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3,348,010

TRIGGER OPERATED TOOL HANDLE SWITCH

Filed Oct. 24, 1965

2 Sheets-Sheet 1

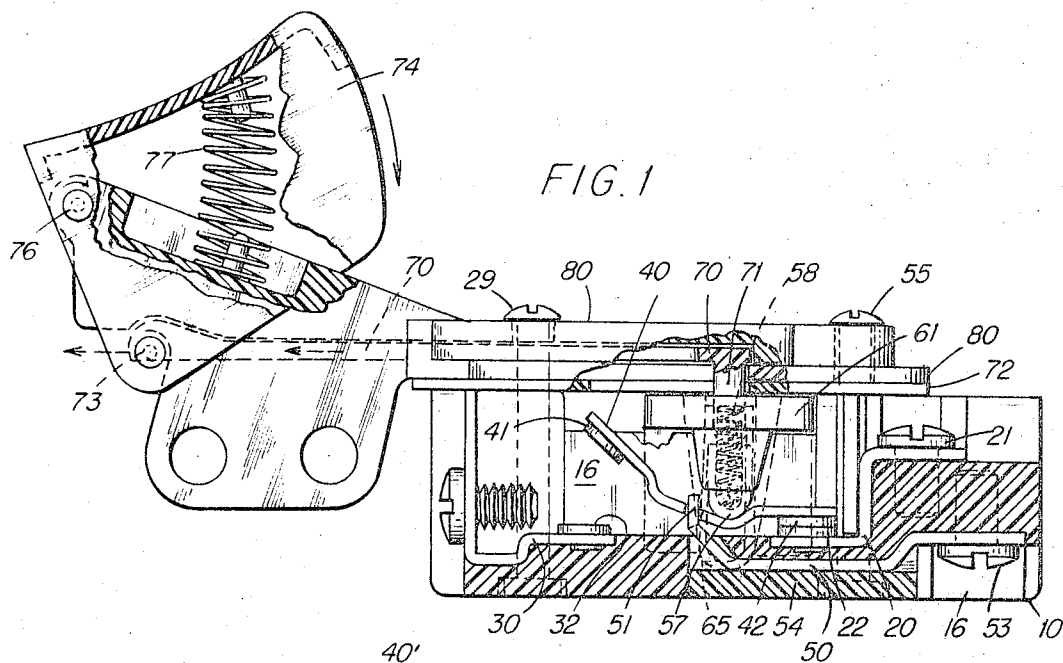
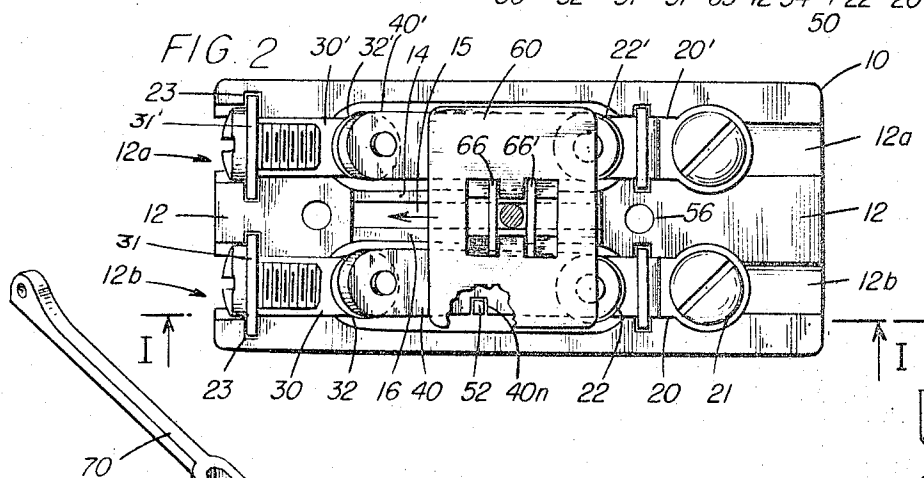


FIG. 3

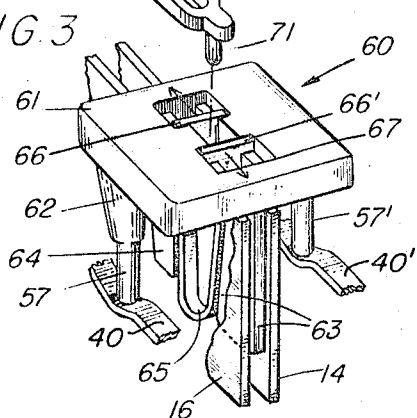
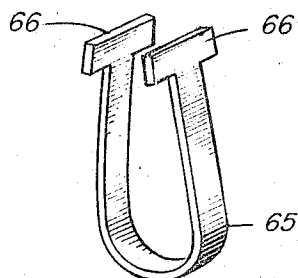


