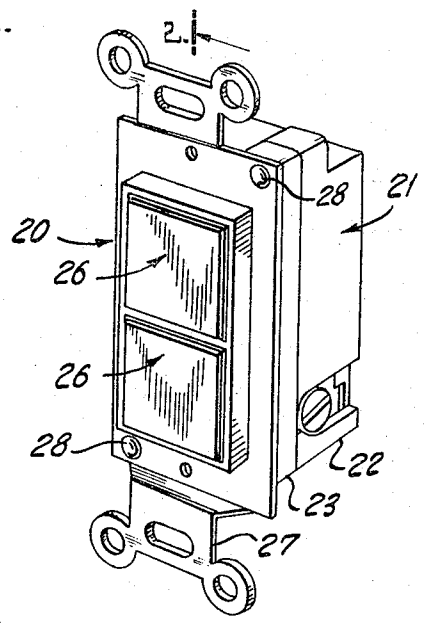
July 18, 1967 G. H. SMITH ETAL 3,331,933

PUSH-BUTTON TYPE OF ELECTRICAL SWITCH

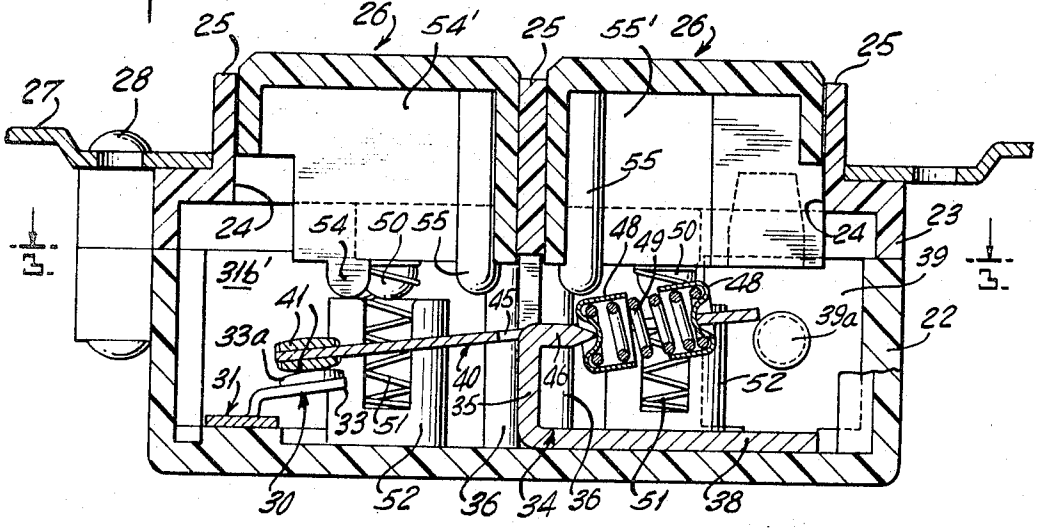
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Fig. 1.



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Fig. 2.



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PUSH-BUTTON TYPE OF ELECTRICAL SWITCH

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Fig. 3.

