

Nov. 30, 1965

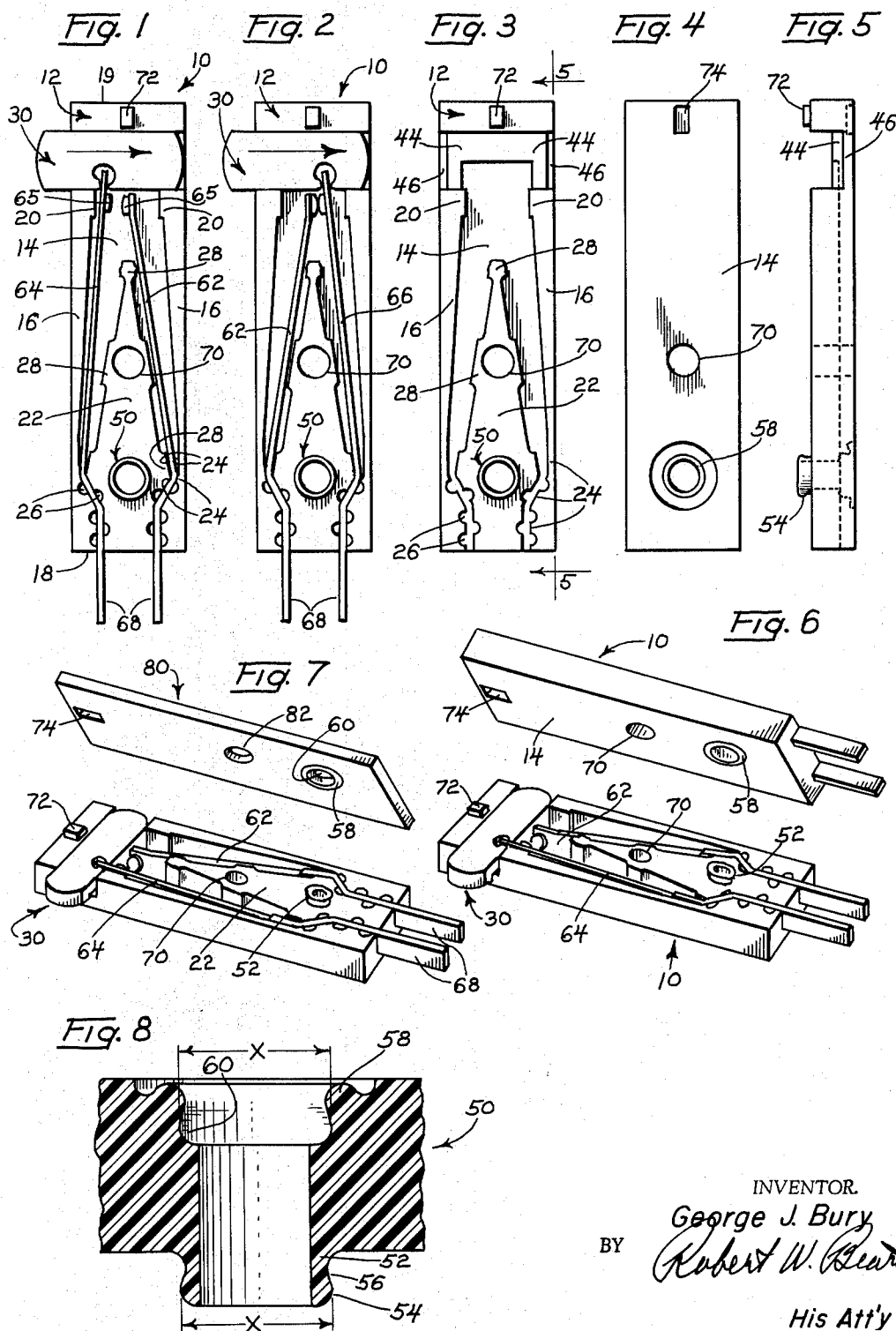
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3,221,131