FIG. 4

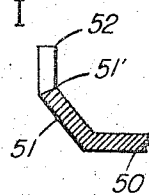


FIG. 5

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FIG. 6

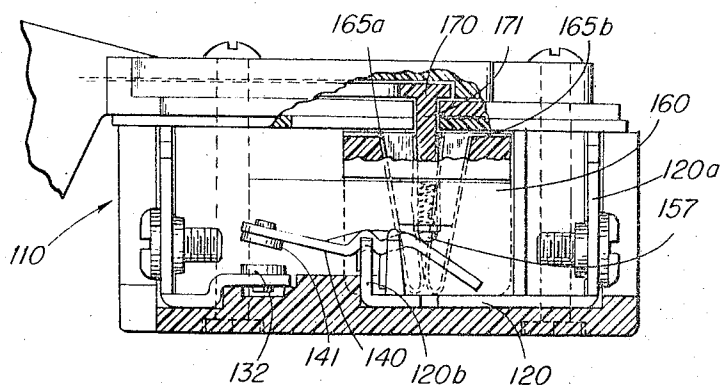


FIG. 7

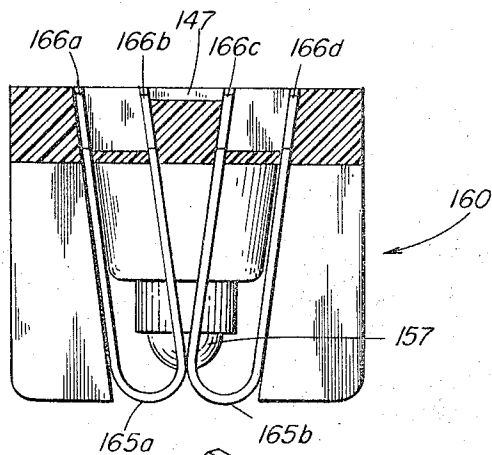
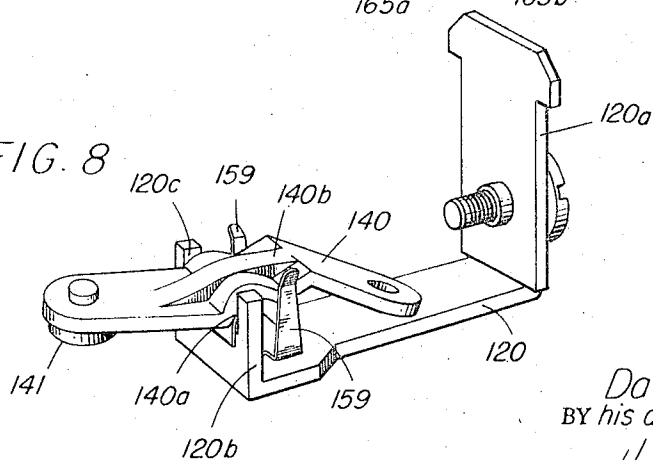


FIG. 8



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TRIGGER OPERATED TOOL HANDLE SWITCH
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15 Claims. (Cl. 200—157)

ABSTRACT OF THE DISCLOSURE

An electric switch, particularly suited for use in tool handles, operated by a trigger member whose movement tensions U-shaped spring means, one part or the other of which engages and moves a contact carrying cradle when the spring tension is sufficiently built up by trigger movement. The spring means may include one or two such springs.

This application is a continuation-in-part of my copending application Ser. No. 356,099 filed Mar. 31, 1964, now abandoned.

This invention relates to electric switches and, more particularly, to electric switches operable by pressure on a finger piece or trigger available outside of the handle or casing of the electric device controlled by the switch while the switch is contained inside the housing or handle. The invention also relates to such switches which are capable of 20 ampere 125 volt ratings.

Switches for use in tool handles heretofore have either had lower ratings than the present invention, or were too large for use in tool handles of usual size, or could be held in dead-center position. Sometimes prior switches suffered all of these disadvantages.

Therefore, one object of this invention is to produce a compact double-pole, single or double-throw switch with butt-type contacts capable of a rating of 20 amperes at 125 volts A.C. and capable of use also in many applications of direct current work.

