal portion 120 rest on a ledge 130 formed by the adjacent side edge of the bottom wall 4 of the casing. The terminals 118 are held locked in their operative positions by integral locking projections 132 on the casing engaging behind integral locking projections 134 provided on the legs of the outer terminal portion 120.

As before, each terminal 118 is provided with a terminal screw 50 and a nut 52, and the bottom wall 4 of the casing may also have a wire channel 136 providing access to the recess in which the nut 52 for the terminal screw is located.

It will now be apparent that the terminals 118 may be assembled with casing 104 in the same manner as the terminals and casings shown in Figs. 1 to 4 are assembled, that is, by merely sliding the terminals 118 into their respective casing recesses 126. The only difference resides in the operation of the key-hole slots 124 provided in the outer terminal portions 120, in that the shank of the terminal screw 50 is adapted to be forced into the key-hole portions 124 during assembly of the terminals, and the key-hole slot 124 thus prevents the terminal screw 50 from assuming a position other than one perpendicular to the side walls 110 of the switch casing.

The switch 16 in the embodiment of the invention illustrated in Figs. 5 to 8 is located in a longitudinally ex-

tending side recess **138** provided in the outer portion of the switch casing **104**, with the inner end of the handle and the toggle mechanism being located in a central recess **140** in the casing. The operating handle **114** has opposed trunnions **144** extending from opposite sides thereof to be received in pivot recesses **145** forming half bearings for the trunnions in each of the side walls **110** of the casing, with the outer half of the trunnion bearings being formed by half bearing portions **150** formed in depressed portions **148** of the cover at each side of the handle opening **146**. The depressed portions **148** of the cover are adapted to be accommodated in appropriate notches cut in each side wall **110** of the casing at the open side of the casing. Such a bearing arrangement prevents motion of the handle longitudinally of the switch out of contact with a motion restraining wall, to thus contribute to the quiet operation of the switch.

The operating handle **114** is provided with opposed stop abutments **156** similar to the abutments **68** provided for the operating handle **14** shown in Figs. 1 to 4, for cooperation with the resilient toggle block **74** in the same way as in the previously described embodiment of this invention. The side of operating handle **114** at the inner end thereof which is adjacent switch **16** is cut away to form an operating cam **142** having an abrupt radial shoulder **152** for cooperation with the offset portion **100** in switch blade **18** to operate the switch as in the previously described embodiment of the invention. Operating handle **114** also has an inner operating projection **158** having a V-shaped pivot recess **160** in the inner end thereof for engagement with the outer pivot portion **80** on the outer keeper plate **78** of the resilient toggle block **74**. As in the previously described embodiment of the invention, the pivot projection **80** of the inner keeper plate is adapted to be pivotally mounted in a pivot recess **162** formed in the bottom wall **106** of the switch casing **104**.

It will be observed that a stop shoulder **155** is formed on the lower end wall **108** of the switch casing **104** to limit opening movement of the switch contacts, so that the operation of the specific form of switch shown in Figs. 5 to 8 in opening and closing the switch is substantially identical with the operation of the form of invention specifically illustrated and described in connection with Figs. 1 to 4 of the drawings, and consequently will not be repeated in detail. However, it will be noted that the contact separation is limited as in the embodiment of the invention shown in Figs. 1 to 4, and that the resilient toggle block **74** is moved overcenter by the operating handle to retain the operating handle at its two extreme positions, and to effect rapid making and breaking of the switch contacts.

Having described preferred embodiments of the invention in accordance with the patent statutes, it is desired that it be understood that the invention is not limited to these particular constructions, as it will be apparent to persons skilled in the art that certain features may be employed in still different settings; thus the resilient toggle may be used with switches of many other different types, and other features, such as the switches themselves and the terminal mountings may be used in switches having varied types of operating mechanisms. Accordingly, it is desired that the invention be not limited to the particular structures illustrated, but be given a broader scope.

I claim as my invention:

1. A switch comprising, separable contacts, operating means for said contacts including a non-metallic mass of resilient material which is mounted for pivotal overcenter movement, and operating means mounted for movement in a different manner for moving said material overcenter while stressing the same to move said contacts and operating means to open or closed circuit position with a rapid action and to maintain them at the position to which they are moved.

2. A switch comprising, separable contacts, operating means for said contacts including a non-metallic mass of resilient material which is mounted for pivotal overcenter movement, and an operating lever pivotally engaging said material for moving it overcenter while stressing the same to move said contacts and operating means to open or closed circuit position with a rapid action and to maintain them at the position to which they are moved.