PUSH BUTTON SWITCH FOR INDIVIDUAL USE OR IN AN
ASSEMBLY OF SIMILAR SWITCHES

Filed Nov. 12, 1963

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 9

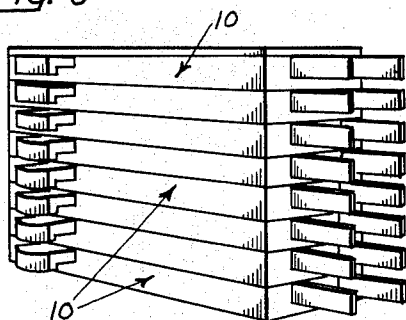


Fig. 10

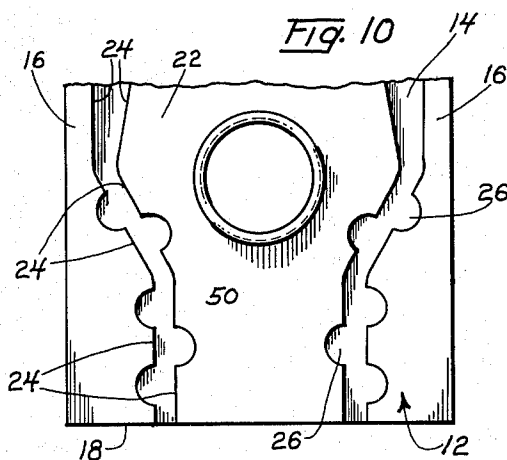


Fig. 11

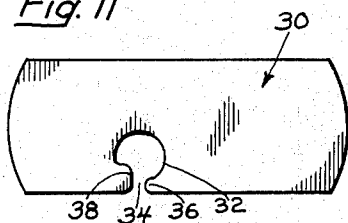


Fig. 12

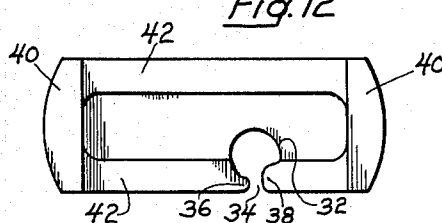


Fig. 14

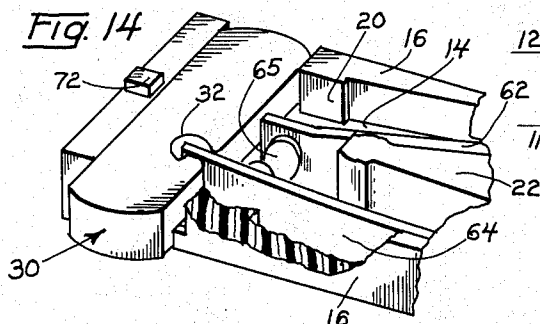


Fig. 13

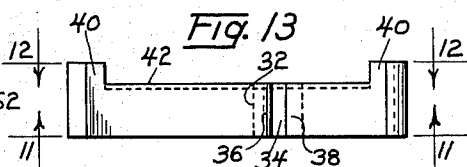


Fig. 15

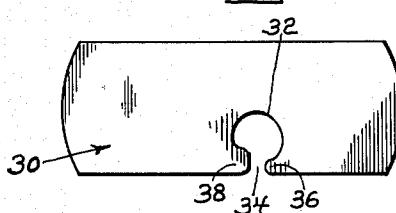


Fig. 16

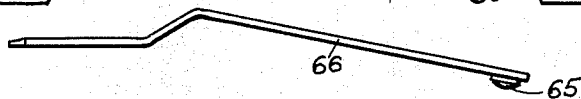


Fig. 17

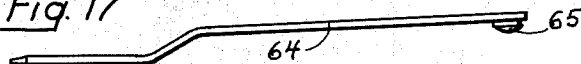
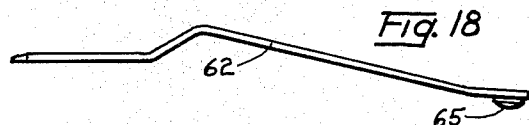


Fig. 18



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**PUSH BUTTON SWITCH FOR INDIVIDUAL USE OR
IN AN ASSEMBLY OF SIMILAR SWITCHES**

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Works Inc., Chicago, Ill., a corporation of Delaware
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27 Claims. (Cl. 200-168)

This invention relates to control devices for electric circuits, and more particularly relates to a novel switch and switch body housing which is primarily, although not exclusively, designed for use with calculating, addressing, and other business machines.