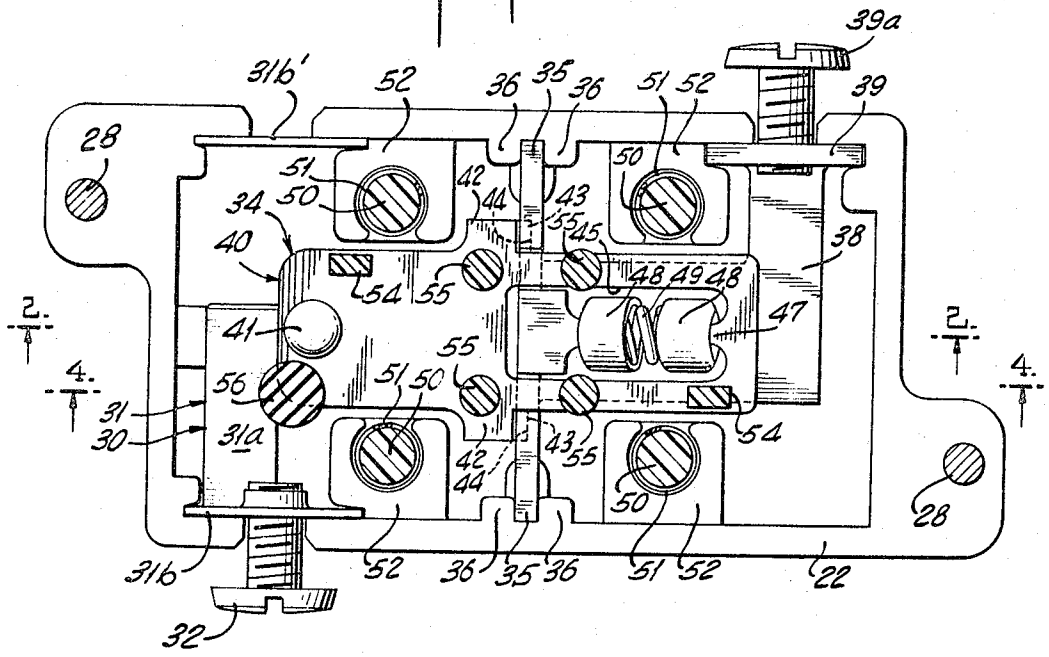
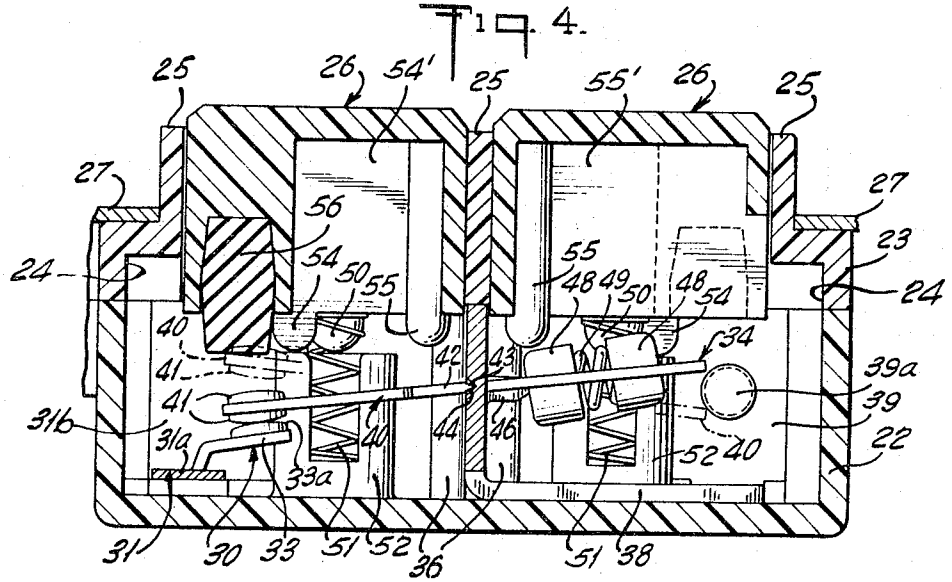


Fig. 4.



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Fig. 5.

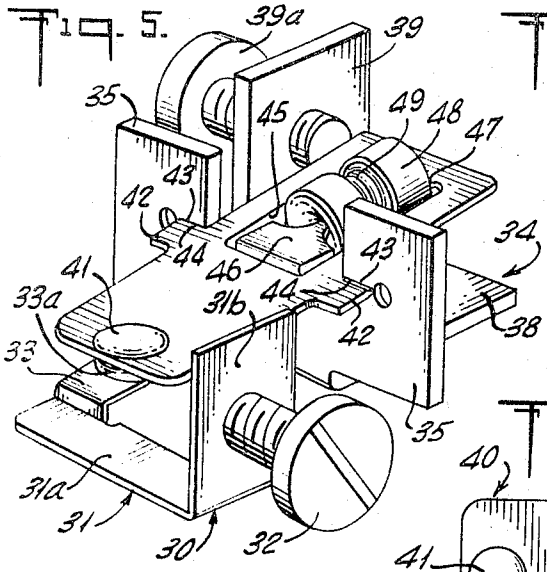


Fig. 6.

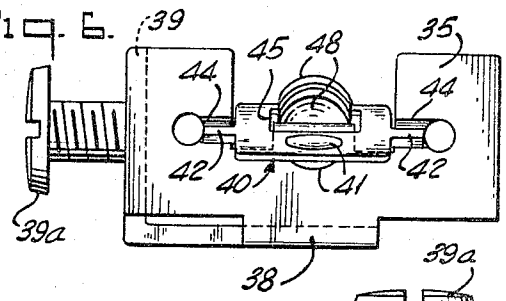


Fig. 7.

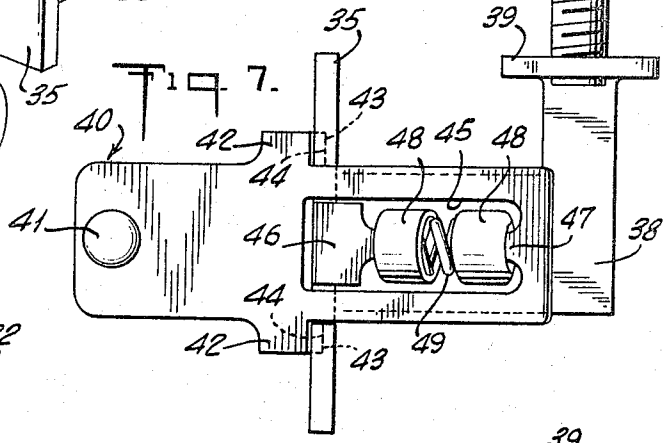


Fig. 11.