Another object is to provide a switch having the above characteristics which will not hang on a dead-center position.

Another object is to produce a switch having the above characteristics which can be made small enough to fit conveniently into the handle of a portable tool of usual size.

Other objects and advantages of the invention will appear as it is described in connection with the accompanying drawing.

In the drawing:

FIG. 1 is a side elevation view of a switch embodying the invention, partly broken away and partly in section along line I—I of FIG. 2.

FIG. 2 is a top plan view of the invention as embodied in FIG. 1 with the cover and actuating mechanism removed.

FIG. 3 is a perspective view of certain details of the movable contact operating parts.

FIG. 4 is a detail perspective view of the spring used to move the movable switch contact from one position to another.

FIG. 5 is an enlarged detail view, partly in section, of a portion of the combined fulcrum and contact member.

FIG. 6 is a view in side elevation partly cut away and partly in vertical section of a modified form of the switch shown in FIGS. 1-5.

FIG. 7 is a view in vertical section of the operating cradle and spring of the switch of FIG. 6.

FIG. 8 is a perspective view of the movable contact assembly of the modified form of the switch shown in FIG. 6.

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Referring to the drawing, the switch contacts and their associated parts are housed in an insulating base or casing 10 made of molded insulating material and hollowed out for the reception of the fixed and movable contacts, their associated parts and wire terminals. The casing is symmetrically formed with a central spine or dividing wall 12 on each side of which is a recess, such as 12a and 12b running the length of the casing but of irregular depth along it. The dividing wall 12 is solid except for its midportion which comprises a pair of parallel thin walls 14 and 16 between which is a narrow longitudinal recess 15 to receive and guide the movement of a contact carrier or operating cradle, as hereinafter fully described.

In the longitudinal recesses 12a and 12b at each end of the casing is a pair of combined fixed contact-and-terminal members 20, 20' and 30, 30'.

The members 20, 20' are of Z-shape, each having a terminal screw 21 or 21' in its upper outwardly extending portion and a butt-contact button 22 or 22' on the upper surface of its lower inwardly extending portion at the floor level of the casing.

The members 30, 30' are of substantially L-shape, each having an upstanding leg 31 or 31' slidable into place in the casing with its edges fitting into oppositely facing slots 23 in the side walls of the end portion of the left end (as viewed in FIG. 2) of the longitudinal recesses 12a and 12b.

The other leg of each member 30, 30' extends inwardly and lies on the floor of the casing and has a butt-contact button 32 or 32' mounted on its upper surface.

The movable contact members 40, 40' are tiltably mounted in the midportion of each of the longitudinal recesses 12a and 12b. On the lower surface at each end of each movable contact member is mounted a butt-contact button such as 41 and 42 for engagement with the fixed contacts 32, 22, respectively, and in alternation so that when buttons 42, 22 are engaged, 41, 32 are disengaged.

To support the movable contact members tiltably at their midpoints, combined contact and fulcrum members 50 and 50' are provided beneath the floor of the casing in recesses formed in the bottom outside surface of the casing beneath the fixed contact members 20, 20' and extending into a point midway between the buttons (such as 22, 32). The inner end 51 of the fulcrum members are extended upwardly through an aperture in the floor of the casing to afford a fulcrum 51' about which the movable contacts can tilt. Preferably the movable contacts have notches, such as 40n, in opposite side edges at their midpoints; and the fulcrum ends are bifurcated so that the bifurcations such as 52 fit into the notches as the movable contact member is assembled on the fulcrum point.

Preferably the movable contact and terminal members as well as the combined fulcrum and terminal member are all stamped from sheet metal.

The fulcrum end is bent up from the midportion of the member 50 first obliquely and then perpendicularly to the floor of the casing. Since the fulcrum and contact member 50 is first stamped from flat sheet metal with the bifurcations formed in one end thereof and then is bent into the form illustrated in FIGS. 1 and 5, a peak or knife edge 51' is thus presented upon which the movable contact member rests.

At the opposite end of the member 50 from the fulcrum, terminal screws, such as 53, are mounted.

The fulcrum members are held in place in the bottom recesses by a stamped sheet insulation plate 54 which extends across the casing in a recess in the bottom surface of the casing and lies flush against the midportion of both of the combined fulcrum and terminal members. The plate 54 is held by a screwbolt 55 or rivet, or other securing means that passes through a bore 56 in the casing and

through a casting or frame member 80 which is held over the upper surface of the casing.