3. A switch comprising, separable contacts, operating means for said contacts including a plastic-elastic mass of material which is mounted for pivotal overcenter movement, operating means mounted for movement in a different manner for moving said material overcenter while stressing the same to move said contacts and operating means to open or closed circuit position with fast action and to maintain them at the position to which they are moved, and said mass having integral stop portions for limiting movement of said switch at the open and closed circuit positions, respectively.

4. A switch comprising, a pair of toggle levers one of which comprises a non-metallic, plastic-elastic mass of compressible material, and separable contacts which are moved into and out of engagement by movement of said toggle levers overcenter in opposite directions, respectively.

5. A switch comprising, a pair of toggle levers one of which comprises a non-metallic, plastic-elastic mass of compressible resilient material, and the other of which includes an operating handle extension, and separable contacts which are moved into and out of engagement by movement of said toggle levers overcenter in opposite directions, respectively.

6. A switch comprising, a pair of toggle levers one of which comprises a mass of compressible resilient material, cooperating stop portions on said levers, respectively, for limiting the overcenter movement thereof in both directions, and separable contacts which are moved into and out of engagement by movement of said toggle levers overcenter in opposite directions, respectively.

7. A switch comprising, separable contacts, operating means for said contacts including a block of flexible and resilient material having opposed faces, rigid pivot bearing means attached to said opposite faces of the block, means pivotally supporting one of said bearing means, an operating lever pivotally engaging the other of said bearing means for moving said block overcenter in opposite directions while stressing the same and move said contacts to open or closed circuit position with a fast action.

8. A switch comprising, separable contacts, operating means for said contacts including a non-metallic mass of resilient material which is mounted for pivotal overcenter movement, and a pivoted operating lever pivotally engaging said material and having means for actuating said contacts and being operable to move said mass overcenter while stressing the same to move said contacts and operating means to open or closed circuit position with a fast action and to maintain them at the position to which they are moved.

9. A switch comprising, a casing of insulating material, separable contacts supported in said casing, an overcenter toggle mechanism mounted in said casing including a non-metallic resilient link and a toggle member having cam means engageable with one of said contacts for causing opening and closing of said contacts in response to movement of said toggle mechanism overcenter in opposite directions.

10. A switch comprising, a casing of insulating material, separable contacts supported in said casing, an overcenter toggle mechanism mounted in said casing including a plastic-elastic link and a pivoted operating handle of insulating material having integral cam means engageable with one of said contacts for causing opening and closing of said contacs in response to movement of said toggle mechanism overcenter in opposite directions.

11. A switch comprising, a casing of insulating material having an open side, said casing having spaced pas-

sageways, each of which extends at an angle to said open side adjacent one side thereof and is open at opposite ends to said open side and said one side, respectively, a terminal member adapted to be slidably received in each of said passageways, a rigid locking projection on one wall of each pasageway, each terminal member having a cooperating locking projection on a resilient portion thereof adapted to yield and slip past said rigid locking projection during insertion of each terminal member to prevent withdrawal thereof, separable switch contacts connected with said terminal members, respectively, and located in said casing outwardly of said terminal members, and an operating handle for said contacts pivotally mounted substantially at said open side of the casing.

12. A switch comprising, a casing of insulating material having an open side, said casing having spaced passageways, each of which extends at an angle to said open side adjacent one side thereof and is open at opposite ends to said open side and said one side, respectively, a terminal member adapted to be slidably received in each of said passageways, a rigid locking projection on one wall of each passageway, each terminal member having a cooperating locking projection on a resilient portion thereof adapted to yield and slip past said rigid locking projection during insertion of each terminal member to prevent withdrawal thereof, and separable switch contacts rigidly mounted on said terminal members, respectively.

13. A switch comprising, a casing of insulating material having an open side, said casing having spaced passageways, each of which extends at an angle to said open side adjacent one side thereof and is open at opposite ends to said open side and said one side, respectively, a terminal member adapted to be slidably received in each of said passageways from the open side of the casing, said casing having integral stop means limiting inward sliding movement of said terminal members, a rigid locking projection on one wall of each passageway, each terminal member having a cooperating locking projection on a resilient portion thereof adapted to yield and slip past said rigid locking projection during insertion of each terminal member when inward movement of said terminal members is stopped by said stop means, to thereby rigidly maintain said terminal members at predetermined positions in said casing.