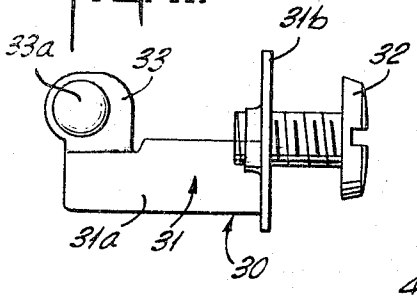


Fig. 8.

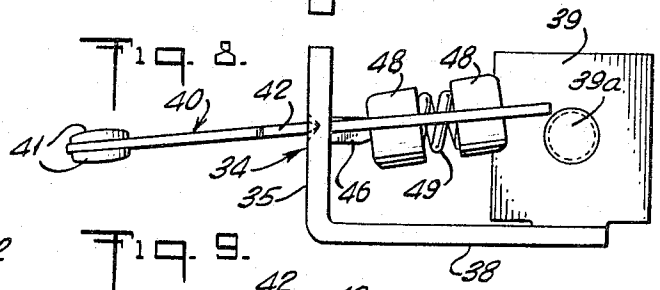


Fig. 12.

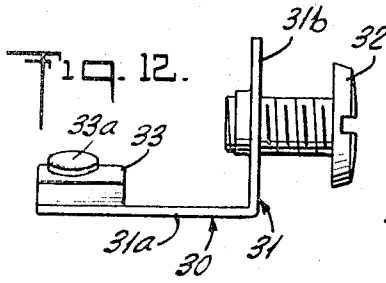


Fig. 9.

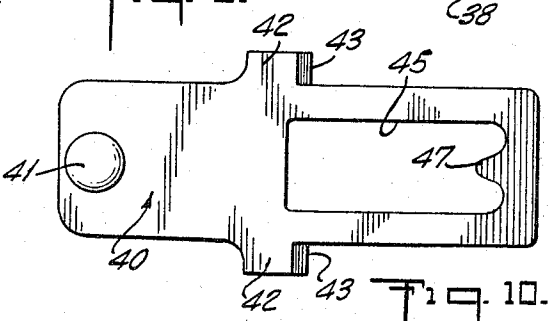


Fig. 13.

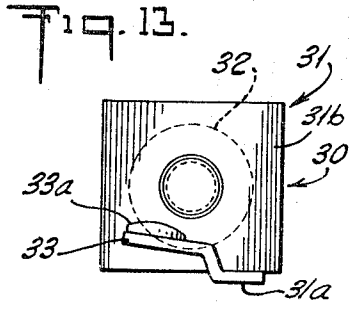
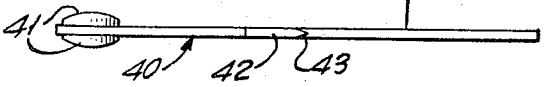


Fig. 10.



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PUSH-BUTTON TYPE OF ELECTRICAL SWITCH

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Fig. 14.

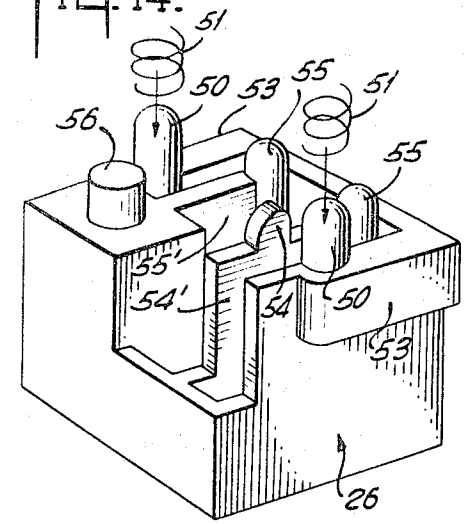


Fig. 15.

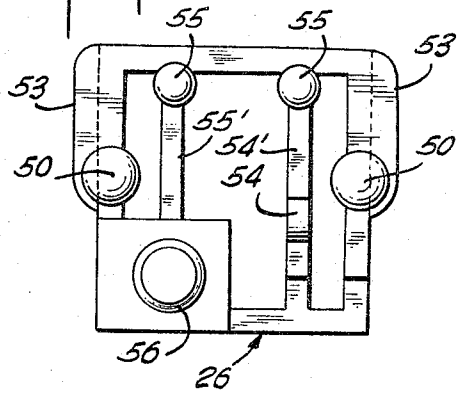


Fig. 16.

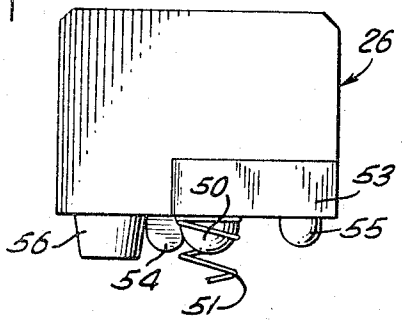


Fig. 17.

