

[54] ELECTRICAL SWITCH

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[51] Int. Cl.² **H01H 13/52; H01H 1/26**

[58] Field of Search **200/159 R, 159 A, 276, 200/275, 5 A**

[56]

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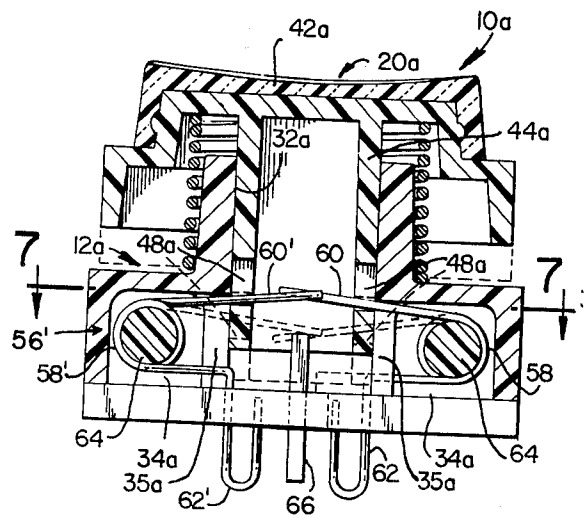
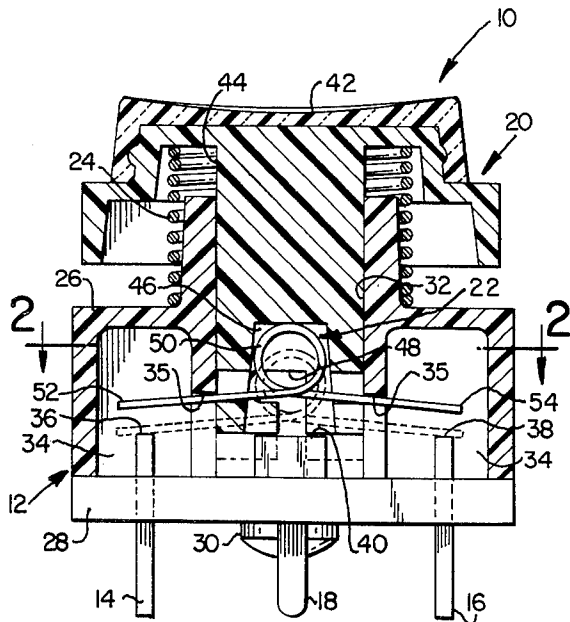
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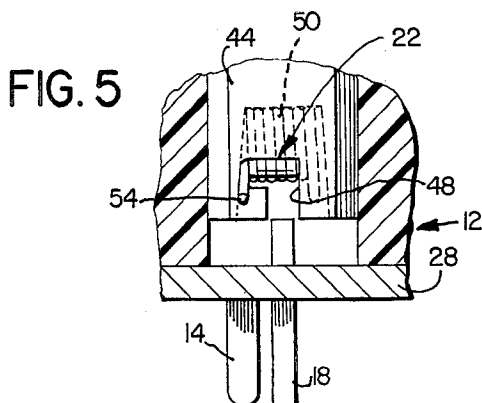
