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[54] HIGH SPEED PUSH BUTTON SWITCH

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[52] **U.S. Cl.** **200/160**, 200/77, 200/78

[51] **Int. Cl.**.....**H01h 15/18**

[58] **Field of Search**.....200/77, 78, 160

[56] **References Cited**

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[57] **ABSTRACT**

A normally open, momentary, double make, push button contact switch includes a push button which is biased outward by a spring. Upon depression of the push button, a cam surface on the push button engages and separates a pair of flexible legs which hold a contact disc in a fixed non-circuit position. After the legs are separated, a spring drives the contact disc downward to engage a pair of spaced, flexible contact blades. Momentary electrical connection of the blades is provided by the passing disc. Upon release of the push button, a collar associated with the push button separates the contact blades so that the assembly may reassume its original, unactivated position without again making an electrical circuit.

27 Claims, 13 Drawing Figures

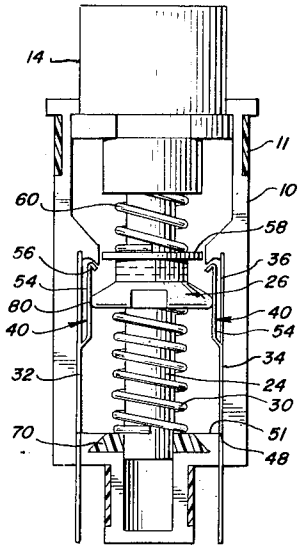


FIG. 1

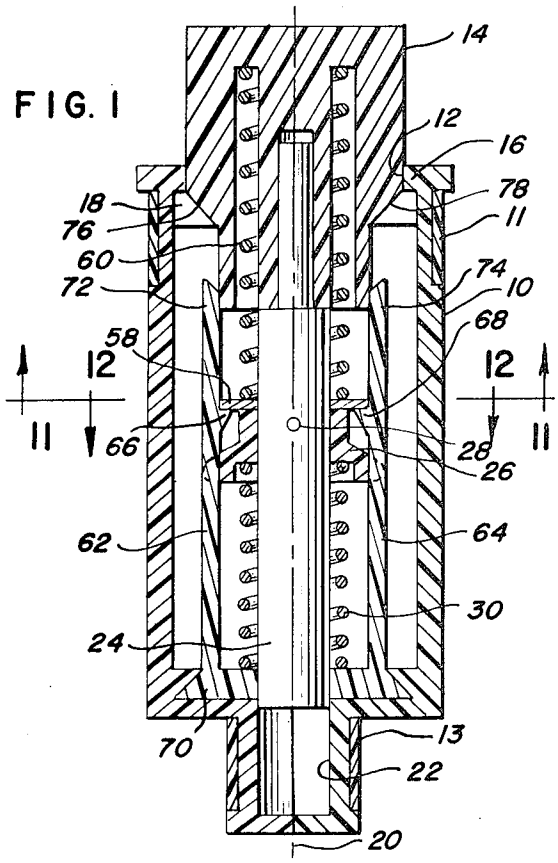


FIG. 2

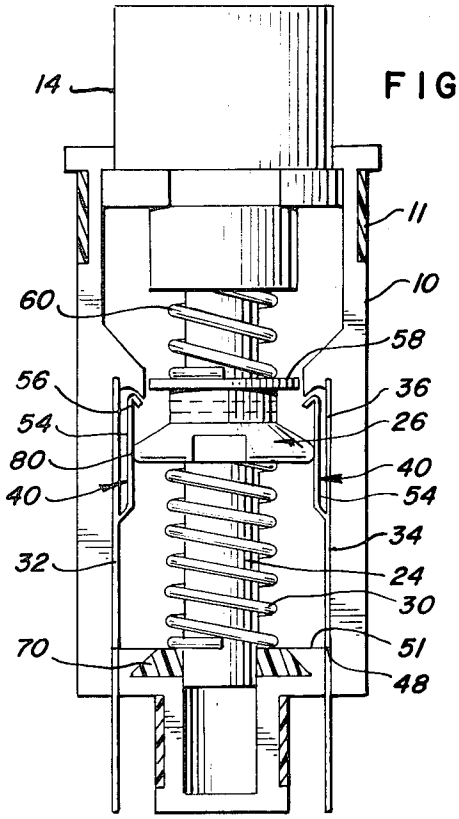


FIG. 3

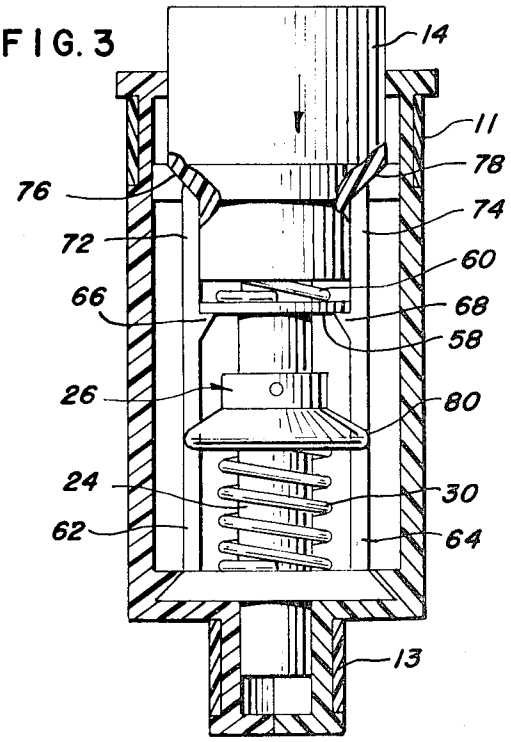
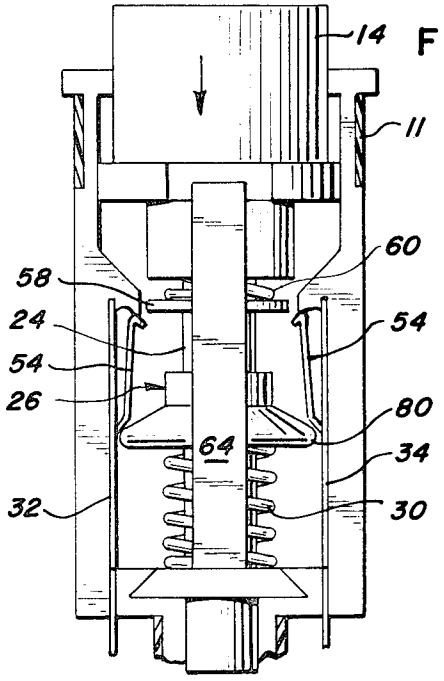


FIG. 4



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FIG. 5

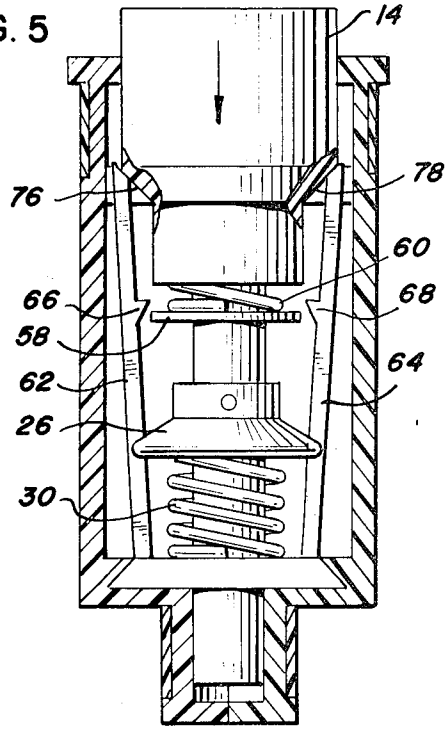


FIG. 6

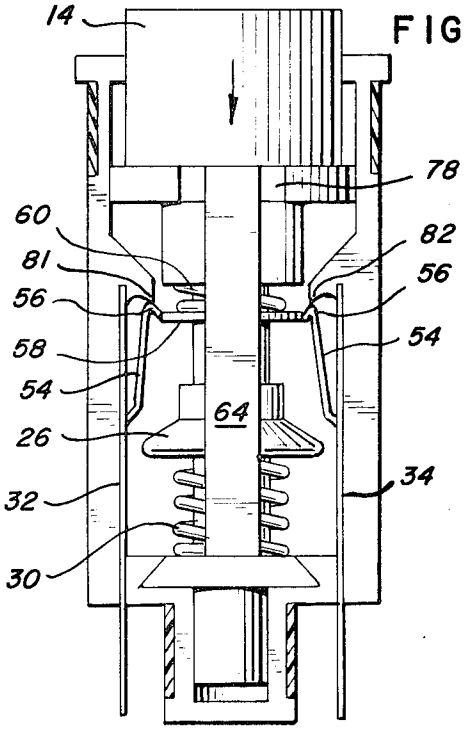


FIG. 7

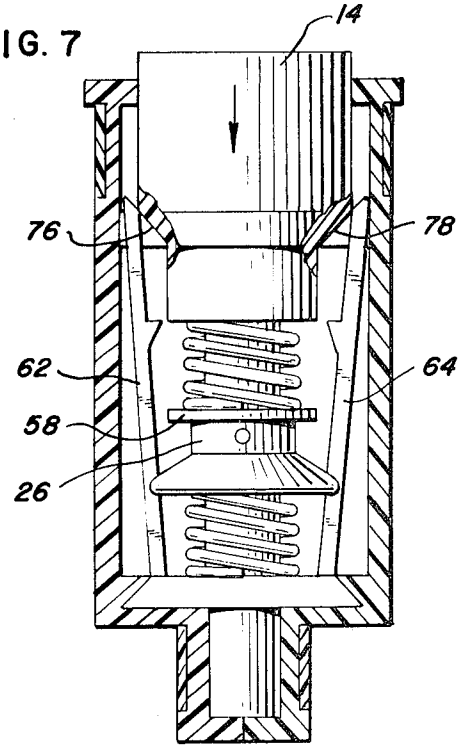
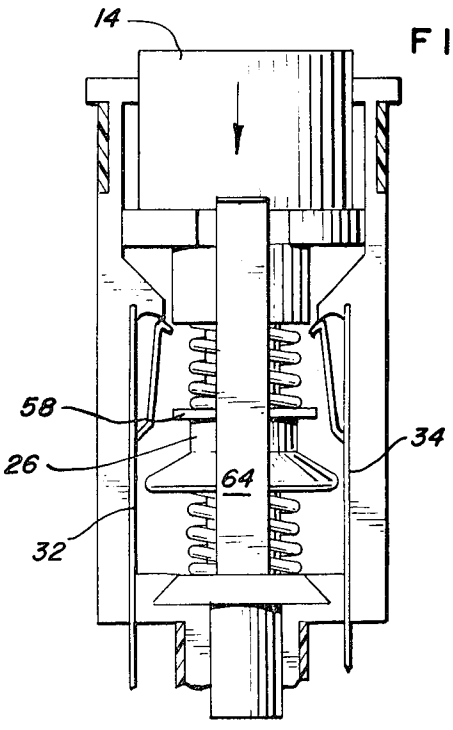


FIG. 8



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FIG. 9

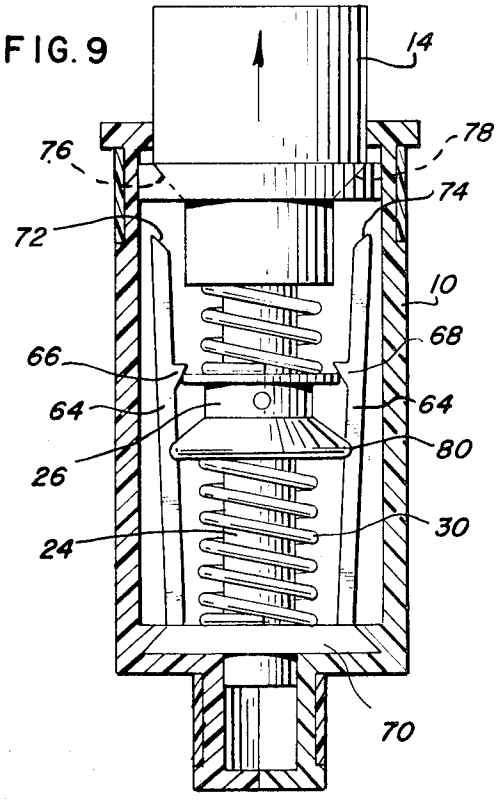


FIG. 10

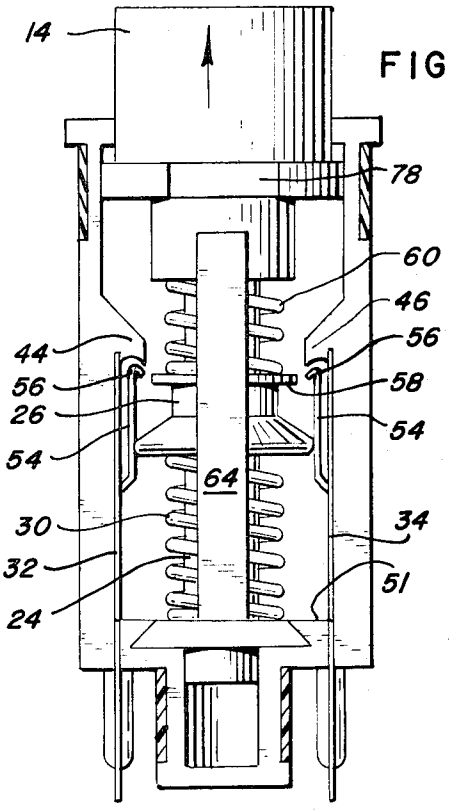


FIG. 11

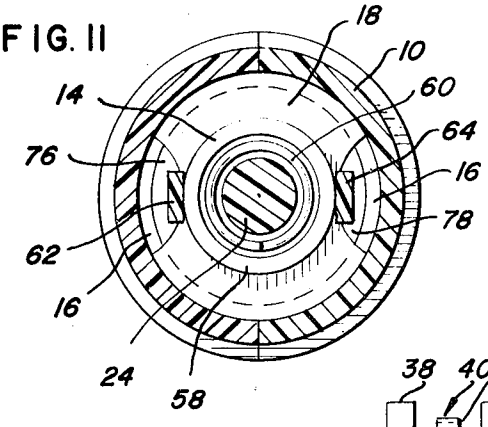


FIG. 12

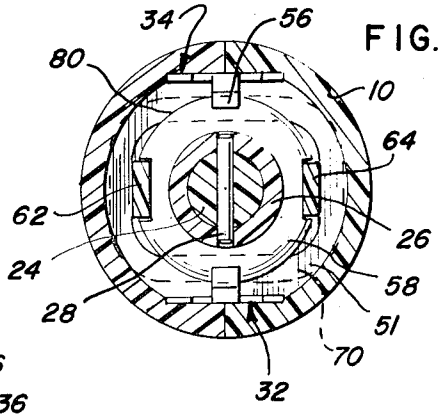
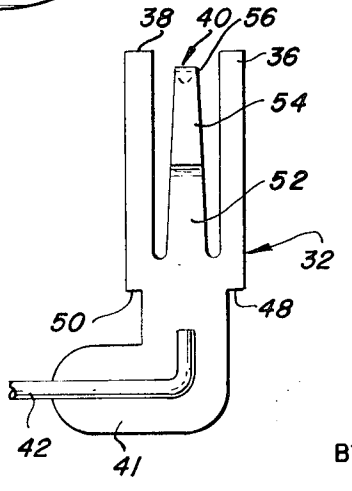


FIG. 13



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HIGH SPEED PUSH BUTTON SWITCH

BACKGROUND OF THE INVENTION

In a principal aspect, the present invention relates to a momentary contact, push button switch which provides positive electrical contact momentarily between two spaced contact blades.

With the advent of more complex electrically operated equipment, it has become necessary to develop switches which are more sensitive and which provide positive, stable, though momentary signals. It is also desirable to provide a momentary push button switch which supplies a signal only upon depression of the push button and not upon release of the push button. Additionally, it is desirable to provide a mechanical, high speed push button switch.

SUMMARY OF THE INVENTION

In a principal aspect, the present invention comprises a normally open, momentary, double make push button contact switch for making momentary contact connections between contact blades upon manual depression of a push button member of the switch. The momentary mechanical connection is effected by driving a movable contact member between two substantially fixed contact members so that a momentary electrical connection is provided through all of the contact members. The movable contact member is driven by a biasing spring whenever a push button associated with the switch is depressed. Upon release of the push button, the movable contact member is returned to its original position without completing an electrical circuit between the fixed contact blades.

It is thus an object of the present invention to provide an improved push button switch.

It is a further object of the present invention to provide an improved momentary push button contact switch which provides an electrical connection between a movable contact and a pair of fixed contacts.

It is a further object of the present invention to provide an economically constructed momentary push button switch.

Still one further object of the present invention is to provide a momentary push button switch which includes means for completing an electric circuit for a few microseconds upon depression of the push button associated with the switch.

One further object of the present invention is to provide a momentary push button switch of simple design and compact in size.

These and other objects, advantages and features of the present invention will be set forth in the detailed description which follows.

BRIEF DESCRIPTION OF THE DRAWING

In the detailed description which follows, reference will be made to the drawing comprised of the following figures:

FIG. 1 is a cross-sectional view of the switch of the invention wherein the push button is in a non-depressed position;

FIG. 2 is a cross-sectional view of the switch of the invention in the same position shown in FIG. 1 with a section being taken at 90° from the section of FIG. 1;

FIG. 3 is a cross-sectional view of the switch of the invention with the push button partially depressed;

FIG. 4 is a sectional view taken 90° from the view of FIG. 3;

FIG. 5 is a sectional view of the switch wherein the push button is depressed to release the contact disc;

FIG. 6 is a sectional view taken 90° from the view of FIG. 5;

FIG. 7 is a sectional view of the switch wherein the push button has been fully depressed;

FIG. 8 is a sectional view taken 90° from the view of FIG. 7;

FIG. 9 is a sectional view of the switch wherein the push button has been released and is returning to its non-depressed position;

FIG. 10 is a sectional view taken 90° from the view of FIG. 9;

FIG. 11 is a cross-sectional view of the switch taken along the line 11—11 in FIG. 1;

FIG. 12 is a cross-sectional view of the switch taken substantially along the line 12—12 in FIG. 1; and

FIG. 13 is an elevation of the fixed contact blade incorporated as part of the switch of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The figures are arranged in pairs of views showing cross-sections of the switch of the invention. The pairs of figures illustrate the switch at its various stages of operation, with each associated pair of views being taken at 90° from each other. Thus, FIGS. 1 and 2, FIGS. 3 and 4, FIGS. 5 and 6, FIGS. 7 and 8, and FIGS. 9 and 10 represent respectively the sequence of position of the switch as it is being operated.

Referring to the FIGS. 1 through 13, the switch includes a cylindrical outer housing 10 which is generally fabricated from a nonconductive plastic material by a molding process. The housing 10 is generally comprised of two mirror image parts or halves which are joined along a longitudinal axis. Straps 11 and 13 hold the assembly together. The cylindrical housing 10 includes an opening 12 for a push button 14. A circumferential collar or flange 16 around the opening 12 of the housing 10 cooperates with a collar or flange 18 on the push button 14. That is, the flanges 16 and 18 cooperate to limit the travel of the push button 14 upward along a longitudinal axis 20 of the switch.

The lower end of the housing 10 includes a cylindrical guide channel 22 adapted to receive a rod 24. The rod 24 is connected with the push button 14 as illustrated in FIG. 1. The push button 14 and rod 24 may be integrally molded also. A collar 26 is fastened to the rod 24 by means of a pin 28. A restoring spring 30 is interposed between the collar 26 and a base or dove-tail section 70 mounted in a housing 10 to constantly bias the push button 14 outward along axis 20. Thus, the spring 30 tends to drive flanges 16 and 18 into continuous engagement.

The interior of the housing 10 is substantially a cylindrical cavity of a constant or uniform diameter. Positioned within this cavity on opposite sides of the cavity are a pair of substantially fixed contact blades 32 and 34. A contact blade 32 is illustrated in greater detail in FIG. 13. Referring to FIG. 13, the contact blade 32 includes a pair of planar lobes 36 and 38 and a flexible projecting lobe 40. At the opposite end of the contact 32 away from the lobes 36, 38 and 40, the contact

blade 32 includes a lead wire connection 41 for cooperation with a lead as at 42.

As illustrated in FIGS. 2, 4, 6, 8, 10 and 12, the contact blades 32 and 34 are locked in position against planar inside surfaces of the housing 10. The planar lobes 36 and 38 are engaged in appropriate openings defined in interior extensions 44 and 46 of the housing 10. A pair of projections 48 and 50 (shown in FIG. 13) at the lower edge of blades 32 and 34 cooperate with the bottom surface 51 of the housing 10 to hold the blades 32 and 34 in a fixed position within the housing 10.

The projecting lobe 40 of blades 32 and 34 includes a first longitudinal run 52 which is substantially coplanar with lobes 36 and 38. An upper extension of the lobe 40 is comprised of a second run 54 which terminates with an arcuate end portion 56. Arcuate end portion 56 defines the portion of the blades 32 and 34 which makes electrical contact with a disc 58 discussed below. The projecting lobe 40 is flexible toward the interior side walls of the housing 10 since it is made from a flexible contact blade material. The axis of flexion is substantially at the connection between the first run 52 and the second run 54.

The arcuate end portion 56 of lobe 40 extends downward toward the bottom surface 51 of the housing 10 for a desired distance. The length of the downward portion of the arcuate end portion 56 determines, in part, the duration in time of the momentary making of contact by the switch of the present invention.

Also positioned within the housing 10 above the top of the collar 26 is an annular contact disc or movable contact 58. The disc 58 is fabricated from an electrically conductive material so that when the contact disc is appropriately positioned against projecting lobes 40 of blade 32 and blade 34, a circuit will be completed through the switch. Normally, when the push button switch is in the non-depressed position, the disc 58 is maintained in the position illustrated in FIG. 1 by a disc biasing or drive spring 60. Spring 60 is positioned on the rod 24 in the same manner as the spring 28. The spring constant of spring 60 is less than the spring constant of spring 30 so that the spring 30 will tend to drive the unactivated switch to the position shown in FIGS. 1 and 2.

Cooperating with the spring 60 and disc 58 is a pair of cam legs 62 and 64. The cam legs 62 and 64 are fabricated from a non-conductive material. Legs 62 and 64 extend longitudinally in the housing 10. The cam legs 62 and 64 are cantilevered members and are thus preferably constructed of a flexible plastic material. The cantilever members or cam legs 62 and 64 are connected at their lower ends by an annular dovetail section 70 which is integrally molded with the cam legs 62 and 64. Besides serving as a base for fastening the cam legs 62 and 64, the dove tail section 70 includes a circumferential wedge cross section as illustrated in the figures which cooperates to lock the halves or sections of the housing 10 together and, in addition, serves to maintain the cam legs 62 and 64 in a fixed position.

Each leg 62 and 64 includes an inwardly projecting barb or shoulder 66 and 68 respectively. The barbs 66 and 68 are positioned to engage the disc 58 and hold it in a fixed position in cooperation with the spring 60. The legs 62 and 64 also include upper active portions 72 and 74 respectively which cooperate, respectively, with cam leg driving surfaces 76 and 78 defined in the push button 14. Thus, surfaces 76 and 78 cooperate to separate the cam legs 62 and 64, thereby releasing the disc 58 permitting the spring 60 to bias disc 58 downwardly about the rod 24. Note that the rod 24 serves as a guide for the disc 58.

The collar 26, which was previously identified, includes a circumferential cam section 80 that cooperatively engages the second run 54 of the blades 32 and 34. This is described in greater detail below. A description of the operation of the apparatus will also provide a more complete appreciation of its construction.

Referring first to FIGS. 1 and 2, the switch is shown in the non-depressed or unoperated position. The disc 58 rests against the barbs 66 and 68. Simultaneously, the cam section 80 of collar 26 separates the runs 54 of blades 32 and 34. In this position, no electric contact is established between the blades 32 and 34 since the blades are (1) separated, and (2) the disc 58 is elevated above the arcuate end portions 56.

Turning next to FIGS. 3 and 4, the push button 14 has been partially depressed, thereby compressing the springs 30 and 60. The cam section 80 is now no longer engaged with the second runs 54. Thus, the second runs 54, by virture of their self-biasing action, are displaced so that the arcuate end portions 56 are placed in a path of travel that the disc 58 will take when guided by the rod 24. The arcuate end portions 56 of blades 32 and 34 are precisely positioned in the path of travel of disc 58 because the arcuate end portions 56 are biased toward axis 70 and are in contact with lips 81 and 82 defined in the housing 10. Lips 81 and 82 are, of course, of an insulating material. The disc 58 is still maintained in position by the shoulders 66 and 68. Note that the upper active portions 72 and 74 of legs 62 and 64 are just being engaged by the surfaces 76 and 78 of the push button 14. Note also that the collar 26 serves the dual function of compressing the spring 30 and, when appropriate, engaging the second run 54.

Referring next to FIGS. 5 and 6, the cam legs 62 and 64 have been separated by the action of the push button 14. This causes the shoulders 66 and 68 to release the disc 58 as illustrated in FIG. 5. As shown in FIG. 6, the disc 58 then completes an electric circuit between the blades 32 and 34. This results because the disc 58 engages the arcuate end portions 56 of the blades 32 and 34. The spring 30 is still maintained in a compressed configuration by the collar 26. The duration of the connection of the disc 58 with the arcuate end portions 56 is dependent upon a number of features, among them the driving force or spring constant of the drive spring 60 and the length of the downwardly extending section of the arcuate end portions 56. Again, it should be noted that the lips 81 and 82 hold the arcuate end portions 56 in a fixed position relative to the path of travel of disc 58. The biasing force of the second run 54 maintains the arcuate end portions 56 in position against lips 81 and 82. Thus, the switch components can be chosen to adjust the contact time in the range of a few microseconds to about 100 microseconds.

Referring next to FIGS. 7 and 8, the switch is shown in a fully depressed position. Here it can be seen that the collar 26 serves to catch the disc 58 and prevents its

further downward movement. The cam legs 62 and 64 are now fully separated, but the disc 58 is no longer in contact with the blades 32 or 34.

Next in the sequence of operation, the push button is released as illustrated in FIGS. 9 and 10. Upon release of the push button 14, the spring 30 drives the collar 26, the rod 24 and button 14 upward. The cam section 80 of the collar 26 engages the second runs 54, thereby separating the second runs 54 so that the arcuate end portion 56 will not engage the disc 58 as it passes upward along the rod 24. Thus, momentary electrical contact is provided only upon depression of the push button 14 and not upon release thereof.

When the switch is in the non-operated position, the distance of separation of the surface 76 and 78 from the end portions 72 and 74 is equal to or greater than the length of engagement of runs 54 with cam sections 80. This insures that the end portions 56 will be engaged by disc 58 when legs 62 and 64 are separated.

This momentary switch may be of very small construction. Further, the duration of contact does not depend upon the speed at which the push button 14 is depressed. That time is dependent upon the features discussed above and is substantially constant regardless of how slowly button 14 is depressed. The spring constant of spring 60 determines the speed at which disc 58 is driven and thus the period of contact.

While in the foregoing there has been set forth a preferred embodiment of the invention, it is to be understood that the invention is only to be limited by the following claims and their equivalents.

What is claimed is:

1. A normally open, momentary, double make, push button contact switch for making momentary contact connections upon depression of a manually operative member of said switch, comprising, in combination:

a switch housing;

at least two spaced contact blades mounted in said housing;

a movable contact translatable in said housing along a path and capable of momentarily connecting said contact blades during translation of at least a portion of said path;

guide means positioned in said housing for guiding said movable contact on said path;

means in said housing for normally retaining said movable contact in a first no make, non-translating position;

a manually operative member mounted for positional change in said housing;

means responsive to positional change of said manually operative member from a non-operated position for disengaging said means for retaining said movable contact in a first no make non-translating position; and

means in said housing for driving said movable contact on said guide means along said path into momentary electrical connection with said contact blades whenever said means for retaining is disengaged from said movable contact by said means responsive to positional change.

2. The switch of claim 1 wherein said contact blades include a portion for electrical connection with said movable contact along a fixed distance of said path during translation of said movable contact to thereby control the period of contact of said movable contact with said blades.

3. The switch of claim 1 including means positioned in said housing for displacing said contact blades to a position for non-engagement with said movable contact.

4. The switch of claim 3 wherein said means for displacing is driven in said housing by engaging said means responsive to positional change of said manually operative member from a non-operated position.

5. The switch of claim 1 wherein said guide means and said manually operative member comprise an integral component of said switch.

6. The switch of claim 1 wherein said means for retaining comprises at least one displaceable cam surface mounted in said housing, said cam surface normally engaging and retaining said movable contact in a first no make, non-translating position when said manually operative member is in a non-operated position.

7. The switch of claim 6 wherein said manually operative member drives and displaces said displaceable cam surface when said manually operative member is translated to an operated position thereby disengaging said movable contact from said means for retaining.

8. The switch of claim 1 wherein said means for driving said movable contact includes biasing means positioned in said housing to continuously bias said contact against said means for retaining, said biasing means, upon disengagement of said means for retaining, subsequently driving said movably contact along said guide member into momentary electrical connection with said contact blades.

9. A normally open, momentary, double make, push button contact switch for making momentary contact connections upon depression of a manually operative member of said switch, comprising, in combination:

a housing with a longitudinal axis and having a push button end and an opposite end;

first and second spaced contact blades mounted in said housing substantially parallel to each other and to said longitudinal axis;

a movable contact translatable in said housing in a path along the direction of said longitudinal axis and engageable with at least a portion of said contact blades along at least a portion of said path during translation in at least one direction along said path;

a guide member positioned in said housing for guiding said movable contact on said path for connecting said contact blades during translation, said guide member extending substantially parallel to said longitudinal axis;

means in said housing for normally retaining said movable contact in a first no make, non-translating position;

a manually operative member mounted for positional change with respect to said housing for disengaging said means for retaining said movable contact in a first no make, non-translating position whenever said manually operative member is moved to a first operating position; and

means in said housing for driving said movable contact on said guide member along said path to momentarily engage said contact blades whenever

said means for retaining is disengaged from said movable contact by positional change of said manually operative member to thereby momentarily complete a circuit.

10. The switch of claim 9 including means in said housing for displacing at least one of said contact blades to a position for non-engagement with said movable contact.

11. The switch of claim 10 including means in said housing for displacing said contact blades comprising a contact blade biasing cam driven on said guide member in response to positional change of said manually operative member from a non-operated position.

12. The switch of claim 9 wherein said guide member and said manually operative member are mounted for coincident movement substantially parallel to said axis, and including restoring biasing means continuously biasing said guide member and said manually operative member toward a non-operated position of said switch.

13. The switch of claim 9 wherein said guide means is a rod and wherein said movable contact is a disc member slidably mounted on said rod within said housing.

14. The switch of claim 9 wherein said contact blades include a flexible run within said housing, substantially parallel to said axis, said run being normally biased toward a position for engagement with said movable contact, and including means in said housing for displacing at least one of said runs to a position for non-engagement with said movable contact.

15. The switch of claim 14 wherein said means for displacing is driven along said guide member by said manually operating member between an engaging position with said blade and a non-engaging position with said blade.

16. The switch of claim 9 wherein said guide means is a rod and said movable contact is a disc member slidably mounted on said rod, said rod being biased to a non-operated position, said rod being translatable in said housing parallel to said axis in the opposite direction of said biasing by positional change of said manually operative member from a non-operated position.

17. The switch of claim 9 wherein said guide means comprises a translatable rod parallel to said axis and wherein said movable contact is an annular disc member slidably mounted on said rod and translatable parallel to said axis, said rod including a disc blocking member for engagement by said disc, and said means for driving said contact including disc biasing means in said housing for constantly biasing said disc toward engagement with said blocking member.

18. The switch of claim 9 wherein means for retaining said movable contact includes at least one displaceable cam surface in said housing for engaging said movable contact whenever said manually operative member is in a non-operated position, said manually operative member including means for disengaging said displaceable cam surface upon positional change of said manually operative member from a non-operated position to release said movable contact.

19. A normally open, momentary, double make, push button contact switch for making momentary contact connections upon depression of a manually operative member of said switch, comprising, in combination:

a housing having a longitudinal axis, a push button end and an opposite end;

a translatable push button at said push button end mounted for positional change in said housing including a longitudinal rod extending parallel with said axis and translatable within said housing;

first biasing means in said housing for biasing said rod and button to a non-depressed position;

at least two contact blades mounted in said housing parallel to said axis and spaced from said rod;

a disc member mounted on said rod for translation in a direction parallel to said axis from a position of non-engagement with said contact blades to a position of momentary engagement with said blades during translation;

disc member biasing means positioned in said housing for biasing said disc member toward engagement with said blades;

stop means positioned in said housing for normally retaining said disc member from engagement with said blades; and

means responsive to positional change of said push button from a non-operated position for disengaging said stop means and permitting said disc member to be translated along said rod into momentary engagement with said blades.

20. The switch of claim 19 including a cam block mounted on said rod, said cam block being engageable with said blades to displace said blades from a position in the path for engagement with said disc member whenever said push button is returned from a depressed position to a non-depressed position.

21. The switch of claim 20 wherein said blades have a first run parallel to said axis, said cam block being engageable with said blades along said run, and wherein said means responsive to positional change of said push button from a non-operated position for disengaging said stop means is operative to disengage said stop means upon disengagement of said cam block with said blades.

22. The switch of claim 19 including lip means in said housing for maintaining said blades in a fixed path for engagement with said disc member.

23. The switch of claim 19 wherein said blades include a portion for engagement with said disc member along a fixed distance during translation of said disc member parallel to said axis.

24. The switch of claim 23 wherein the fixed distance of said portion is chosen to control the period of contact of said disc member with said blades.

25. The switch of claim 19 wherein said disc member biasing means is chosen to control the period of contact of said disc member with said blades.

26. The switch of claim 19 wherein said disc member is freely mounted on said rod to make momentary engagement with said blades during longitudinal translation of said disc along said rod.

27. A normally open, momentary, double make contact switch for making momentary contact connections, comprising, in combination:

a guide member;

a movable contact translatable in a path along said guide member;

means for translating said movable contact along said guide member;

at least two contact blades mounted adjacent said guide member in said path for electrical connection between said blades through said movable contact during translation of said movable contact along said guide member;

means for normally retaining said movable contact in a non-translated position on said guide member and rendering said means for translating ineffective to translate said contact; and

means for disengaging said means for retaining said movable contact and render said means for translating effective thereby permitting said movable contact to translate in said path along said guide member to make momentary connection with said blades during translation.

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