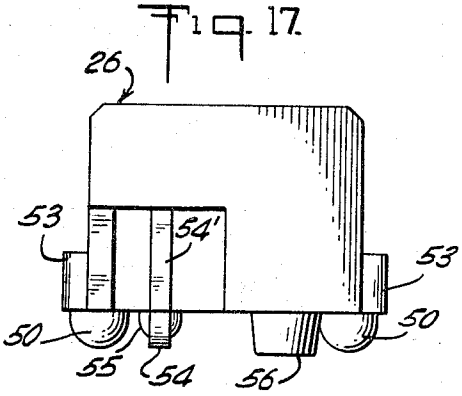
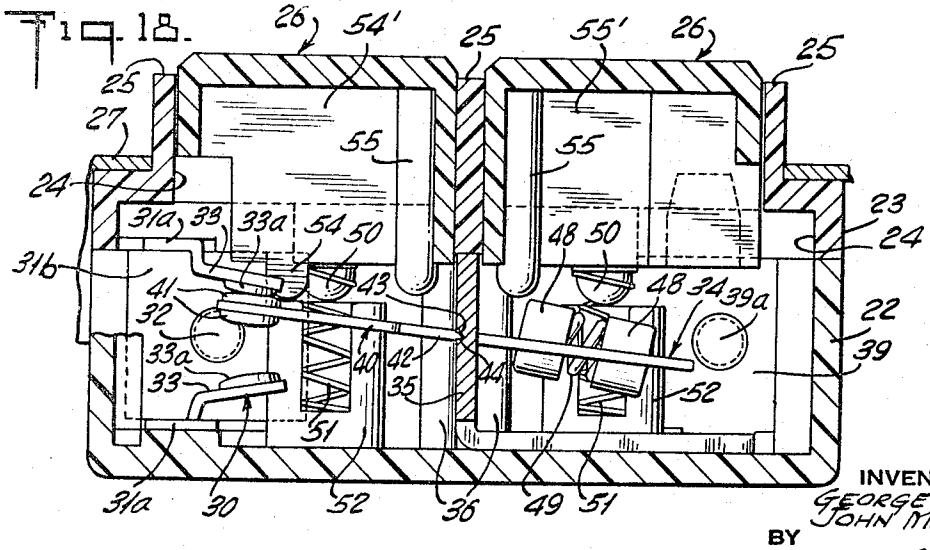


Fig. 18.



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3,331,933

PUSH-BUTTON TYPE OF ELECTRICAL SWITCH

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Filed Oct. 22, 1965, Ser. No. 501,053
19 Claims. (Cl. 200—67)

ABSTRACT OF THE DISCLOSURE

An electrical switch having a housing of insulating material in which a movable brush or contact-carrying member of electrically conductive material is pivotally mounted on a plate of conductive material with one end of the brush being arcuately movable into and out of engagement with one or more fixed contacts through engagement with the brush of manually depressible push buttons mounted in openings in the cover for the housing. The contact engaging end of the brush being biased toward the limits of its arcuate movement by a toggle spring interposed between the brush supporting plate and the other end of the brush.

The present invention relates to a push-button electric switch. It relates, more particularly, to a push-button switch of the quiet type for use in A.-C. circuits.

An object of the invention is to provide a push-button electrical switch which requires only a very light pressure on the push-button and a short movement of the push-button to operate the switch.

A further object of the invention is to provide a push-buton electric switch in which the construction and assembly of the various components of the switch, particularly the electrical components, has been greatly simplified and which does not require ratchets or the like to translate linear movement of the push-buttons into rotary movement.

Other objects and advantages of the invention will become apparent and be better understood from the following description and the accompanying drawings, in which:

FIG. 1 is a perspective view of a push-button type of electrical switch embodying the invention;

FIG. 2 is a side-elevational view in vertical section taken along the line 2—2 of FIG. 1, but is drawn to an enlarged scale;

FIG. 3 is a plan view in horizontal section taken along line 3—3 of FIG. 2;

FIG. 4 is a side-elevational view in vertical section of the switch shown in FIG. 1, with the section being taken along line 4—4 of FIG. 3;

FIG. 5 is a perspective view illustrating electrical components of the switch shown in FIG. 1 in their assembled relation;

FIGS. 6, 7 and 8 are an end view, plan view and side-elevational view in partial section, respectively, illustrating one of the assemblies of electrical components shown in FIG. 5;

FIGS. 9 and 10 are a plan view and side-elevational view, respectively, of a movable electrical contact element or brush forming part of the assembly shown in FIGS. 6–8;

FIGS. 11, 12 and 13, are a plan view, end view and side-elevational view, respectively, of a fixed electrical contact element and terminal forming one of the assemblies shown in FIG. 5;

FIG. 14 is a perspective view illustrating, in inverted position, one of the push-buttons employed in the switch shown in FIGS. 1, 2, and 4.