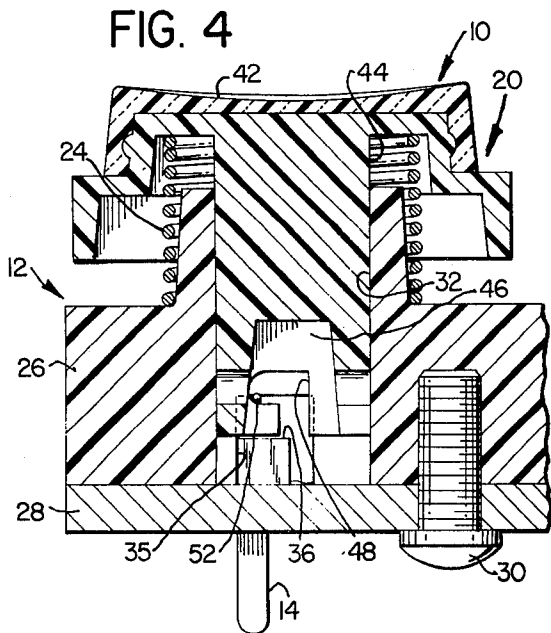
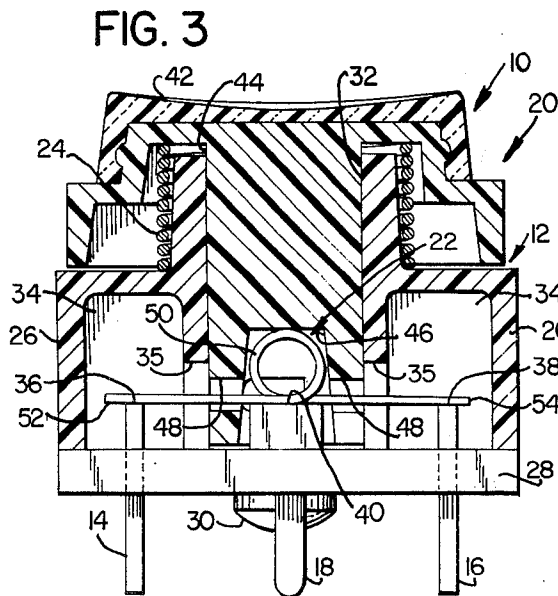
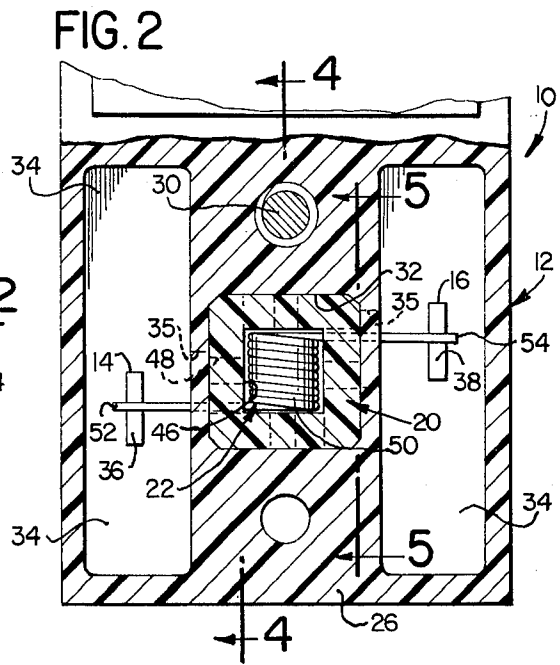
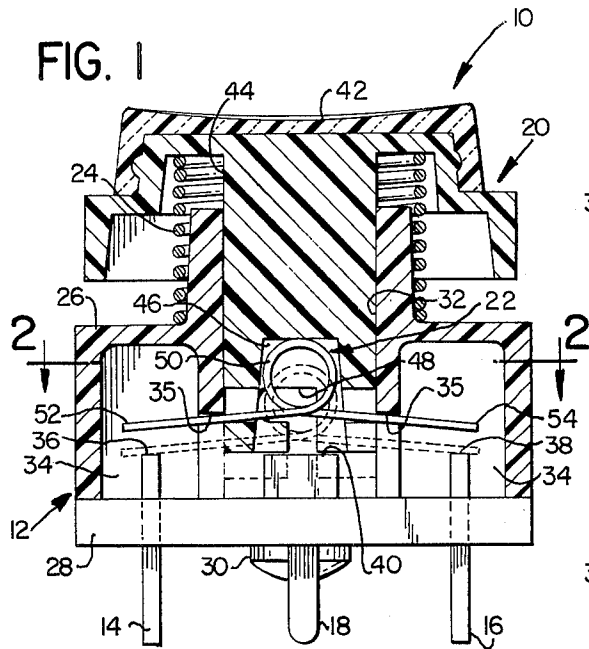
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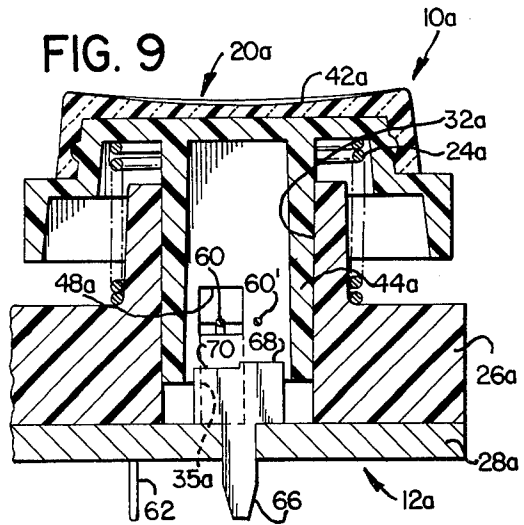
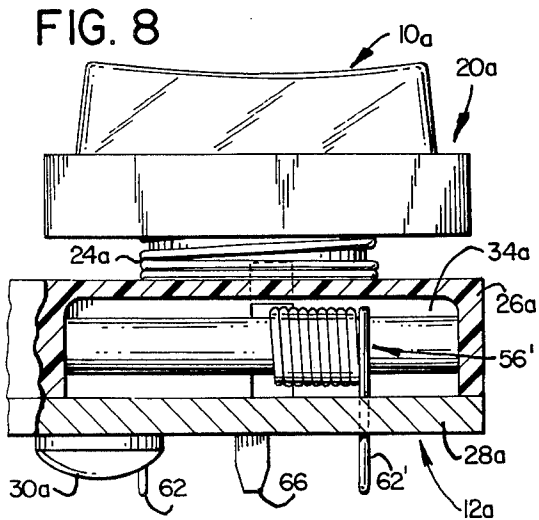
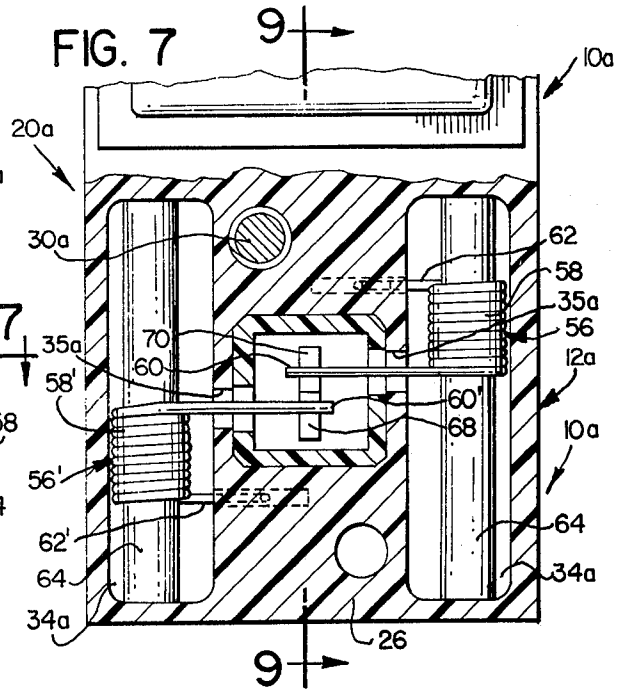
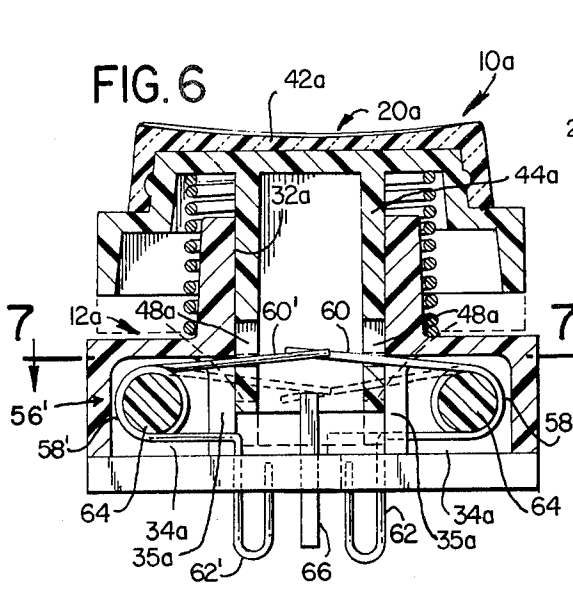
[57] **ABSTRACT**