In order to cause the movable contacts to tilt simultaneously, a pair of hollow cylindrical insulating members or sliders 57, 57', each having one semi-spherical closed end, are slid along the upper surface of each of the movable contact members from one side to the other of the fulcrum points 51' of the movable contact supports.

The semi-spherical ends of the sliders 57, 57' provide substantially point contacts with the surface of the movable contact members 40, 40' to minimize friction and minimize the possibility of the holding of the movable contact on dead-center. The insulating sliders 57, 57' are resiliently pressed against the tiltable contact members by coiled compression springs, such as 58, one end of which seats in a hollow upper end of the sliders 57, 57' while the opposite ends of the springs are seated in wells in opposite sides of an operating cradle designated generally by the numeral 60.

The operating cradle is molded from insulating material with a top plate 61 positioned across the top of the casing 10 parallel to the casing floor. Depending from the under surface near opposite edges of the plate 61 are projections 62 which contain the circular wells into which the upper ends of springs 58 seat. The diameter of the wells is sufficient to permit the sliders to telescope into the projections when the switch is assembled and to be guided by the walls of the projection as the slider moves toward and from the operating cradle during the movement of the sliders over the surface of the movable contacts.

Between the projection 62 in a single medial longitudinal plane perpendicular to the plate 61 are two flat plate-like legs 63, 64 which are adapted to fit between the parallel divisions 14 and 16 of the central wall or spine 12 of the casing so as to be guided thereby as the operating cradle is moved longitudinally of the casing.

In order to move the operating cradle and sliders with a quick make and break action over the fulcrum line, a U-shaped spring 65 is mounted on the operating cradle between the legs 62 and 63. The U-spring is stamped from flat spring metal into the shape best illustrated in FIG. 4 with T-shaped heads 66, 66'. The spring is mounted on the operating cradle by insertion through an I-shaped aperture 67 running lengthwise of the casing in the center of the top plate of the cradle. The central portion of the "I" passes entirely through the plate portion 61 of the operating cradle, but the lateral portions of the "I" pass only partway through the plate portion 61, thus forming shoulders which the lateral extensions of the heads 66, 66' of the spring come to rest.

Due to the central part of the aperture passing entirely through the plate portion 61 of the operating cradle, the T-heads 66, 66' of the U-spring are permitted limited movement (as shown by the small arrows in FIG. 3) within the aperture.

Finger pressure is transmitted to one or the other of the T-heads of the spring by a small finger 71 which projects downwardly from the end of an actuating link 70 into the space between the T-heads of the spring. The link 70 extends longitudinally along and over the top of an insulating liner plate 72 that lies on top of the casing and covers the open portion of the top surface of the casing. The link 70 is connected at one end by a pin 73 to a pivoted finger piece or trigger 74 of conventional form which is, in turn, pivotally mounted on a molded insulation frame member 80 by a pin 76.

The frame 80 is formed with a hollow portion overlying the top insulation plate 72 and providing a passageway between that plate and the frame in which the link 70 can move longitudinally as the trigger 74 is pressed and released. To return the trigger, link, cradle and movable switch contacts to initial position, a coiled compression return spring 77 of conventional form is provided between the trigger and the frame.

For securing the frame upon the casing, there is provided, in addition to the securing bolt or means 55, another securing bolt or conventional securing means 79 which passes through apertures and passages in the frame 80, the liner plate 72 and base 10.

From the foregoing, it will be apparent that the invention provides a trigger-operating switch which can be made small enough to fit in a portable tool handle and which embodies butt-type contacts suitable for higher current ratings than switches for similar use heretofore. The switch has provision for double-pole double-throw action of tiltable type movable contacts by the action of a slidable operating member. The movable contact has a knife-edge fulcrum and point-contact of the operating member or slider to insure quick change from one position to the other of the movable contact without the possibility of hanging the movable contact on dead-center position.

In moving the switch from the position of FIG. 1, as the trigger is depressed, the actuating finger 71 is pressed against the head 66 of the spring 65 and bends it to the left (FIGS. 1, 2 and 3). This imposes stress on the other arm of the U-spring and causes its head 66' to press against the operating cradle without the equalizing pressure of the other head 66, thus tending to move the cradle to the left. The cradle 60 does not move immediately, however, because of the inertia of the system and the frictional engagement of sliders 57, 57' against the central portions of the movable contacts 40, 40'. As the spring 65 is increasingly distended however, the force exerted by the head 66' on the cradle 60 increases, eventually overcoming the inertia and frictional forces tending to keep the cradle at rest. Once the cradle starts to move it is accelerated by spring 65. The sliders 57, 57' ride over the fulcrum and compress the springs 58. The movable contacts 40, 40' then tilt with a snap action from the position of FIG. 1 to the position wherein the contact buttons 41, 41' engage fixed contact buttons 32, 32'.