FIGS. 15, 16 and 17 are a bottom plan view, a side-elevational view, and an end elevational view, respectively, of the push-button shown in FIG. 14; and

FIG. 18 is a side-elevational view in vertical section corresponding generally to FIG. 2, but illustrating a modified form of electrical switch embodying the invention.

For the purposes of illustrating and describing the various components and assemblies thereof comprising a push-button electrical switch embodying the invention and the operation thereof, particular reference will be made to a single-pole, single-throw or two-way switch. However, it will be understood that the invention is not limited to such a switch, but may be utilized in other types of switches as shown for example in FIG. 18.

Referring now to the drawings and, in particular, to FIG. 1, there is an electrical switch designated generally by the reference numeral **20** comprising a hollow housing or body **21**. The housing may be formed of two parts; namely, a hollow base **22** and cover **23**, which are molded from the usual plastic insulating materials, such as a phenolic resin.

The base has a bottom and upstanding side walls which define a cavity shaped to receive and support the electrical components of the switch and assemblies thereof in their operating positions as will be described hereinafter. The cover extends over the cavity in the base and contains a pair of openings **24** which provide access to operating mechanisms of the switch which are located within the housing.

The openings in the cover are defined by upstanding or vertical walls **25** and the upper or closed end of a push-button **26** projects through each of the openings in the cover, with the sides of the push-buttons being in slidable engagement with the upstanding walls surrounding the respective openings. In the illustrated embodiment, the push-buttons and the openings in the cover are of rectangular configuration, but other configurations may be employed if desired. The push-buttons which are hollow, may also be molded from a suitable plastic insulating material and, as will be described, each of the push-buttons carries switch-actuating members on its lower surface in position to engage with and cause operation of the electrical components located within the housing when the push-button is depressed.

A metal strap **27** for supporting the switch in a wall box or the like, is mounted on top of the cover and has an opening therein through which the upstanding walls of the cover which surround the push-buttons project. The metal support strap and the cover are secured to the base by rivets **28** or the like which are located at opposite ends thereof. When the cover is secured to the base, it holds the electrical components of the switch in place within the housing.

For convenience in assembling the switch, the electrical components are formed as separate units for installation in the base. A fixed contact and terminal **30** forms one such unit. As shown best in FIGS. 11, 12 and 13, the fixed contact and terminal includes an L-shaped member **31** of electrically conductive material, such as brass, which has been formed into the desired configuration. The L-shaped member has a horizontally extending leg **31***a* and a vertically extending leb **31***b*. The vertical leg forms a terminal plate and has a terminal screw **32** threaded therein. However, other ways of making a connection thereto may be employed if desired.

The horizontal leg has a bent up tab **33** at its end and a silvered contact button **33***a* is mounted on the upper surface thereof. When installed in the base, the terminal plate extends vertically along a side wall of the base and in opposing relation to a slotted opening formed in the side wall. Projections formed on interior surfaces of the side wall define slots in which opposite side edges of the

terminal plate fit so as to hold the plate in placed and the slotted opening receives and provides access to the terminal screw.

The horizontal leg of the L-shaped member rests on and extends transversely across the bottom of the base at one end thereof to a position where the upwardly facing silvered contact button is located at the center of the base in a lengthwise direction.

It should be noted here that the fixed contact and terminal is of such configuration that it may be also installed in the housing body in an inverted position. For this purpose, a slotted opening is provided in an opposite wall of the base and the terminal plate of an inverted fixed contact will extend downwardly in opposing relation thereto. When not in use, this opening is closed by a blank **31***b*′ of insulating material corresponding in size and shape to the terminal plate. The horizontal or contact-carrying leg of an inverted contact extends laterally across the top of the cavity in the base and beneath the cover. A switch employing two fixed contacts and terminals which are inverted relative to each other is illustrated by the modification shown in FIG. 18. In such an arrangement, the contact buttons carried by the fixed contacts are positioned in opposing spaced relation at the center (lengthwise) of the base.

The remaining electrical components of the switch are also assembled as a unit **34**, as shown in FIGS. 6–8, for installation in the base of the housing. This unit includes a contact-supporting member and terminal of electrically conductive metal, such as brass, which has been formed into the desired configuration. The contact-supporting member and terminal comprises a vertical U-shaped plate **35**. When installed in the base, the U-shaped plate extends across the cavity in the base at the center thereof, as shown in FIGS. 3 and 4, with the open end of the U facing upwardly and with the lower or closed end thereof resting on the bottom of the base. Spaced projections **36** extending inwardly from opposite sides of the base define slots into which the edges at opposite sides of the U-shaped plate fit with the plate being held in upright or vertical position.

A connecting strip **38** extends rearwardly from the bottom of the U-shaped plate along the bottom of the base and a terminal plate **39** extends upwardly from the end of the strip in opposing relation to another slotted opening formed in a side wall of the base. The connecting strip and terminal plate are formed as part of the U-shaped plate. The side edges of the terminal plate are also slidably fitted into slots defined by projections formed on the side wall of the base and a terminal screw **39***a* which is threaded into the terminal plate, is accessible through the slotted opening.