A keyboard switch comprises a push button operator supported by a base for movement between projected and depressed positions. A contact spring carried by the push button operator electrically connects three terminals mounted in fixed position on the base when the operator is depressed. The spring cooperates with the terminals to provide a second "make" contact which occurs always after a first "make" contact. The contact spring also serves to retain the push button operator in assembly with the base. In a further embodiment, two contact springs carried by a base have free end portions which extend into the path of a push button operator supported on the base. Portions of the two contact springs define two of three terminals associated with the switch base. A third terminal mounted on the base has spaced contact surfaces thereon sequentially engaged by free ends of the two contact springs when the push button operator is depressed.

27 Claims, 9 Drawing Figures







ELECTRICAL SWITCH

BACKGROUND OF THE INVENTION

This invention relates in general to electrical switches and deals more particularly with improved push button switches of double form, momentary contact type. The switches of the present invention are particularly adapted for use as keyboard switches for electric typewriters, calculators, computers and the like, and are particularly suitable for use where a second "make" contact is desired which always occurs after a first "make" contact. However, the present switches may also be employed where simultaneous double form output is desired. The increase demand for low cost electrically operated business machines and like apparatus has created need for improved low cost keyboard switches for such digital applications. However, a switch suitable for the aforescribed applications must be substantially free of undesirable contact bounce characteristics, since the tendency of switch contacts to bounce apart after making may result in loss of contact signal and the generation of arcs at the contacts which results in electromagnetic interference.