14. A switch comprising, a casing of insulating material having an open side, said casing having spaced passageways, each of which extends at an angle to said open side adjacent one side thereof and is open at opposite ends to said open side and said one side, respectively, a terminal member adapted to be slidably received in each of said passageways, a rigid locking projection on one wall of each passageway, each terminal member having a cooperating locking projection on a resilient portion thereof adapted to yield and slip past said rigid locking projection during insertion of each terminal member to prevent withdrawal thereof, and separable switch contacts rigidly mounted on said terminal members, respectively, one of said contacts being biased to engage the other under pressure, and means integral with said casing limiting separating movement of said contacts.

15. A switch comprising, a casing of insulating material having an open side, said casing having spaced passageways, each of which extends at an angle to said open side adjacent one side thereof and is open at opposite ends to said open side and said one side, respectively, a terminal member adapted to be slidably received in each of said passageways, a rigid locking projection on at least one side wall of each passageway, each terminal member having a split inner end forming yieldable legs, one of which carries a cooperating locking projection adapted to yield and slip past said rigid locking projection during insertion of each terminal member to prevent withdrawal thereof.

16. A switch comprising, a casing of insulating material having an open side, said casing having spaced passageways, each of which extends at an angle to said open side adjacent one side thereof and is open at opposite ends to said open side and said one side, respectively, a terminal member adapted to be slidably received in each of said passageways, a rigid locking projection on at least one side wall of each passageway, each terminal member having a split inner end forming yieldable legs, one of which carries a cooperating locking projection adapted to yield and slip past said rigid locking projection during insertion of each terminal member to prevent withdrawal thereof, the inner end of each terminal member being exposed at the outside of the adjacent side wall of the casing, a depression in the casing beneath the inner end of each terminal member for receiving a nut, and a terminal screw received between the yieldable legs of each terminal member to threadedly engage its corresponding nut.

17. A switch comprising, a casing of insulating material having an open side, said casing having spaced passageways, each of which extends at an angle to said open side adjacent one side thereof and is open at opposite ends to said open side and said one side, respectively, a terminal member adapted to be slidably received in each of said passageways, a rigid locking projection on at least one side wall of each passageway, each terminal member having a split inner end forming a keyhole slot forming yieldable legs, one of which carries a cooperating locking projection adapted to yield and slip past said rigid locking projection during insertion of each terminal member to prevent withdrawal thereof, the inner end of each terminal member being exposed at the outside of the adjacent side wall of the casing, a depression in the casing beneath the inner end of each terminal member for receiving a nut, and a terminal screw threadedly engaging said nut and being forced into the inner portion of said keyhole slot during insertion of said terminal member.

18. A switch comprising, a casing of insulating material having an open side, said casing having spaced passageways, each of which extends at an angle to said open side adjacent one side thereof and is open at opposite ends to said open side and said one side, respectively, a terminal member adapted to be slidably received in each of said passageways, a rigid locking projection on opposite side walls of each passageway, each terminal member having a split inner end forming yieldable legs each carrying a cooperating locking projection adapted to yield and slip past said rigid locking projection during insertion of each terminal member to prevent withdrawal thereof.

19. A switch comprising, separable contacts, operating means for said contacts including a block of flexible and resilient material having opposed faces, rigid pivot bearing means attached to said opposite faces of said block, supporting means pivotally engaging one of said bearing means, an operating lever pivotally engaging the other of said bearing means for moving said block overcenter in opposite directions while stressing the same and moving said contacts to open or closed circuit position with a fast action, and spaced integral rigid stops on said supporting means for engaging said block to limit movement of said block in opposite directions.

20. A switch comprising, separable contacts, operating means for said contacts including a block of flexible and resilient material having opposed faces, rigid pivot bearing means attached to said opposite faces of the block, means pivotally supporting one of said bearing means, a rigid operating lever pivotally engaging the other of said bearing means for moving said block overcenter in opposite directions while stressing the same and move said contacts to open or closed circuit position with a fast action, and said lever having spaced integral portions located to engage said block to limit the movement of said block in opposite directions.

21. A switch comprising, separable contacts, operating means for said contacts including a block of flexible and resilient material having opposed faces, rigid pivot bearing means attached to said opposite faces of said block,

supporting means pivotally engaging one of said bearing means, a rigid operating lever pivotally engaging the other of said bearing means for moving said block over-center in opposite directions while stressing the same and moving said contacts to open or closed circuit position with a fast action, and spaced integral rigid stop portions on said supporting means and said lever for engaging said block to limit movement of said block and handle in opposite directions.