The strength of spring 65 should be adequate to overcome the forces resisting movement of the slide 60, namely friction of the sliders 57, 57' and compressive resistance of springs 58, when the left arm is bent just to the maximum allowable within the I shaped aperture in cradle 60; but even if it is not and the positive push unparted when finger 71 pushes head 66 against the left end of the I shaped aperture starts the cradle moving, a snap action takes place under the influence of spring 65 once the cradle has started to move. The spring 65 insures snap action; without it snap action does not occur.

On release of the trigger, the return spring 77 will return the trigger to the position of FIG. 1 and reverse action of the operating cradle 60 will cause the movable contacts to return to the FIG. 1 position.

Turning now to FIGS. 6 to 8, in the figures a modified form of the invention is shown. The embodiment of FIGS. 6 and 7 is very similar to that of FIGS. 1 to 5 but differs from the embodiment of FIGS. 1-5 in two ways; first in that two U shaped springs are used instead of one and second in that the switch is a single throw switch and the movable contacts are therefore of somewhat different construction. The use of two U springs instead of one results in a substantial extension of operating life.

As shown best in FIG. 7, the cradle 160 is identical with cradle 60 of FIGS. 1-5, but has two U shaped springs 165a and 165b. The springs 165a, 165b are identical in shape to spring 65 of FIGS. 1 to 5, and have T-shaped heads 166a-d. The spring 165a is positioned in the left hand portion (as viewed in FIG. 7) of the I shaped slot 147 of cradle 160; the spring 165b in the right hand portion. The function of the springs 165a and b is very similar to the function of the spring 65 in FIGS. 1 to 5; that is to say as the link 170 (identical with link 70 of FIGS. 1 to 5) moves to the left in FIG. 6, its finger 171 moves the T shaped head 166b to the left. The spring 165a is thus compressed. T-shaped head 166a pushes against the left side of the cradle 160, and when

the force engendered by bending of the spring is sufficient to overcome frictional forces, the cradle is moved with a swift movement to the left causing snap closing of contacts 132 and 141. The same action occurs in reverse, when the link 170 is moved to the right in FIG. 6. In that case reaction of T-shaped head 166d causes snap disengagement of contacts 132 and 141.

The fixed and movable contact structure shown in FIGS. 6 and 8 is also somewhat different than that shown in FIGS. 1 to 5. The embodiment illustrated in FIGS. 6 and 7 is a single throw contact. Thus contacts are closed when the link 170 is in the left hand position in FIGS. 6 and 7 but no contact is closed when the link 170 is in the extreme right hand portion which is the position shown in FIG. 6.

The movable contacts such as 140 of switch 109 are each provided at one end with a contact button 141 to engage fixed contacts such as 132. The other end of the movable contact is bent downwardly as viewed in FIG. 6 to engage carrier plate 120 and thus limit the travel of the contact. The carrier plate 120 has a positioning leg 120a which is held in slots (not shown) in casing 110 and a fulcrum leg 120b. In a square notch 120c in the latter, the movable contact 140 is balanced, rounded rocker notches 140a being built into the moving contact to cooperate with the notch 120c in leg 120a. The carrier plate 120 is also provided with brush fingers such as 159 of the same nature as is disclosed in the copending application of Harold E. Schleicher, S.N. 438,583, filed Mar. 10, 1965 patented Apr. 4, 1967, No. 3,312,801, to improve the electrical connection between the carrier plate 120 and the movable contact 140. Two of these fingers are provided, one on either side of the movable contact. They press against the sides of the contact, assisting in centering it and maintaining self cleaning rubbing engagement with it.

Operation of the switch shown in FIGS. 6 to 8 is believed obvious. As the slide 160 is moved to the left in FIG. 6, the spring loaded sliders 157 ride over a switch track 140b formed on the upper surface of movable contact 140. The reinforcing action of spring 165a comes into play as described above, causing snap contact between contact button 141 and fixed contact button 132. When slide 160 is returned to the right in FIG. 6 the reverse occurs and the bent end of contact 140 is snapped against the carrier plate 120, separating contact buttons 141 and 132.

Many modifications within the scope of the invention will occur to those skilled in the art. Therefore, the invention is not limited to the specific embodiment illustrated and described.