Accordingly, the general aim of the present invention is to provide improved switches of the aforescribed general type which have a minimal number of parts, are of simple durable construction for low cost manufacture and are substantially free of undesirable contact bounce characteristics.

SUMMARY OF THE INVENTION

In accordance with the present invention, an improved electrical switch is provided which comprises a base member, an operating member supported by the base member for movement in one and an opposite direction relative thereto between one and another switching position, means defining three electrical terminals mounted in fixed position on the base member and having contact surfaces, and contact spring means carried by one of the members and having two projecting free end portions. The free end portions engage associated contact surfaces when the operating member is in its other switching position whereby to electrically connect the terminals. The switch may be connected in circuit to provide an electrical output at one of the terminals followed by an electrical output at another of the terminals or may be arranged to provide simultaneous electrical output at two terminals. The contact spring means may also serve to retain the operating member in assembled relation with the switch base.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an end view of an electrical switch assembly embodying the present invention, the push button operator and switch housing being shown in vertical axial section.

FIG. 2 is a fragmentary sectional view taken along the line 2-2 of FIG. 1.

FIG. 3 is similar to FIG. 1 but shows the push button operator in a depressed position.

FIG. 4 is a fragmentary sectional view taken generally along the line 4-4 of FIG. 2.

FIG. 5 is a fragmentary sectional view taken along the line 5-5 of FIG. 2.

FIG. 6 is an end view of another electrical switch assembly embodying the present invention, the push but-

ton operator and switch housing being shown in vertical axial section.

FIG. 7 is a fragmentary sectional view taken generally along the line 7-7 of FIG. 6.

FIG. 8 is a fragmentary side elevational view of the switch of FIG. 6, a portion of the housing side wall shown broken away to reveal structure therebehind.

FIG. 9 is a fragmentary sectional view taken along the line 9-9 of FIG. 7.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning now to the drawings, and referring first to FIGS. 1-5, a fragmentary portion of a keyboard switch assembly is shown which includes a push button switch module embodying the present invention and indicated generally by the reference numeral 10. The illustrated switch module 10 is of a double form, momentary contact type, and comprises a part of the keyboard switch assembly which includes a plurality of switch modules integrally connected in side-by-side series and particularly adapted for use in the keyboard for a computer, electric typewriter or the like. It includes a base, indicated generally at 12, which has three spaced apart electrical terminals 14, 16 and 18 mounted in fixed position thereon, and further includes an operating member or push button operator, indicated generally at 20. The push button operator is supported on a base for movement in one and an opposite direction relative thereto between projected and depressed positions corresponding to one and another switching position. A contact spring indicated generally at 22 and carried by the push button operator 20 has two projecting free end portions. Each of the spring free end portions engages a contact surface on one of the electrical terminals when the push button operator is in its depressed position to provide electrical connection between the three terminals 14, 16 and 18 as will be hereinafter further discussed. The free end portions of the spring 22 also cooperate with the base 12 and the push button operator 20 to retain the latter two parts in assembled relation, as will be hereinafter further discussed. Another spring 24 acts between the push button operator 20 and the base 12 to continuously urge the operator toward its projected position.

The base 12 may, as shown, form a common base for a plurality of integrally connected switch modules and comprises a hollow housing 26 and a terminal board 28 secured thereto by suitable fasteners such as the fastener 30. The housing 26 is made from an electrical insulating material and is preferably molded from plastic or like material. Further considering an individual switch module 10, the housing 26 thereof has a generally cylindrical neck portion at its upper end which partially defines a bore 32 of rectangular cross-section which extends downwardly therethrough. A pair of downwardly opening recesses 34, 34 are formed in the lower portion of the housing 26 at opposite sides of the housing bore. Each recess 34 is separated from the bore 32 by a dividing wall which has a downwardly opening slot 35 formed therein. Thus, each slot 35 communicates between an associated recess 34 and the bore 32 as best shown in FIGS. 2 and 3. The terminal board 28 comprises a generally rectangular strip of electrical insulating material common to the various switch modules 10, 10 which comprise the keyboard assembly and provides closures for the housings thereof. The electrical terminals 14, 16 and 18 are

mounted in fixed position on the terminal board 28 and have terminal portions which extend downwardly therethrough for connection to an external circuit network or, if desired, to a printed circuit associated with either side of the terminal board. The terminals 14, 16 and 18 respectively define upwardly facing contact surfaces 36, 38 and 40. The contact surfaces 36 and 38 are respectively disposed within associated recesses 34, 34 whereas the contact surface 40 associated with the central terminal 18 is disposed centrally within the bore 32.