As shown best in FIGS. 5–8, a movable contact element or brush **40** is pivotally mounted in the opening between the legs of the U-shaped plate with its ends extending on either side thereof toward the opposite ends of the base.

As shown in FIGS. 9 and 10, the movable brush comprises a flat strip of electrically conductive material, such as brass, having silvered contact buttons **41** mounted on opposite faces thereof at one end. Trunnions **42** formed at the center of the strip extend outwardly on opposite sides thereof in opposing relation to opposing surfaces of the legs of the U-shaped plate. The rearwardly facing side edges of the trunnions are tapered to knife-like edges **43** which engage with and are seated in depressions **44** formed in the opposing surfaces of the legs of the U-shaped plate.

The rear portion of the movable brush contains an elongated opening **45**. The sides of the brush at its forward end of the opening extend around a tongue **46** which is formed on the lower portion of the U-shaped plate extending between the legs thereof. The tongue on the plate faces rearwardly in opposing relation to

a tongue **47** formed at the other or rear end of the elongated opening in the movable brush.

The ends of the opposing tongues are pointed so as to fit into and engage, respectively, with closure caps **48** surrounding opposite ends of a coil spring **49**. The coil spring which is located in the opening in the rear end of the movable brush and is held under compression between the opposing tongues, urges the movable brush rearwardly relative to the U-shaped plate and holds the knife-like edges of the trunnions in firm engagement with the legs of the U-shaped plate so that good electrical contact is established between the movable brush and the U-shaped plate to which a terminal connection is made. The brush is movable between two positions and the spring urges the brush toward one or the other of its positions. The spring imparts a toggle action to the movable brush in arcuate movement thereof from one position to the other position thereof; i.e., as the brush passes through the horizontal or center point of its arcuate movement, the line of action of the spring shifts and the spring urges the brush in the direction of its movement. Thus, depending upon the position of the brush, the spring will urge the brush either in a direction where the two opposing contact buttons are in firm engagement or in a direction where the contact buttons are separated.

The push-buttons **26** are located on opposite sides of the vertical U-shaped plate and are thus positioned above the ends of the movable brush which extend on opposite sides of the U-shaped plate. Each of the push-buttons which are similar in construction, is provided with a pair of downwardly projecting guide pins **50** at opposite sides thereof. Light coil springs **51** interposed between the base of the housing and the bottom of the push-button, urge the push-button upwardly toward its extended or raised position. An end of each of the springs surrounds one of the guide pins with the other end of the spring being seated in a socket **52** formed in the base of the housing.

Stops **53** formed on and extending outwardly from opposite sides of the push-buttons engage with the bottom of the cover and limit outward movement of the push-buttons relative to the cover under the influence of the return springs.

Each of the push-buttons is also provided with a brush-actuating member or lug **54** which extends downwardly from the lower surface of a rib **54**′ extending across the lower face of the push-buton. The brush-actuating lug is positioned above and in opposing relation to an outer end of the movable brush. In addition, each push-button is provided with supplementary brush actuating members **55** in the form of spaced pins which extend downwardly from one end of the rib **54**′ and the end of a second rib **55**′ in opposing relation to the movable brush at a point closer to its pivot point.

In operation of the switch, depression of the push-button which is in opposing relation to the end of the brush in a raised or elevated position brings the outer or first brush-actuating lug into engagement with the brush at a point near the end of the brush and after the brush moves through part of its arcuate movement the supplementary members then engage with the movable brush to insure that movement of the brush in the direction indicated is completed. For example, the push-button at the right in FIG. 4 when depressed will act on the raised right end of the brush and will force the raised end downward against the force of the spring until a point is reached where effective force of the spring will act to urge the opposite end of the brush upwardly or toward the dotted line position as shown in FIG. 4. In this movement of the brush, the opposing contact buttons will be separated interrupting the circuit. It also places the switch in condition for movement of the brush in opposite direction by depression of the other push-button which will bring the contact buttons into engagement closing the circuit.

In a two-way switch as shown in FIG. 4, upward movement of the brush in separating the contact buttons is limited by engagement of the contact carrying end of the brush with a bumper **56** of resilient material carried by and projecting downwardly from the bottom of the push-button. This insures quiet operation of the switch. One end of the rubber bumper is fitted into a socket or cavity formed in a lower surface of the push-button so that the bumper can be installed in the appropriate push-button as required.

Movement of the brush in the opposite direction to bring the contact buttons into engagement is limited by engagement of the opposing contact buttons and thus, a resilient bumper need not be provided on the other push-button. This permits the push-buttons to be formed in the same molds. The push-buttons when assembled in the switch are reversed end for end relative to each other in order to place the brush-actuating members on the respective buttons in proper positions relative to the movable brush.