22. A switch comprising, a casing of insulating material having an open side, said casing having spaced passageways, each of which extends at an angle to said open side adjacent one side thereof and is open at opposite ends to said open side and said one side, respectively, terminal members adapted to be slidably received in said passageways, respectively, from the open side of the casing, each of said terminal members having a flat terminal portion in the plane of said sliding movement and an inner U-shaped portion having the outer end of one leg thereof integral with the inner end of said terminal portion and contact means on the other leg thereof, a stop abutment integral with said casing positioned to engage the U-shaped portion of a terminal member adjacent the bight portion thereof to limit the aforesaid inward sliding movement thereof to an operative position where its terminal portion is closely adjacent to and exposed through the opening in its passageway at said one side of the casing, abutment means integral with the casing engaging the terminal portions of said terminal members at their operative positions for preventing lateral movement thereof, and means on the terminal portion of each terminal member engaging portions of said casing adjacent thereto at least at the operative positions of said terminal members for preventing sliding movement in the reverse direction to withdraw said terminal members from said casing.

23. A switch comprising, a casing of insulating material having an open side, said casing having spaced passageways, each of which extends at an angle to said open side adjacent one side thereof and is open at opposite ends to said open side and said one side, respectively, terminal members adapted to be slidably received in said passageways, respectively, from the open side of the casing, each of said terminal members having a flat terminal portion in the plane of said sliding movement and an inner U-shaped portion having the outer end of one leg thereof integral with the inner end of said terminal portion and contact means on the other leg thereof, a stop abutment integral with said casing positioned to engage the U-shaped portion of a terminal member adjacent the bight portion thereof to limit the aforesaid inward sliding movement to an operative position where its terminal portion is closely adjacent to and exposed through the opening in its passageway at said one side of the casing, abutment means integral with the casing engaging the terminal portion of each terminal member at their operative positions for preventing lateral movement thereof, and means on the terminal portion of each terminal member engaging portions of said casing adjacent thereto at least at the operative positions of said terminal members for preventing sliding movement in the reverse direction to withdraw said terminal members from said casing.

24. A switch comprising, a hollow casing of insulating material having an open front, said casing having spaced passageways, each of which extends at an angle to said open front adjacent one side of the casing and is open only at opposite ends to said open front and said one side, respectively, terminal members adapted to be slidably received in said passageways, respectively, from the open front of the casing each of said terminal members having a flat inner end terminal portion in the plane of said sliding movement and at the outer end having contact means thereon, means for limiting insertion of each of said terminal members in its respective passageway to an operative position where its flat inner terminal portion is exposed at said one side of the casing and its contact means is located within the casing adjacent said open front, and the side edges of said terminal portion cooperating with adjacent portions of said casing to prevent withdrawal of said terminal members.

25. A switch comprising, a hollow casing of insulating material having an open front, said casing having spaced passageways, each of which extends at an angle to said open front adjacent one side of the casing and is open only at opposite ends to said open front and said one side, respectively, terminal members adapted to be slidably received in said passageways, respectively, from the open front of the casing, each of said terminal members having a flat inner end terminal portion in the plane of said sliding movement and at the other end having contact means thereon, means for limiting insertion of each of said terminal members in its respective passageway to an operative position where its flat inner terminal portion is exposed at said one side of the casing and its contact means is located within the casing adjacent said open front, each of said flat inner terminal portions having a slot extending inwardly from the outer end thereof for receiving a terminal screw located in the end of its passage which is open at said one side of the casing during insertion of the terminal members, and means for securing said terminal members at their operative positions.

26. A switch comprising, a hollow casing of insulating material having an open front, said casing having spaced passageways, each of which extends at an angle to said open front adjacent one side of the casing and is open only at opposite ends to said open front and said one side, respectively, terminal members adapted to be slidably received in said passageways, respectively, from the open front of the casing, each of said terminal members having a flat inner end terminal portion in the plane of said sliding movement and at the other end having contact means thereon, means for limiting insertion of each of said terminal members in its respective passageway to an operative position where its flat inner terminal portion is exposed at said one side of the casing and its contact means is located within the casing adjacent said open front, each of said flat inner terminal portions having a slot extending inwardly from the outer end thereof, a terminal screw having a head and a captive nut located in the end of each passage which is open at said one side of the casing so that the shank of each screw is received in the slot in the corresponding terminal portion during insertion of its terminal member into its passageway, and means for securing said terminal members at their operative positions.

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