The push button operator 20 has a button portion 42 at its upper end and an axially elongated shank portion 44 which depends from the button portion and has a generally rectangular cross-sectional configuration to complement the cross-sectional configuration of the bore 32 in which it is slidably received. At its lower end, the shank 44 has a downwardly opening recess 46 to receive the spring 22 therein. Four downwardly opening bayonet slots 48, 48 are formed in the walls of the shank 44 which surround the recess 46.

The spring 24 comprises a compression spring which surrounds the cylindrical neck portion of the housing 26 and acts between the housing and the button portion 42 to urge the push button operator 20 upwardly toward its projected position as it appears in FIG. 1. The spring 22 retains the push button operator 20 in assembly with the base member 12 and also limits the travel of the push button operator relative to the base member 12, as will be hereinafter further discussed.

Considering now the spring 22 in further detail, it comprises a torsion spring which has a helically coiled body portion 50 and a pair of free end portions 52 and 54 which project tangentially outwardly in opposite directions from opposite ends of the helical body portion. The spring 22 is assembled with the push button operator 20 and a base member 12 after the compression spring 24 has been positioned on the neck of the housing 26 and the shank 44 has been inserted into the bore 32. The body portion 50 is positioned within the recess 46 and thereafter the free end portions 52 and 54 are deflected laterally inwardly or toward each other to facilitate entry into a pair of generally diametrically opposed bayonet slots 48, 48. Each free end portion is also disposed within an associated slot 35. The free end portions 52 and 54 cooperate with the bayonet slots to retain the spring 22 in assembly with the push button operator 20, as best shown in FIG. 5. Each of the free end portions 52 and 54 extend outwardly through an associated slot 35 in the housing 26 and into an associated recess 34. When the push button operator 20 is in its projected position, as it appears in FIGS. 1 and 4, it will be noted that each of the free end portion of the spring 22 engages the upper edge of the associated slot 35 and the lower edge of an associated bayonet slot 48 to limit the upward travel of the operator 20 and to retain it in assembly with the base member 12.

The switch assembly is completed by securing the terminal board 28 in assembly with the housing 26 with fasteners 30, 30. When the switch 10 is fully assembled, each free end portion of the spring 22 is positioned above and in general alignment with an associated contact surface defined by one of the electrical terminals. Thus, the free end portion 52 is positioned above and generally aligned with the contact 36 whereas the free end portion 54 is positioned above and aligned in like manner with the contact 38, as best shown in FIGS. 1 and 2. It should be further noted that the central

contact surface 40 on the terminal 18 is positioned below and aligned with the spring body portion 50.

Considering now the operation of the switch 10 and referring first particularly to FIG. 1, when the push button operator 20 is depressed, the free end portions 52 and 54 respectfully engage the contact surfaces 36 and 38 before the body portion 50 engages the contact surface 40, a partially depressed position of the push button operator 20 being indicated in broken lines. When the operator 20 attains its fully depressed position, as it appears in FIG. 3, the body portion 50 engages the contact surface 40 to establish electrical connection between the contacts 14, 16 and 18. The switch 10 may be connected in circuit so that it is first conditioned to establish two circuit paths through the terminals 14 and 16 and then establish a common path to ground through the terminal 18. Thus, the switch may be employed to provide simultaneous output at the two terminals 14 and 16. The switch 10 may also be arranged in an external circuit network to complete a first circuit associated with the terminal 14 and 16 when the push button operator 20 is in a partially depressed position, as it appears in broken lines in FIG. 1, and to complete a second circuit which includes the central terminal 18 and either or both the terminals 14 and 16 when the operator is fully depressed, as it appears in FIG. 3.

The legs 52 and 54 are carried or lowered into initial engagement with the respectively associated contact surfaces 36 and 38 by the downward movement of the push button actuator 20, the initial position of contact spring engagement being indicated by broken lines in FIG. 1. Thereafter, further downward pressure on the push button operator causes the contact surface 36 to exert a generally upward or clockwise biasing force on the leg 52 and the contact surface 38 to exert a generally upward or counterclockwise biasing force on the leg 54, as will be evident from reference to FIGS. 1 and 3. This arrangement substantially eliminates any tendency for the spring end portions 52 and 54 to bounce with respect to the contact surfaces 36 and 38 after making. Accordingly, the present switch is substantially free of contact bounce characteristics which renders it particularly suitable for use as a keyboard switch where a sharp digital signal is required.