A very slight pressure is sufficient to depress the push-buttons against the force of the return springs and the force exerted by the toggle spring. Also, the push-button need only move a very small distance to effect movement of the brush from one position to the other position thereof. Generally, the outermost lug on the push-button which engages with the brush near its end will effect movement of the brush to a point where the action of the toggle spring will become effective to complete the indicated movement of the brush. However, in the event the initial movement is not sufficient for this purpose or the brush should resist such movement, the supplementary brush-actuating members then engage with the brush and force it to move in the indicated or desired direction.

With reference to the modification illustrated in FIG. 18, similar reference characters have been applied to parts corresponding to parts previously described and hence the description of such parts need not be repeated. The switch shown in FIG. 18 is a single-pole, double-throw or three-way switch in which a pair of fixed contact and terminal units are employed. The fixed contacts are inverted relative to each other with the contact buttons being spaced and in opposing relation to each other. The contact buttons on the end of the brush oppose the fixed contact buttons and are movable therebetween. In this form, a rubber bumper is not required on either of the push-buttons as movement of the brush is limited in both directions by engagement of the opposing contact buttons.

It will be understood that various changes and modifications may be made in the embodiments of the invention illustrated and described herein without departing from the scope of the invention as defined by the following claims.

We claim:

1. In a contact assembly for an electrical switch, the combination comprising a contact-supporting plate, said plate having an opening therein, a movable contact member pivotally mounted on one face of said plate and extending through the opening therein, said movable contact member having ends extending beyond opposite sides of the plate, each of said ends being movable in an arcuate path between a first position and a second position in pivotal movement of the contact member relative to the plate, and a spring interposed between one of the ends of the movable contact member and the plate, said spring urging the movable contact member into electrical engagement with the plate and biasing the ends of the movable contact member toward the limits of their arcuate movement with a toggle action in pivotal movement of said ends between their first and second positions.

2. In a contact assembly for an electrical switch, the combination as defined in claim **1** which includes a terminal member integrally connected to and forming part of the contact-supporting plate.

3. In a contact assembly for an electrical switch, the combination as defined in claim **1** wherein the contact supporting plate includes a spring-engaging member extending rearwardly relative to the surface on which the movable contact member is pivoted, said spring-engaging member being located at one end of the opening therein and the movable contact member has a spring-receiving opening in one end thereof and includes a second spring-engaging member at one end of said opening, the spring-engaging members on the plate and the movable contact member being arranged in opposing spaced relation with the toggle spring being interposed and held under compression therebetween.

4. In a contact assembly for an electrical switch, the combination as defined in claim **3** wherein the movable contact member includes trunnions extending outwardly at opposite sides thereof and in opposing relation to sides of the face of the contact-supporting plate on opposite sides of the opening therein.

5. In a contact assembly for an electrical switch, the combination as defined in claim **1** wherein the contact-supporting plate extends in a vertical plane and the movable contact member is pivotally mounted on said plate for movement about a horizontal axis extending transversely with respect to said vertical plane.

6. In a contact assembly for an electrical switch, the combination as defined in claim **1** wherein the contact-supporting plate is U-shaped and has upwardly extending legs defining the opening therein through which the movable contact member extends.

7. A contact assembly for an electrical switch, the combination as defined in claim **1** which includes a fixed contact element, said fixed contact element being positioned in opposing relation to one end of the movable contact member and being engaged by said one end of the movable contact member under the influence of the toggle spring at one of the two positions of said end of the movable contact element.

8. A contact assembly for an electrical switch, the combination as defined in claim **7** which includes a second fixed contact element, the first and second fixed contacts being spaced relative to each other and being located on opposite sides of the said one end of the movable contact member.

9. In an electrical switch of the push-button type having a hollow housing of insulating material, said housing including a base defining a cavity and a cover secured to the base, said cover having openings therein which provide access to the interior of the housing, the improvement which comprises a first contact assembly mounted within the housing, said contact assembly including a contact located in a fixed position at one end of a cavity in the base of the housing, a second contact assembly mounted within the housing, said second contact assembly including a contact-supporting plate extending transversely across the cavity in the base at a point intermediate its ends, said plate having an opening therein facing the ends of the cavity, a movable contact member pivotally supported on one surface of said plate and extending lengthwise through the opening in said plate, said member having arcuately movable ends located on opposite sides of the plate, one of said ends being positioned in opposing relation to the fixed contact and being movable into and out of engagement therewith, and spring means interposed between the contact-supporting plate and the other end of the movable contact member, said spring means urging the movable contact into electrical engagement with the contact-supporting plate and biasing the first-mentioned end of the movable contact member toward the limits of its arcuate movement with a toggle action, a push-button slidably mounted in and extending through each of the openings in the cover, said push-buttons being positioned, respectively, in opposing relation to the opposite ends of the movable contact member, a return spring interposed between each of the push-

buttons and the base, said return springs biasing the push-buttons outwardly relative to the cover, stop means formed on each of the push-buttons for engagement with the cover, said stop means limiting upward movement of the push-buttons relative to the cover, and switch-actuating means carried by each of the push-buttons for engagement with the movable contact member on opposite sides of the contact-supporting plate, said switch-actuating means including at least one member extending downwardly from the push-button in opposing relation to the movable contact member.

10. In an electrical switch of the push-button type, the improvement as defined in claim **9** wherein the switch-actuating means includes a pair of downwardly extending members carried by each of the push-buttons, said downwardly extending members being spaced apart and successively engaging with an end of the movable contact member in effecting arcuate movement thereof.

11. In an electrical switch of the push-button type, the improvement as defined in claim **9** which includes a pair of the first contact assemblies each of which includes a fixed contact, the fixed contacts of the respective assemblies being spaced relative to each other and being located in opposing relation to the contact-engaging end of the movable contact member on opposite sides thereof.

12. In an electrical switch of the push-button type, the improvement as defined in claim **9** which includes a rubber bumper carried by one of the push-buttons which is in opposing relation to the contact-engaging end of the movable contact member, said bumper engaging with and limiting arcuate movement of the said end of the movable contact member in one direction.

13. In an electrical switch of the push-button type, the improvement as defined in claim **9** wherein the spring means acting on the movable contact member comprises a coil spring and the movable contact member has an opening formed in one end thereof and a spring-engaging member formed at an outer end of said opening, an opposing spring-engaging member formed on the contact-supporting plate, said opposing spring-engaging members engaging with opposite ends of the coil spring and holding said spring under compression therebetween.

14. In an electrical switch of the push-button type, the improvement as defined in claim **9** wherein the contact-supporting plate is U-shaped with the legs of said U-shape extending upwardly and defining the opening in said plate.

15. In an electrical switch of the push-button type, the improvement as defined in claim **14** wherein the movable contact member has trunnions extending outwardly from opposite sides thereof, said trunnions pivotally engaging with the legs of said U-shaped plate.

16. In an electrical switch of the push-button type, the improvement as defined in claim **9** wherein the first and second contact assemblies include terminals which are formed as integral parts of the respective contact assemblies.

17. In an electrical switch of the push-button type, the improvement as defined in claim **9** wherein the first and second contact assemblies include terminals which are formed as integral parts of the respective contact assemblies, each of said terminals comprising a plate extending along an interior surface of a wall of the base of the housing.

18. A push-button type of electrical switch comprising a hollow housing of insulating material which includes a base and a cover, said base having upstanding side and end walls defining a cavity, said cover being secured to

the base and having a pair of openings therein providing access to the cavity in the base, a first contact assembly mounted in the base, said contact assembly including a contact located in a fixed position at one end of said cavity, a second contact assembly assembly mounted in the base, said second contact assembly including a contact-supporting plate extending transversely across said cavity at a point intermediate its ends, said plate being supported in a vertical position and having an opening therein facing opposite ends of the base, a movable contact member pivotally engaging with one surface of said plate and extending lengthwise through the opening therein with its ends being located on opposite sides of the plate, said ends being arcuately movable between a raised position and a lowered position, one of said ends being positioned in opposing relation to said fixed contact and being movable into and out of engagement therewith, a coiled spring interposed between the contact-supporting plate and the other end of the movable contact member, said spring urging the movable contact into electrical engagement with the plate and biasing the first-mentioned end of the movable contact member toward its raised and lowered positions with a toggle action, a push-button slidably mounted in and extending through each of the openings in the cover, each of said push-buttons being located, respectively, in opposing relation to the ends of the movable contact member, return springs interposed between each of the push-buttons and the base and biasing the push-buttons outwardly relative to the cover, stop means formed on each of the push-buttons, said stop means engaging with the cover and limiting upward movement of the push-buttons relative to the cover under influence of the return springs, and switch-actuating means formed on each of the push-buttons for engagement with the ends of the movable contact member located on opposite sides of the contact-supporting plate, said switch-actuating means comprising at least one lug extending downwardly from each of the push-buttons in opposing relation to an end portion of the movable contact member, said lug being adapted to effect movement of the end of the movable contact member engaged thereby from its raised position to its lowered position.

19. In a contact assembly for an electrical switch, the combination comprising a contact-supporting plate of electrically conductive material, a movable contact member of electrically conductive material pivotally mounted on one face of said plate and being in electrical contact therewith, said movable contact member having ends extending on opposite sides of said plate, each of said ends being movable in an arcuate path between a first position and a second position in pivotal movement of the contact member relative to the plate, and a spring interposed between one of the ends of the movable contact member and the plate, said spring urging the movable contact member into electrical engagement with the plate and biasing the ends of the movable contact member toward the limits of their arcuate movement with a toggle action in pivotal movement of said ends between their first and second positions.

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