Technological advances in high speed business machines have necessitated the use of a large amount of electrical control devices such as switches, to provide for the rapid determination and solution of business problems. In order to make a practical use of switches and other control devices in these machines, the cost, size, operation and quick replacement or conversion of component parts are deciding factors. A practical solution to these and other related problems is contemplated by the present invention as particularly related to a novel switch device which can be used individually, or grouped together in an electrical circuit as desired.

One of the objects of the present invention is the provision of a novel switch body housing which permits either the stacking of a plurality of switch housing in superimposed relation, or the use of such a housing in a single switch arrangement.

Another object of the present invention is the provision of a novel switch body housing permitting the stacking of a plurality of such housings in superimposed relation for use in a switch bank or the like, and wherein a plurality of electrically conductive contact means mounted in one housing is electrically and atmospherically shielded from contact means mounted in adjacent housings.

Another object of the present invention is to provide a novel fastening means in a switch body housing for releasably securing either a plurality of housings in superimposed relation or a single switch housing and cover element together.

A further object of the present invention is the provision of a novel fastening elements which are molded in the body of a switch housing, and which functions to releasably secure a plurality of housings or a single switch and cover element together without additional machining or processing steps.

Still a further object of the present invention is the provision of novel fastening elements of the above-described type which are adapted to receive means for resisting lateral shifting of a plurality of switch housings or a single switch housing and cover element.

Another object of the present invention is in the provision of a novel switch housing which is adapted to receive electrically conductive contact means of either the normally closed or opened variety.

More particularly, it is an object of the present invention to provide a novel switch housing which releasably secures a pair of contact means of either the normally closed or opened variety therewithin to facilitate removal of such contact means and replacement thereof when such contact means are defective, or when it is desired to provide a contact means having a different sequence of relative movement.

Another object of the present invention is to the provision of a novel switch wherein the contact means associated therewith are provided with a terminal end portion to facilitate the connection of the switch to an outlet within an electrical circuit.

Another object of the present invention is the provision of a specially constructed contact means which eliminates

bounce and chatter of such contact means during their relative approaching and separating movement.

Still another object of the present invention is the mounting the above-described contact means in a manner which provides a contact wiping action.

A further object of the present invention is the provision of a novel switch actuator means for controlling the movement of a first contact means relative to a second contact means in a switch body housing in an efficient manner.

Still a further object of the present invention is the provision of an actuator means of the above-described type which is releasably mounted within a switch body housing to insure quick assembly and subsequent replacement or conversion of switch components.

Another object of the present invention is the provision of an actuator means of the above described type wherein the stacking of adjacent housings or the assembly of a switch housing and cover element prevents the removal of such actuator means, and electrical isolation of the contact means associated therewith.

Still a further object of the present invention is the provision of an actuator means for controlling the movement of a first contact means relative to a second contact means in a switch body housing, and wherein the actuator means facilitates angular deflection of the first contact means relative to the second contact means.

It is another object of the present invention to provide an actuator means of the above-described type which is restricted in its movement within the switch body housing to prevent excessive overtravel of the switch contact means.

Another object of the present invention is in the provision of an actuator means of the above-described type which is designed to move only in a single plane to assure an electrical connection between a pair of fixed contacts mounted on the contact means.

Yet another object of the present invention is to provide a novel switch made of a minimum number of parts, which can be assembled in a compact array and utilize only a relatively small amount of space.

A still further object of the present invention is to provide a novel switch for use with both relatively large and small currents, and which has an exceedingly long cycle life.

Other objects and advantages will become apparent from the following description when read in conjunction with the accompanying drawings wherein:

FIG. 1 is a top plan view of the novel switch constructed in the form of a normally opened switch;

FIG. 2 is a top plan view of the novel switch constructed in the form of a normally closed switch;

FIG. 3 is a top plan view of the novel switch body housing incorporating features of the present invention;

FIG. 4 is a bottom plan view of the novel switch body housing shown in FIGS. 1-3;

FIG. 5 is a side elevational view of the novel switch body housing;

FIG. 6 is a perspective view of a pair of novel switches prior to assembly in stacked relationship;

FIG. 7 is a perspective view of a novel switch and cover element prior to assembly;

FIG. 8 is an enlarged fragmentary sectional view of the novel fastening means associated with each switch body housing;

FIG. 9 is a perspective view of a plurality of switches arranged in stacked superimposed relation;

FIG. 10 is an enlarged fragmentary top plan view of one end of the switch body housing showing the details thereof;

FIG. 11 is a top plan view of an actuator means used

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in conjunction with a switch of the normally opened variety;

FIG. 12 is a bottom plan view of the actuator means shown in FIG. 11;

FIG. 13 is a side elevational view of the actuator means shown in FIGS. 12 and 13;

FIG. 14 is an enlarged fragmentary perspective view of the actuator means as mounted in a switch housing;

FIG. 15 is a top plan view of an actuator means used in conjunction with a switch of the normally closed variety;

FIG. 16 is a side elevational view of a preformed contact blade used in a normally closed switch;

FIG. 17 has a side elevational view of a preformed contact blade used in a normally opened switch;

FIG. 18 is a side elevational view of a preformed contact blade used with both a normally opened and closed switch.

Referring now to the drawings wherein like numerals have been used to designate the same parts throughout the various figures, there is shown in FIGS. 1-2 a novel switch 10 having an integral switch body or housing means 12 for receiving a pair of normally opened contact blades 62, 64 or a pair of normally closed contact blades 62, 66, blades 64 and 66 being operated by an actuator means 30. The switch body or housing means 12 is preferably formed of a tough, durable, moldable thermoplastic which has good insulating characteristics, one of the materials best suited for this purpose being a polycarbonate plastic manufactured by General Electric Company and sold under the trademark Lexan. This material is particularly suited to the instant invention since it will permit the molding of complex and intricate shapes such as the switch body or housing means 12. The actuator means 30, on the other hand, is made of a relatively flexible thermoplastic material such as nylon to facilitate movement of such actuator means in the switch housing. The contact blades 62, 64 and 66 are made of a heat treated alloy such as beryllium copper to provide flexibility and electrical conductivity while the fixed contacts 65 mounted at one end of the blades are made of fine silver which has the highest electrical and heat conductivity of any metal, and is, therefore, widely used as contact material.

As best shown in FIGS. 1-3 and 6-7, the switch body or housing means 12 has a side face 14 and a pair of flange means 16 extending upwardly therefrom to provide a concavity in which the contact blades are received. Each of the blades of either the normally opened variety as shown in FIG. 1, or the normally closed variety as shown in FIG. 2 are mounted at one end 18 of the housing between the tongue means 22 and the flange means 16. The tongue and flange means, as best shown in the enlarged view of FIG. 10, are provided with a plurality of complementary angularly offset surfaces 24 which aid to releasably secure the contact blades within the housing. When the housings are molded, a plurality of semicircular apertures 26 are formed adjacent the angularly offset surfaces 24 in both the tongue and flange means to facilitate the insertion of a blade within the angularly offset surfaces, and provide a plurality of spaced pressure contact points for each blade.

Each of the blades has a terminal end portion 68 for connection to an electrical outlet, other types of connecting means may be used with the switch of the present invention in place of the terminal end portions if desired.

The blades in either the normally opened or closed form are initially preformed or prestressed as shown in FIGS. 16-18 so that they will be held by the angularly offset surfaces 24 of the housings when positioned thereagainst. Prestressing the blades also eliminates contact bounce or chatter when the fixed contacts 65 engage one another. Each pair of cooperating contact blades are so formed that they are initially prestressed in opposite di-

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rections to each other to restrict and substantially hinder contact rebound.

Blade 64 of the normally opened switch is maintained in a prestressed condition by an abutment means 20 formed on the flange means 16 of the housing. This will not only aid in preventing contact bounce or chatter, but will tend to force the actuator means or abutment 30 toward its inoperative position as will become apparent hereinafter. Blade 62 of either the normally opened or normally closed switch is restricted in its movement toward the other contact blade by abutments 28 formed on the tongue means 22 so as to maintain blade 62 in a desired angular position for subsequent electrical contact.

Securing the contact blades at one end of the housing will provide a pivotal mounting for the blades, and permit the contacts 65 to traverse an arc during their relative approaching and separating movement. This movement of the contacts provides a wiping action during the engagement and separation of the contacts which is desirable for these reasons: (1) sulphur and/or ammonia fumes which are present in the atmosphere can cause contact corrosion, and the wiping action of the contacts will penetrate this surface film with every operation of the switch; (2) the contact wiping action will actually shear a weld caused by heavy loads which tend to weld the switch contact blades together.

It is to be noted that the symmetrical arrangement of the switch body or housing means 12 as best shown in FIGS. 1-3 will readily provide for the conversion of the switch from a normally opened variety to one that is normally closed, or vice versa. This symmetrical arrangement of the housings and the particular configuration of the blades necessitates the production of only three blades for both a normally closed and opened switch. Contact blade 62 is used in both the normally closed and opened switch arrangements as shown in FIGS. 1-2, while contact blades 64 and 66 have been preformed for adaption with one of the switch arrangements. Reduction in cost and the quick conversion to either a FIG. 1 or 2 switch are the most obvious advantages that will be obtained by this arrangement.

The movement of the contact blades from a rest position, where the contacts 65 are either in engagement or separated from one another, to a second position is accomplished by the actuator means 30. As will be perceived from an inspection of FIGS. 11-15, the actuator means or button 30 is a one-piece elongated member having a substantially C-shaped opening formed therein for receiving one of the contact blades. The opening 32 is spaced from one side of the elongated member and opens into a passageway 34 which intersects such one side. The marginal portions 36, 38 surrounding the passageway 34 will thus engage opposite sides of one of the contact blades as illustrated in FIGS. 1-2, 6-7 and 14. To increase the area of surface contact with a particular blade, one of the marginal portions 38 has been enlarged to effectively transmit force from the actuator means or button 30 when depressed.

FIG. 11 shows an actuator means for a normally opened switch, while FIG. 15 shows an actuator means for a normally closed switch. In comparing these figures, it will be observed that the opening 32 in the normally opened switch arrangement is located nearer the left hand end portion of the actuator means, whereas in the normally closed switch, the opening is nearer the right hand end portion. The particular location of these openings will permit the accommodation of a particular contact blade of either the normally closed or opened variety. In either case, the movement of the actuator means 30 will be in the same direction as indicated by the arrows in FIGS. 1 and 2, and it is for this reason that the marginal portions 36, 38 are in the same relative position even though the opening 32 and passageway 34 have been shifted.

The actuator means 30 is adapted to slide in the housing within a U-shaped recess formed adjacent end 19. Extending upwardly from a bottom surface 46 of the recess are a pair of substantially parallel upstanding abutments 44 on which the actuator 30 slides. The upstanding abutments 44 cooperate with a pair of downwardly projecting flanges 40 formed at opposite ends of the actuator means 30 and restrict the travel thereof. However, the downwardly projecting flanges 40 are spaced apart a distance greater than the upstanding abutments 44 and permit limited travel of the actuator means 30 for a distance approximating the separation between the flanges and the upstanding abutments. Planar movement of the actuator means 30 is accomplished by a pair of coplanar elongated protuberances 42 extending between the flanges 40 on the bottom side of the actuator. These protuberances 42 rest upon the upstanding abutments 44 and slide thereon when the actuator is depressed.

The blades 64 and 66 of the normally opened and closed switches are engaged by the actuator 30 at a point spaced from one end thereof. This provides continuous engagement of the marginal portions 36, 38 with blades 64, 66 throughout their entire movement, while opening 32 permits angular deflection of the blades without restricting movement thereof. The connection between the flexible blades 64, 66 and the actuator 30 is an important feature of the present invention since the blades will move relative to the actuator while traversing an arc in their pivotal movement. It is necessary, therefore, that the actuator permit sliding movement of the blades without limiting angular movement. By using an actuator of the type proposed, effective engagement and freedom of movement of the blades will be accomplished without affecting the precise relative approaching and separating movement of the contacts 65.

Referring now to another important feature of the present invention, it will be observed that the switch body or housing means 12 is provided with a unique fastening means to permit the stacking of a plurality of switch housings in superimposed relation as shown in FIGS. 6 and 9, or the assembly of a cover element with a switch housing as shown in FIG. 7. The fastening means formed in each switch body or housing means generally comprises annular male and female locking members 50 located adjacent end 18 of the housing, a lug and slot connection 72, 74 formed adjacent end 19, and an aperture 70 formed intermediate therebetween.

In FIG. 8, an enlarged showing of the male and female locking members 50 is illustrated. The male member is provided with an annular projection 52 having an annular rim extending outwardly from the outer free extremity of the projection, and having a generally tapering surface 56 formed therebetween. The male member of a switch body or housing means is adapted to cooperate with a female member of an adjacent housing or cover element for enclosing the concavity of the switch housing and encase substantially the entire length of the contact means therein. The female member fastening means, which is formed in the switch body or housing means 12 is provided with an annular protuberance 58 received within a recess formed in the housing. The inner periphery of the annular protuberance 58 has a taper which converges toward the free extremity thereof to form an undercut surface. The dimension of the undercut surface of the female member is identified by the letter "X" in FIG. 8 and is substantially equal to the annular rim 54 of the male member. Thus, when the male member of one housing is inserted into the female member of another housing or cover element, the annular rim 54 of the male member will be circumferentially contracted by the outer free extremity of the annular protuberance 58 until received within the undercut surface. At this point, the locking members will be held in snug fitting relationship. The "snap button effect" of the annular male and female fastening

means of adjacent housings or a housing and cover element will effectively retain the parts together while permitting separation thereof by a relatively small amount of force. FIGS. 6 and 7 illustrate the mounting of an adjacent housing or a cover element 80 on one of the switch housings. The male and female elements can receive a mounting pin (not shown) in either the single or multiple switch arrangement and prevent lateral shifting thereof.

To aid in securing an adjacent housing or cover element to one housing member, a lug and slot connection 72, 74 is located adjacent end 19 of one of the housing members, and is aligned with the male and female members 50 to prevent lateral shifting of a housing or cover element with respect to an adjacent housing. Each housing is also provided with an aperture 70 which will be aligned when a plurality of housings are stacked upon one another for receiving a mounting pin (not shown) like the male and female members 50 of each housing. Spaced mounting pins will resist lateral shifting in any direction. In the case of the cover element 80, an aperture 82 is provided which is aligned with aperture 70 of the housing when the cover element is assembled thereon. It is to be noted that the male and female members 50 and the aperture 70 are formed in the thickest section of the housing, which in the arrangement shown herein, is the tongue means 22. This will strengthen the housing for the reception of the mounting pins.

The electrical rating of a switch having the above-described characteristics can vary from 10 milliamperes at 20 volts D.C. to 350 milliamperes at 170 volts D.C. The minimum life of this particular switch has been found to exceed one hundred million cycles of minimum life with spark suppression limited to an arc of 30 volts and 4 milliseconds time duration.

From the foregoing, it will now be apparent that the present invention contemplates a novel and unique switch which may be readily adapted for a multitude of purposes, while having an exceedingly long cycle life and minimum number of parts. A plurality of switch housings may be mounted upon one another to provide a multi-switch arrangement for use in the high speed type of business machine, or a single switch may be provided by simply mounting a flat cover element over the switch housing. The assembled parts are held in a secure fashion, but may be readily separated from one another to permit the replacement or conversion of the switch components when desired. The symmetrical arrangement of the housing and the configuration of the various switch components permit ready conversion to either a normally closed or opened switch in a minimum of time and with a minimum exchange or replacement of components.

Contact blades of any particular shape or design may be used with the novel switch of the present invention. For example, flat or rounded contact blades may be designed to have a snap action or overcenter movement instead of the illustrated contact and return movement. More than a single pair of contact blades may also be used with each switch arrangement by mounting the blades in superimposed relation or other similar fashion in each switch housing.

While the preferred embodiment of the present invention has been shown and described herein, it is obvious that many structural details may be changed without departing from the spirit and scope of the appended claims. The invention is claimed as follows:

1. A switch comprising an integral housing means having one side face and flange means extending therefrom to provide a concavity for receiving a plurality of contact means, said contact means being mounted in the concavity of said housing means, at least one of said contact means pivotally mounted within said housing means and capable of being flexed from a position of rest to a second position with respect to another of said contact means, said contact means being in engagement with one another at one of said positions, a one-piece elongated

actuator means slidably mounted within said housing means and engaging the movable free end of said flexible contact means so as to impart movement thereto from said rest to said second position, said actuator means including means facilitating sliding movement of the movable free end of said flexible contact means relative to said actuator means when moved between its positions, and a cover means enclosing the concavity of said housing to encase the contact means therein, said cover means and said housing means having fastening means for releasably securing said cover and housing means together.

2. The switch as defined in claim 1 wherein said cover means comprises the side face of a second switch housing means which serves as said cover for said first mentioned housing means to encase the contact means therein.

3. A switch as defined in claim 1 wherein said cover means comprises a substantially flat cover element.

4. The switch as defined in claim 1 wherein said flexible contact means in its position of rest is in engagement with said other contact means, and in its second position is separated from said other contact means by movement of said actuator means.

5. The switch as defined in claim 1 wherein said flexible contact means in its position of rest is separated from said other contact means, and in its second position is in engagement with said other contact means by movement of said actuator means.

6. The switch as defined in claim 1 wherein said contact means are releasably mounted within said housing means to facilitate removal thereof and replacement by contact means having a different sequence of relative movement.

7. The switch as defined in claim 1 wherein said flexible contact means is mounted in said housing in an initially prestressed condition to bias said actuator means toward its inoperable position.

8. The switch housing as defined in claim 1 wherein said flexible contact means is mounted in said housing means in a prestressed condition by an abutment formed on one of said flange means whereby to bias said actuator toward its inoperable position, and said other contact means is initially prestressed in a direction opposite to said flexible contact means to eliminate bounce and chatter of said contact means during movement from said rest to said second position.

9. The switch as defined in claim 1 wherein a tongue means is provided in said housing intermediate said flange means and having a plurality of formations thereon, said formations extending outwardly toward each of said flange means on opposite sides of said tongue means and spaced therefrom for restricting movement of one of said contact means.

10. The switch as defined in claim 1 wherein said contact means are elongated flat blades having fixed contacts mounted thereon.

11. The switch as defined in claim 10 wherein said contact blades each have a terminal end portion projecting from an end face of said housing.

12. The switch as defined in claim 10 wherein both said contact blades are pivotally mounted adjacent one end of said housing means whereby to permit the fixed contacts mounted on said blades to traverse an arc during their relative movement and provide a contact wiping action.

13. The switch as defined in claim 10 wherein said actuator means includes an opening adjacent one side thereof and a passageway extending from said opening and intersecting said one side, the marginal portions surrounding said passageway on opposite sides thereof being spaced apart a distance substantially less than said opening and adapted to engage said flexible contact blade on opposite sides thereof at a point spaced from one end, said member when operated permitting movement of said flexible contact blade from a position of rest to a second position with respect to said other contact blade

while said opening facilitates angular deflection of said flexible contact blade.

14. The switch as defined in claim 13 wherein one of the marginal portions surrounding said passageway has a substantially greater area of contact with said flexible contact blade than said other marginal portion.

15. The switch as defined in claim 1 wherein said means facilitating sliding movement of said flexible contact means relative to said actuator means includes substantially C-shaped opening provided in said actuator means for receiving said flexible contact means to facilitate angular deflection thereof.

16. The switch as defined in claim 15 wherein said elongated member is provided with downwardly projecting flanges at opposite ends thereof for engaging upstanding abutments formed on said housing, said flanges of said elongated member being spaced apart a greater distance than said abutments on said housings to permit sliding movement of said member on said housing for a distance approximating the separation between said downwardly projecting flanges and said upstanding abutments.

17. The switch as defined in claim 16 wherein said member is provided with a pair of elongated coplanar protuberances extending between said flanges to provide relative planar movement of said member as it slides on said housing.

18. The switch as defined in claim 1 wherein said fastening means comprises complementary male and female members for mounting said housing means and cover means in assembled relation.

19. The switch as defined in claim 18 wherein said complementary male and female members are provided at one end of said housing and cover means, said male members having an annular projection radiating from one face of said means, an annular rim extending outwardly from the outer free extremity of said projection, and a tapered surface intermediate said rim and the remainder of said projection, the female members having an annular protuberance received within a recess formed in each of said means, the inner periphery of said annular protuberance having a taper which converges toward the free extremity of said protuberance, the dimension of the inner periphery of said protuberance being substantially equal to the annular rim and tapered surface of said projection to provide a snug fit for said projection when received within said protuberance, at least one male and female member on said housing and cover means cooperating to fasten said housing and cover means together.

20. The switch as defined in claim 18 wherein said male and female members include interfitting annular projections at one end of said housing and cover means, and an interfitting lug and slot connection at the other end of said housing and cover means.

21. The switch as defined in claim 20 wherein said annular projections and said lug and slot connection are aligned in the same plane.

22. The switch as defined in claim 1 wherein a tongue means is formed in said housing intermediate said flange means, said tongue means having complementary angularly offset surfaces at one end of said housing for engaging and retaining said contact means between said tongue means and said flange means.

23. The switch as defined in claim 22 wherein a plurality of semicircular apertures are formed in said tongue and flange means intermediate said angularly offset surfaces and one end of said housing means to facilitate the insertion of said contact means.

24. A plurality of switch housings arranged in superimposed relation each having one side face and flange means extending therefrom to provide a concavity for receiving a plurality of contact means, said contact means being mounted in the concavity of each of said housings, at least one of said contact means in each housing capable of being flexed from its position of rest to a second posi-

tion with respect to another of said contact means, said contact means being in engagement with one another at one of said positions, an actuator means for each housing operatively associated with said flexible contact means and serving to impart movement thereto from said rest to said second position, and fastening means associated with adjacent housings for releasably securing said housings to each other, the side faces of each adjacent housing serving as a cover for the next adjacent housing to enclose the contact means thereof.

25. A switch actuator for use in controlling the movement of a first contact blade relative to a second contact blade in a switch housing comprising a one-piece elongated member associated with said switch housing, said member having an opening adjacent one side thereof and a passageway extending from said opening and intersecting said one side, the marginal portions surrounding said passageway on opposite sides thereof being spaced apart a dimension substantially less than said opening and adapted to engage one of said contact blades on opposite sides thereof at a point spaced from one end whereby to permit relative movement of said engaged blade with respect to said other blade while said opening facilitates angular deflection of said engaged blade.

26. The switch actuator as defined in claim 25 wherein said elongated member is received within a U-shaped recess formed in said housing and is adapted to slide on a pair of upstanding abutments projecting from the bot-

tom surface of said recess, said elongated member having a pair of downwardly projecting flanges at opposite ends thereof which are spaced apart a distance greater than said pair of upstanding abutments whereby to permit travel of said elongated member for a distance approximating that of the separation between said downwardly projecting flanges and said upstanding abutments, said upstanding abutments cooperating with said downwardly projecting flanges to limit movement of said elongated member when said flanges engage said abutments.

27. The switch actuator as defined in claim 26 wherein each of said members is provided with a pair of elongated coplanar protuberances extending between said flanges to provide relative planar movement of said members as they ride upon said upstanding abutments.

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