Referring now to FIGS. 6-9, another switch assembly embodying the present invention includes a push button switch module indicated generally by the reference numeral 10a. The switch 10a is similar in some respects to the switch 10 previously described and parts similar to parts previously described bear the same reference numeral and a letter a suffix and will not be described in detail.

The switch 10a has a base 12a which includes a hollow housing 26a and a terminal board 28a secured thereto by fasteners, such as the fastener 30a. It further includes a push button operator 20a and a compression spring 24a which urges the operator 20a toward its projected position. The base 12a differs from the base 12 previously described in that it has a somewhat lower profile. The slots 35a, 35a are also of a slightly different configuration than the slots 35 of the previously described base. The push button operator 20a includes a button portion 42a and a hollow axially elongated shank 44a which has a generally rectangular cross section to complement the cross section of the housing bore 32a. The shank 44a has openings 48a, 48a through opposite walls thereof which communicate with its hollow interior.

The principal differences between the switch 10a and the previously described switch 10 reside in the construction and arrangement of the contact springs and electrical terminals. The switch 10a includes a pair of contact springs indicated generally at 56, 56'. Each contact of the springs 56, 56' comprise a torsion spring and each spring respectively includes a helically coiled body portion 58, 58' and a pair of free end portions or legs 60, 60' and 62, 62'. The latter legs project tangentially outwardly from opposite ends of the body portion in generally parallel relation as best shown in FIG. 6. The lower leg of each spring 56' is bent to form an electrical terminal, the terminals so formed being designated at 62, 62'. Each spring 56, 56' is supported in an associated recess 34a by an elongated cylindrical rod 64 which extends through the spring body and has its ends supported in opposite end walls of the housing 26a as best shown in FIG. 7. The switch 10a also includes a third or central terminal 66 mounted in fixed position on the terminal board 28a. At its upper end the terminal 66 has two axially spaced apart upwardly facing contact surfaces 68 and 70 disposed within the bore 32a.

As in the previously described structure, the push button operator 20a is retained in assembly with the base 12a by contact spring free end portions 60 and 60'. Each of the latter free end portions projects inwardly from an associated recess 34a through an associated slot 35a and into and through an associated opening 48a in the shank. Thus, when the push button operator 20a is in its projected position as it appears in full lines in FIG. 6 and in FIG. 8 and 9, each free end portion respectively engages the upper edge of an associated slot 35a and the lower edge of an associated opening 48a, as best shown in FIG. 9 to retain the push button operator 20a in assembly with the base member 12a. The springs 56, 56' are wound so that each of the legs 60 and 60' is normally biased in the direction if its broken line position of FIG. 6. More specifically the spring leg 60 is biased in a clockwise direction and toward engagement with the contact surface 68 whereas the spring leg 60' is biased in a counterclockwise direction and toward engagement with the contact surface 70. However, the upwardly directed force exerted by the compression spring 24a upon the push button operator 20a exceeds the combined downwardly directed force exerted upon the operator 20a by the spring legs 60, 60'. Therefore, the push button operator 20a is normally maintained in its projected or full line position of FIG. 1 and holds the spring legs 60, 60' out of engagement with the contact surfaces 68 and 70, respectively.

Considering now the operation of the switch 10a, when the push button operator 20a is depressed, the contact spring end portions 60 and 60' are lowered into engagement with the contact surfaces 68 and 70 respectively. Since the contact surface 68 is spaced above a contact surface 70, the leg 60 will engage or "make" with the contact surface 68 before the leg 60' engages the contact surface 70. Thus, circuit continuity is first established between electrical terminals 62 and 66. A second "make" contact occurs when the spring leg 60' engages the contact surface 70 and at this time each of the terminals 62, 62' and 66 are electrically connected. Thus, it will be apparent that the switch may be connected in a circuit network to provide a second "make" contact which occurs always after a first "make" contact occurs or, if desired, the switch may be ar-

ranged to provide simultaneous electrical output at the terminals 62 and 66 if the terminal 62' is connected to a common ground, as previously discussed with reference to the switch 10. As in the previously described switch structure 10, the contact springs 56, 56' are constructed and arranged so that the free end portions 60 and 60' thereof exert downwardly directed biasing force on the push button operator 20a when it is in its fully projected position and during at least a portion of its travel between its projected and depressed positions. Since the end portions 60 and 60' are lowered into contact engagement with the contact surfaces 68 and 70 by depressing the push button operator 20a, the tendency for the movable contacts 60 and 60' to bounce after "making" with the contact surfaces 68 and 70 is substantially wholly eliminated.