What is claimed is:

1. In an electric switch, an insulating casing, fixed contact means in said casing, movable contact means engageable and disengageable with said fixed contact means, a slidable operating members engaging with said movable contact means, a manually operable actuating member movable to and fro, and U-shaped spring means having arms engaged with said slidable operating member and engageable selectively by said actuating member as the latter is moved to and fro, said spring means being stressed by manual movement of said actuating member which causes engagement of one spring arm or another, said spring means upon becoming sufficiently stressed causing said movable contact means to engage or disengage said fixed contact means.

2. In an electric switch, an insulating casing, fixed contact means in said casing, movable contact means engageable and disengageable with said fixed contact means, slidable operating means slidably engaging with and slidable over the surface of said movable contact means, manually operable actuating means movable to and fro, and U-shaped spring means having arms engaged with said slidable operating means and engageable selectively by said actuating means, said spring means

being stressed by manual movement of said actuating means which causes engagement of one spring arm or another, said spring means upon becoming sufficiently stressed causing said movable contact means to engage or disengage said fixed contact means.

3. In an electric switch, an insulating casing, fixed contact means in said casing, tiltable contact means in said casing tiltable to engage and disengage said fixed contact means, slidable operating means slidable over the surface of said tiltable contact means to cause engagement and disengagement of said fixed contact means, manually operable actuating means, U-shaped spring means having arms engaged with said slidable operating means and engageable selectively with said actuating means, said spring means being stressed by manual movement of said actuating means which causes engagement of one spring arm or another, said spring means upon becoming sufficiently stressed causing said movable contact means to engage or disengage said fixed contact means.

4. In an electric switch, an insulating casing, fixed contact means in said casing, tiltable contact means in said casing tiltable to engage and disengage said fixed contact means, a terminal member having a fulcrum portion in the floor of said casing with a knife edge supporting said tiltable contact means, slidable operating means slidable over the surface of said tiltable contact means to cause engagement and disengagement of said fixed contact means, manually operable actuating means, a U-shaped spring member having arms engaged with said slidable operating means and engageable selectively with said actuating means, said spring member being stressed by manual movement of said actuating member which causes engagement of one spring arm or another, said spring means upon becoming sufficiently stressed causing said movable contact means to engage or disengage said fixed contact means.

5. An electric switch as claimed in claim 3 in which the slidable operating means comprises a member guided by the casing during its sliding movement, and a resiliently mounted slider slidable over the movable contact means.

6. A double-pole electric switch as claimed in claim 3 having a central dividing wall in said casing with contact means on each side thereof, said slidable operating means comprising a means having guide means engaged with said wall and guided thereby.

7. A double-pole switch as claimed in claim 6 wherein said central wall comprises spaced parallel plates extending at least part of its length, said guide means and U-spring means being located within the space between said plates.

8. A double-pole electric switch as claimed in claim 3 having a central dividing wall in said casing with contact means on each side thereof, said slidable operating means comprising a member having guide means engaged with said wall and guided thereby and a resiliently mounted slider on each side of said wall slidable over the movable contact means.

9. An electric switch as claimed in claim 4 having a finger-operated member connected to said actuating means and operable to actuate said actuating means, said finger member being pivotally supported from the casing.

10. An electric switch as claimed in claim 3 having butt-type fixed contacts, and a terminal member having a fulcrum portion in the floor of said casing with a knife edge supporting said tiltable contact.

11. An electric switch as claimed in claim 10 in which the slidable operating means comprises a member guided by the casing during its sliding movement, and a resiliently mounted slider slidable over the movable contact means.

12. An electric switch as claimed in claim 1 and comprising two U-shaped spring members each engaged with said operating and actuating means, one of said spring

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members being stressed by movement of said actuating member in one direction and the other by movement of the actuating member in the opposite direction.

13. An electric switch as claimed in claim 3 and comprising two U-shaped spring members each engaged with said operating and actuating means, one of said spring members being stressed by movement of said actuating means in one direction and the other by movement of the actuating means in the opposite direction. 5

14. The switch claimed in claim 1 wherein the spring means comprises a single U-shaped spring, one leg of said spring being extendable by movement of the actuating member in one direction and the other by movement of the actuating means in the opposite direction. 10

15. The switch claimed in claim 3 wherein the spring 15

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means comprises a single U-shaped spring, one leg of said spring being extendable by movement of the actuating means in one direction and the other by movement of the actuating means in the opposite direction.

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