I claim:

1. An electrical switch comprising a base member, an operating member supported by said base member for movement in one and an opposite direction between one and another switching position, contact spring means carried by one of the members and having two projecting free end portions, said contact spring means engaging said other member when said operating member is in its one switching position to maintain said operating member in assembly with said base member, means defining three spaced apart electrical terminals mounted in fixed position on said base member and having at least two contact surfaces, said terminals being electrically isolated from each other when said operating member is in said one switching position, each of said free end portions engaging one of said contact surfaces as said operating member is moved in said one direction from said one to said other switching position, said contact spring means electrically connecting said three terminals when said operating member is in said other switching position.

2. An electrical switch as set forth in claim 1 wherein said contact spring means engages said other member when said operating member is in its one switching position to maintain said operating member in assembly with said base member.

3. An electrical switch as set forth in claim 1 wherein said contact spring means comprises at least one torsion spring having a coil portion and defining at least one of said free end portions.

4. An electrical switch as set forth in claim 1 wherein said contact spring means is a single torsion spring defining said two free end portions.

5. An electrical switch as set forth in claim 4 wherein said one member comprises said operating member.

6. An electrical switch as set forth in claim 5 wherein said base member has a bore, said operating member comprises a push button operator which has an axially elongated shank slidably received in said bore and a recess in said shank, and said spring is disposed within said recess.

7. An electrical switch as set forth in claim 6 wherein said spring includes a helically coiled body portion disposed in said recess with its axis generally normal to the axis of said shank and said free end portions project tangentially outwardly from said body portion and beyond said shank.

8. An electrical switch as set forth in claim 7 wherein each of said contact surfaces is defined by an associated one of said terminals, said body portion is generally aligned with an associated one of said contact surfaces and each of said free end portions is aligned with an as-

sociated other of said contact surfaces.

9. An electrical switch as set forth in claim 8 wherein each of said free end portions biasingly engages said associated other of said contact surfaces before said body portion engages said one contact surface when said push button operator is moved from its one to its other switching position.

10. An electrical switch as set forth in claim 1 wherein said base member comprises said one member.

11. An electrical switch as set forth in claim 10 wherein said contact spring means comprises a pair of torsion springs and each of said torsion springs defines one of said free end portions.

12. An electrical switch as set forth in claim 11 wherein each of said torsion springs has another end portion which defines an associated one of said terminals.

13. An electrical switch as set forth in claim 12 wherein each of said contact surfaces is defined by the other of said three terminals.

14. An electrical switch as set forth in claim 13 wherein one of said free end portions biasingly engages an associated one of said contact surfaces before the other of said free end portions engages another of said contact surfaces when said operating member is moved from its one to its other switching position.

15. An electrical switch as set forth in claim 14 wherein said contact surfaces comprise two contact surfaces spaced apart in the direction of travel of said operating member.

16. An electrical keyboard switch comprising a base, a push button operator supported on said base for movement in one and an opposite direction generally toward and away from said base between one and another switching position, means for biasing said push button operator to and maintaining it in its one switching position, a torsion spring carried by said push button operator and having a helically coiled body portion supported with its axis generally normal to the path of push button operator movement and two free end portions projecting tangentially outwardly from said body portion, said free end portions engaging said push button operator and said base when said operator is in its one switching position to maintain said push button operator in assembly with said base, three spaced apart electrical terminals mounted in fixed position on said base, each of said electrical terminals being electrically isolated from the other of said electrical terminals when said push button operator is in its one switching position, each of said terminals having a contact surface thereon, said body portion engaging one of said contact surfaces and each of said free end portions biasingly engaging an associated other of said contact surfaces when said push button operator is in its other switching position to electrically connect said electrical terminals.

17. An electrical keyboard switch as set forth in claim 16 wherein each of said other contact surfaces engages an associated one of said free end portions and biases it in said opposite direction before said body portion engages said one contact surface when said push button operator is moved from its one switching position toward and to its other switching position.

18. An electrical switch comprising a base member, an operating member supporting by said base member for movement in one and an opposite direction between one and another switching position, a pair of torsion springs carried by said base member, each of said

torsion springs having a free end portion, and means defining three spaced apart electrical terminals mounted in fixed position on said base member, one of said terminals defining two contact surfaces spaced apart in the direction of travel of said operating member, each of the other of said terminals electrically connected to an associated one of said torsion springs, said three terminals being electrically isolated from each other when said operating member is in its one switching position, one of said free end portions engaging an associated one of said contact surfaces before the other of said free end portions engages the other of said contact surfaces when said operating member is moved from its one to its other switching position, said contact springs electrically connecting said terminals when said operating member is in its other switching position.

19. An electrical switch as set forth in claim 18 wherein said torsion springs have said free end portions thereof normally biased toward contacting engagement with said contact surfaces and held out of contacting engagement with said contact surfaces by said operating member when said operating member is in its one switching position and during an initial portion of its travel from said one switching position to said other switching position.

20. An electrical switch as set forth in claim 19 wherein said free end portions engage said base member and said operating member when said operating member is in said one switching position to retain said operating member in assembly with said base member.

21. An electrical switch as set forth in claim 18 wherein said base member has a bore, said operating member comprises a push button operator and has an axially elongated shank slidably received in said bore for movement in said one and said opposite directions generally toward and away from said base, said shank has a recess therein opening through one end thereof and toward said base, said free end portions project inwardly through said shank and into said recess and said one terminal is mounted on said base in alignment with said recess.

22. An electrical switch comprising a base member, an operating member supported by said base member for movement in one and an opposite direction between one and another switching position, contact spring means carried by one of the members and having two free end portions projecting in generally opposite directions and engaging said other member in said one switching position, and means defining three spaced apart electrical terminals mounted in fixed position on said base member and having at least two contact surfaces, said terminals being electrically isolated from each other when said operating member is in said one switching position, each of said free end portions engaging one of said contact surfaces as said operating member is moved in said one direction from said one to said other switching position, said contact spring means electrically connecting said three terminals when said operating member is in said other switching position.

23. An electrical switch as set forth in claim 22 wherein said base member has a bore, said operating member comprises a push button operator and has an axially elongated shank slidably received in said bore and a recess therein, and said free end portions project in generally radial directions through the wall of said shank and through the wall of said bore.

24. An electrical switch as set forth in claim 23 wherein said free end portions are normally spring bi-

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ased into contacting engagement with said contact surfaces and held out of contacting engagement with said contact surfaces by said operating member in its one switching position and during a portion of its travel to its other switching position and including means for biasing said push button operator to and maintaining it in its one switching position.

25. An electrical switch as set forth in claim 24 wherein said biasing means comprises a compression spring coaxially surrounding said shank and acting between said push button operator and said base member.

26. An electrical keyboard switch comprising a base member, a push button operator supported by said base member for movement in one and an opposite direction between projected and depressed positions, means for continuously biasing said push button operator toward its projected position, a pair of torsion springs mounted on said base member, each of said springs having a free end portion projecting into the path of said push button operator, and means defining two contact surfaces spaced apart in the direction of travel of said push button operator, each of said free end portions aligned with an associated one of said contact surfaces and normally spring biased into contacting engagement therewith when said push button operator is in its depressed position, each of said free end portions

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held out of contacting engagement with its associated contact surface by engagement with said push button operator, when said push button operator is in its projected position and during a portion of its travel from its projected to its depressed position, each of said free end portions exerting biasing force on said push button operator in the direction of its depressed position when said push button operator is in its projected positions and during only a portion of its travel from its projected position to its depressed position, each of said free end portions being out of engagement with said push button operator and spring biased into contacting engagement with its associated contact surface during the final portion of push button operator travel from its projected to its depressed position, one of said free end portions engaging its associated contact surface before the other of said free end portions engages its associated contact surface when said push button operator is moved from its projected position to its depressed position.

27. An electrical keyboard switch as set forth in claim 26 wherein said free end portions cooperate with said base member and said push button operator to retain said push button operator in assembly with said base member.

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UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 3,920,943
DATED : November 18, 1975
INVENTOR(S) : Lloyd J. Lapointe

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 1, line 32, "SUUMMARY OF THE INVENTION"
should be --SUMMARY OF THE INVENTION--.

Col. 6, line 29, "leat" should be --least--.

Col. 6, line 48, after "means" insert --comprises--.

Col. 6, line 60, "genrally" should be --generally--.

Col. 6, line 66, "genrally" should be --generally--.

Col. 7, line 39, "genrally" should be --generally--.

Col. 7, Line 65, "operting" should be --operating--.

Signed and Sealed this

twenty-fourth Day of February 1976

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks