

[54] PUSH BUTTON SWITCH

[72] Inventor: **Dean H. Fox**, Golden, Colo.
[73] Assignee: **Hathaway Instruments, Inc.**, Denver, Colo.
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[52] U.S. Cl.335/205
[51] Int. Cl.H01h 3/12, H01h 13/52
[58] Field of Search335/205, 206, 207

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Primary Examiner—Bernard A. Gilheany
Assistant Examiner—R. N. Envall, Jr.
Attorney—McGrew and Edwards

[57] ABSTRACT

A push button switch of the magnetic reed type is provided with a rotatable actuating magnet to close the reed contacts in one position of the magnet and to open them in another. The magnet is rotatably mounted on the switch housing adjacent the reed switch on a stationary axis transverse to the longitudinal axis of the switch and is rotated from one position to the other by a linearly movable spring biased low inertia slide connected to rotate the magnet by operation of a crank pin and lost motion slot connection. The switch housing is a longitudinally split cylinder, provides a bore for the slide and is held in assembled relationship by a cylindrical sleeve and a closure cap.

8 Claims, 12 Drawing Figures

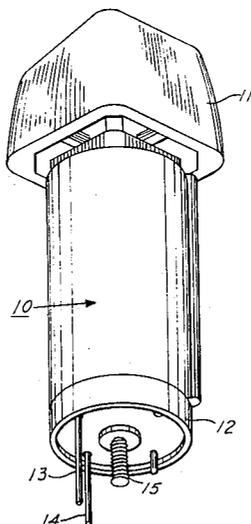


FIG. 1

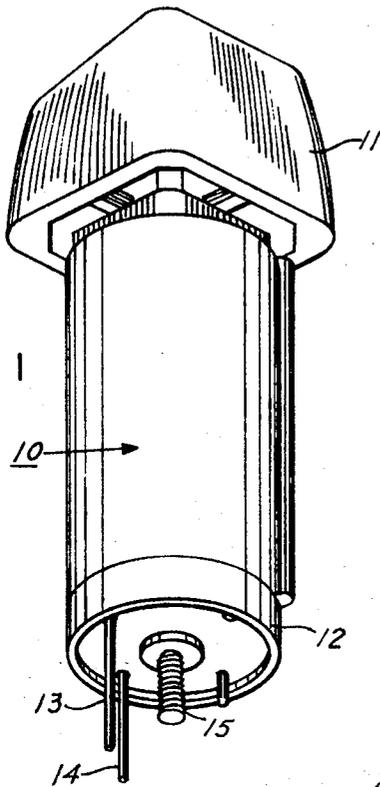
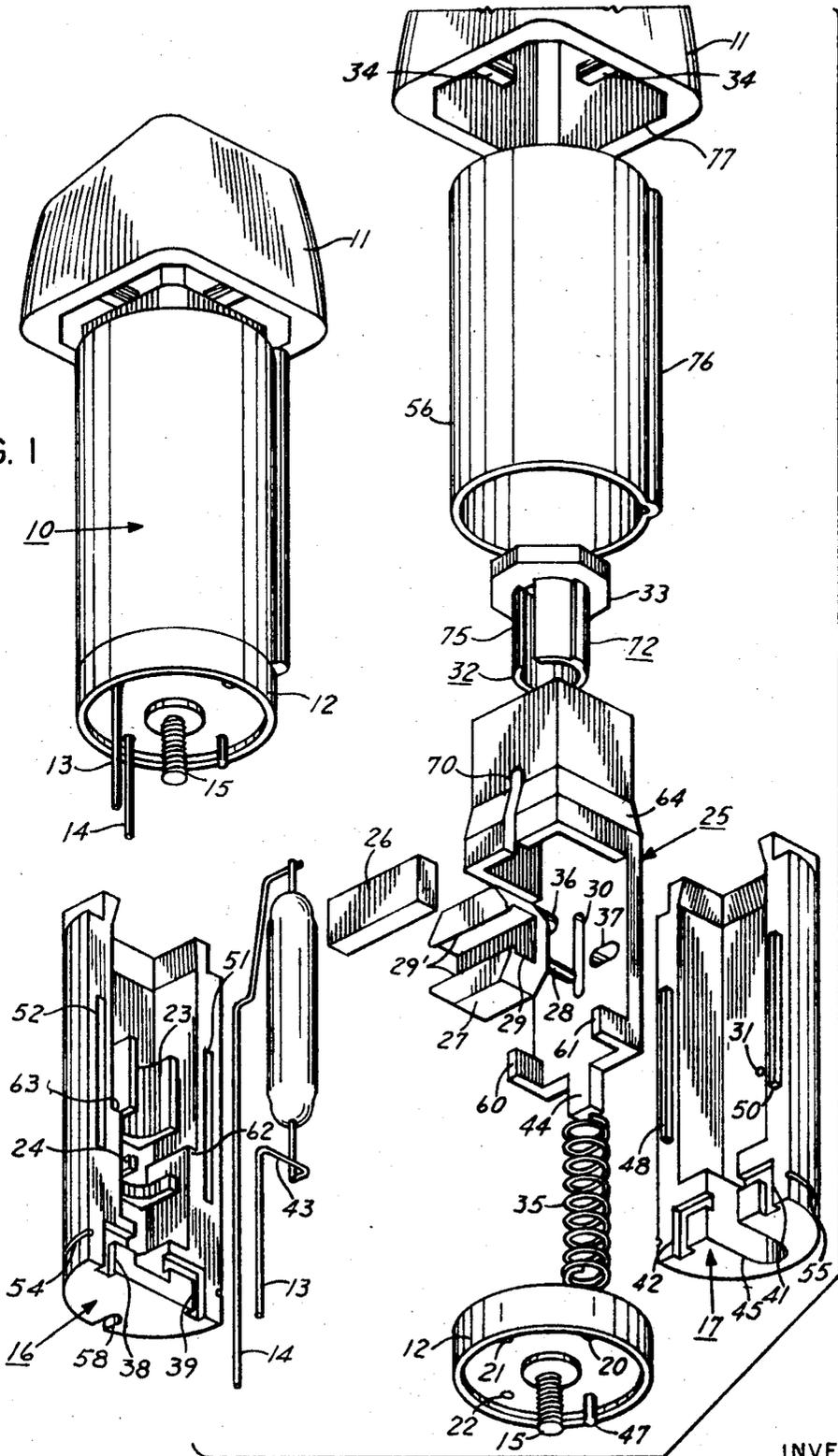


FIG. 2



INVENTOR
DEAN H. FOX
BY *Edward*
ATTORNEYS

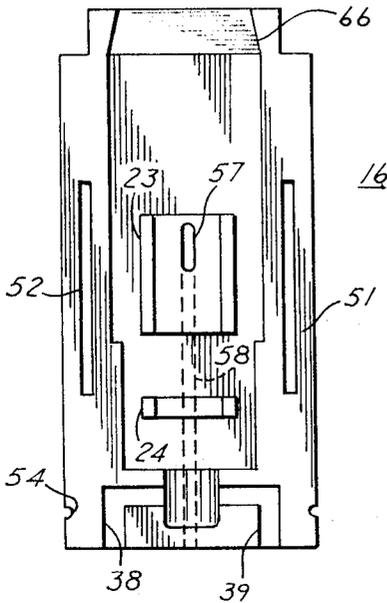


FIG. 3

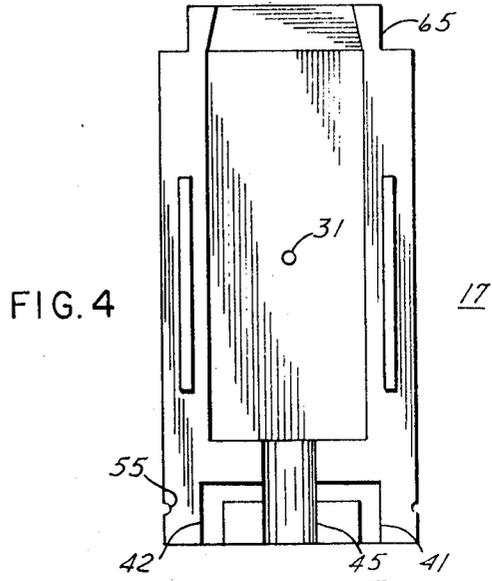


FIG. 4

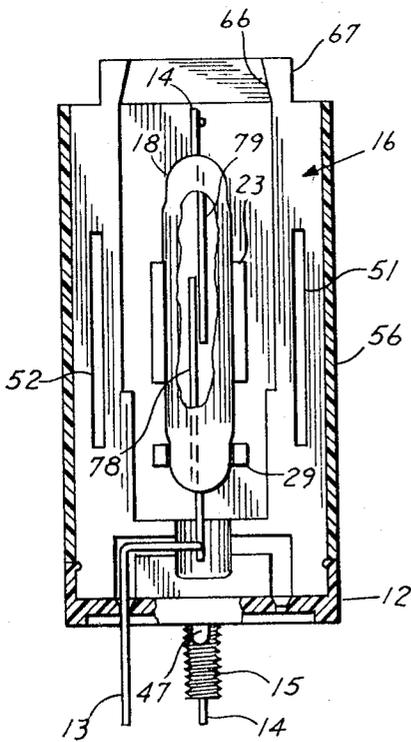


FIG. 6

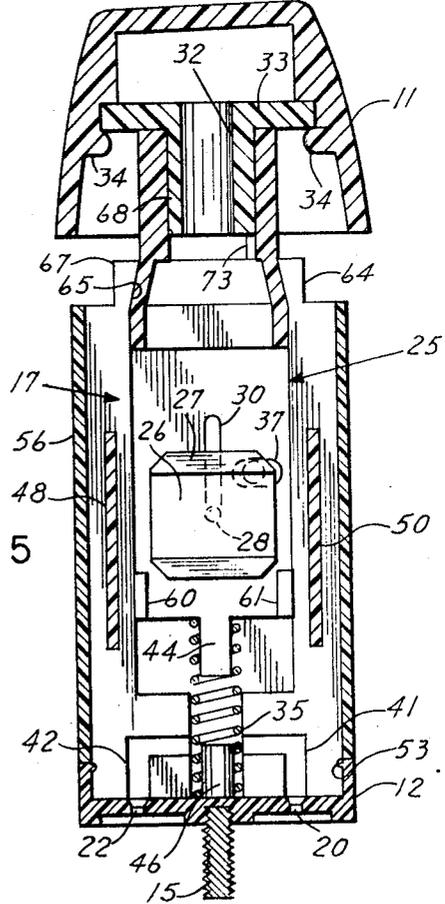


FIG. 5

INVENTOR
DEAN H. FOX
BY *McBrew & Edwards*
ATTORNEYS

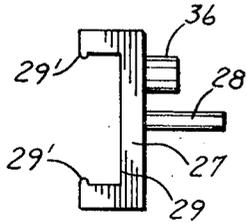


FIG. 10

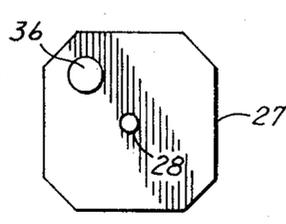


FIG. 11

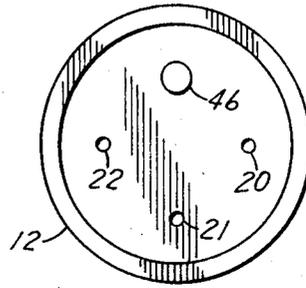


FIG. 12

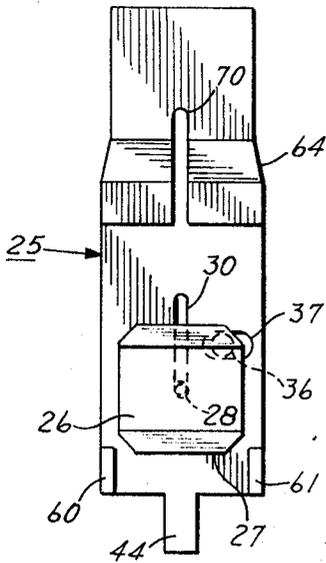


FIG. 7

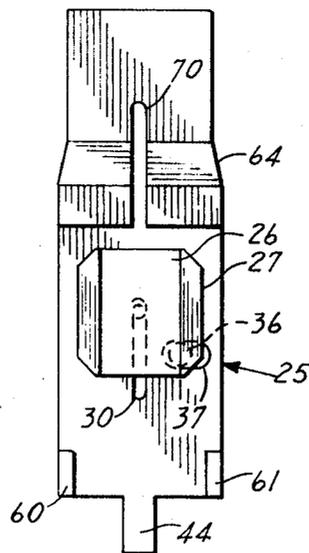


FIG. 8

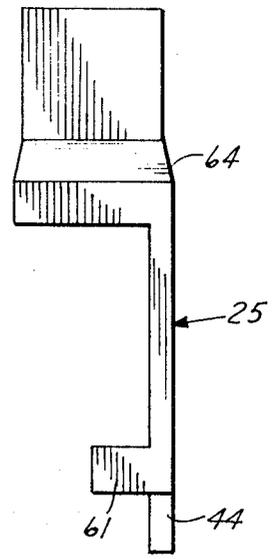


FIG. 9

INVENTOR
DEAN H. FOX
BY *McGraw-Hill*
ATTORNEYS

PUSH BUTTON SWITCH

This invention relates to push button switches of the magnetically actuated switch type and particularly to an improved arrangement for utilizing a rotatable magnet for actuating a switch of the reed type upon depression of the push button.

BACKGROUND OF THE INVENTION

Various types of switch actuators have been provided heretofore, which employ magnetic elements for actuating the switch. The reed switch frequently used today comprises two or more reeds of magnetic material sealed within a glass envelope in an inert atmosphere. These reed switches have been operated by solenoids and by movable magnets which produce magnetic fields along the reeds and effect attraction and contact of the separate reeds. The reeds in some applications have been held open by producing transverse magnetic fields. The operation of such reed switches has been effected in some control mechanisms by rotating a permanent magnet with respect to the longitudinal axis of the reed switch, and such actuators have been employed in push button switches as exemplified by U.S. Pats. No. 3,233,061 Jones et al. and U.S. Pat. No. 3,403,363 Pearce et al. Some of these magnetically actuated switch assemblies have been of complicated construction and others, although of more simple construction, have not been suitable for all applications. Accordingly, it is an object of the present invention to provide an improved push button switch of the magnetically actuated type.

It is another object of this invention to provide a magnetically actuated push button switch of the reed type including an improved positive and reliable actuating mechanism.

It is another object of this invention to provide an improved push button assembly of the magnetic reed switch type which is of simple and reliable construction and which may be easily and quickly position from its component parts.

It is another object of this invention to provide an improved push button switch of the magnetic reed type having low susceptibility to shock or vibration.

SUMMARY OF THE INVENTION

Briefly, in carrying out the objects of this invention in one embodiment thereof, a push button switch is provided which includes a housing comprising two elongated cylindrical half sections held in assembled relationship by a cylindrical shell pressed over the two halves and a cap snapped over the end of the assembly to close one end thereof. A slidable actuating member is mounted for longitudinal movement in a complementary passage formed centrally of the housing. The housing cylinder and slide are constructed from a suitable light, synthetic plastic material. A sealed glass enclosed reed type switch is positioned longitudinally in one of the half sections and a permanent magnet is pivotally mounted on the other on an axis transverse of the switch. The slide is spring biased toward the open end of the housing and an actuating button is attached thereto for pressing the slide inwardly against the biasing force. A transverse slot in the slide and an eccentric pin on the magnet structure provide a driving connection between the slide and magnet for rotating the magnet upon depression of the button. The magnet is moved between a position locating its field transverse to the switch reeds for holding the switch open and a position lengthwise of the reeds for closing the switch. Very small inertial forces are involved and the switch is highly resistant to actuation or injury due to vibration or shock.

THE DRAWINGS

The features of novelty which characterize this invention are pointed out with particularity in the claims annexed to and forming a part of this specification. The invention itself, however, both as to its organization and its manner of operation, together with further objects and advantages thereof, will best be understood from the following description taken in connection with the accompanying drawings, in which:

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

FIG. 2 is an exploded perspective view illustrating the component parts of the switch in FIG. 1;

FIG. 3 is an inside elevation view of one-half of the housing of FIG. 2;

FIG. 4 is an inside elevation view of the other half of the housing of FIG. 2;

FIG. 5 is a sectional elevation view, taken along the plane of division of the housing halves looking toward the housing half of FIG. 4;

FIG. 6 is a section view similar to FIG. 5, looking toward the housing half of FIG. 3 with the push button slide removed;

FIG. 7 is an elevation view of the push button slide with the magnetic actuator in the position of FIG. 5;

FIG. 8 is a view similar to FIG. 7 showing the push button slide and magnet in their actuated position;

FIG. 9 is a side elevation view of the push button slide;

FIG. 10 is a side elevation view of the magnet holding unit;

FIG. 11 is the right hand side elevation view of the magnet holding assembly; and

FIG. 12 is an inside or top plan view of the end closure cap of the housing.

Referring now to the drawings, FIG. 1 illustrates a push button switch comprising a body portion 10, an actuating button 11, and a closure cap 12 through which leads 13 and 14 protrude. The cap 12 is provided with a threaded stud 15 which may be employed for securing the switch in position on the equipment on which it is used. The components of the push button switch of FIG. 1 are illustrated in the exploded perspective view, FIG. 2. As shown in FIGS. 2, 3 and 4, the switch assembly includes a housing of suitable electric insulating material such as a light weight synthetic plastic; the housing is formed in two cylindrical halves 16 and 17. The switch has been illustrated as provided with a two-pole, two-reed sealed switch 18, the terminals of which are connected to the leads 13 and 14. If desired, a three terminal switch may be employed, in which case the additional lead will pass through an opening 20 in the cap 12, the leads 13 and 14 passing through openings 21 and 22, respectively. Switch 18 is arranged to be mounted in cradles or seats, 23 and 24, molded in the central or back inside wall of the housing member 16. A slide member 25 of rectangular cross section is provided for longitudinal movement within the housing formed by the halves 16 and 17, and the configuration of the slide is complementary to the walls of the passage formed by rectangular channels formed within the housings 16 and 17. The permanent magnet 26 is arranged to be mounted in a cross slot 29 in a nonmagnetic holder 27 in which the magnet is retained by a press fit or by suitable cement; retaining ridges 29' are provided for the magnet along the top of the slot 29. The holder 27 is preferably made of light synthetic plastic material and has a shaft 28 positioned to pass through a slot 30 in the slide 25 and to be seated or journaled in a bearing opening 31 in the back or central side wall of the housing member 17. The slide 25 is arranged to be actuated by the push button 11 through an adapter 32, has an octagonal head 33 constructed to be snapped into the push button member 11 and held in place by flexible plastic lugs 34. A helical compression spring 35 is provided to act between the cap 12 and the slide 25 and bias the slide to its upper position. A lug 36 parallel to the shaft 28 of the magnet mounting member 27 and eccentric with respect to the shaft is arranged to engage a cross slot 37 formed in the back wall of the slide 25 when the shaft 28 is in position in the bearing hole 31 in the housing 17. The housing half 16 is provided with right angled slots or grooves 38 and 39 which are complementary to and opposite similar grooves 41 and 42 in the housing half of 17. These grooves are provided to accommodate the leads of switch, the grooves 38 and 41 in the assembled housing providing the passage for a right angled turn in the wire 13 as indicated at 43. The grooves formed by these right angled slots are in register with the openings 20 and 22 in the end cap 12 when the switch is assembled.

The arrangement of the components of the switch when assembled is shown in FIGS. 5 and 6. The two halves 16 and 17 are assembled with the switch 18 and slide 25 together with a

magnet and magnet mounting 26 and 27 in position with the shaft 28 in the bearing opening 31. In the assembled position spring 35 fits over a longitudinally extending lug 44, passes through a passage 45 formed in the lower end of the housing half 17 and engages a seat or a lug formed on the cap 12 on the inside thereof opposite a positioning pin or a lug 47 on the outside of the cap. When the housing sections 16 and 17 are positioned together in their assembled relationship, longitudinal guide or positioning members 48 and 50 along the inside edges of the half section 17 fit into complementary slots 51 and 52, respectively, in the edge walls of the half section 16. The sections are held in assembled relationship by pressing the cap 12 into position with an inner annular ridge 53 thereof, fitting into annular grooves 54 and 55 in the lower ends of the members 16 and 17, respectively. Another cylindrical sleeve 56 is then pressed over the two halves from the upper end of the housing until it seats against the edge of the cap 12 and securely holds the two halves 16 and 17 in their assembled relationship. The entire assembly of the internal parts comprising the switch 18, the slide 25 and the magnet mounting structure are prevented from moving outwardly from the housing by the seating of the switch 18 in the cradles 23 and 24 and by the leads 13 and 14, the lead 14 passing through an opening 57 illustrated in FIG. 3 which passes through the cradle 23 and then outwardly into a groove 58 in the outer wall of the housing member 16.

The slide 25 is provided with two projections 60 and 61 at its lower end, and flush with the bottom wall of the slide from which the lug 44 extends. These projections act as guides or stabilizers for the slide as it moves in the housing section 17 and bear against reduced wall portions 62 and 63, respectively, which extend into the internal passage in housing portion 16. The slide 25 is limited in its upper or outward movement in the passage within the housing by tapered wall portions 64 which engage complementary tapered portions 65 formed in rectangular extensions 66 and 67 of the half portions at the ends of the housing portions 16 and 17, respectively. As shown in FIG. 5, the adapter 32 has its cylindrical portion fitted within a cylindrical passage 68 in the upper rectangular portion of the slide 25. The upper portion of the slide is also provided with a longitudinal slot 70 which prevents interference with the upper leads of the upper lead 14 of the switch 18. The fitting 32 is constructed of suitable synthetic plastic material which is sufficiently flexible to be pressed into and grip the cylindrical walls 68 of the slide. A raised longitudinal guide member 72 is provided to position the adapter in the cylindrical passage 68 in a complementary groove 73 in the slide as indicated in FIG. 5. A longitudinal groove, or slot 75, in the adapter 32 affords greater flexibility for fitting the cylindrical portion thereof in the slide 25.

The cylindrical casing or cover 56 is provided with a longitudinal rib 76 which is employed during the assembly of the switch to obtain the desired relationship of the parts so that the rib 76 fits within a corner of the rectangular hollow portion of the button 11 indicated at 77.

In FIGS. 5 and 6, it will be seen that the magnet 26 is pivotally mounted opposite the overlapping portions of the reeds within the switch 18, which are indicated at 78 and 79. It will also be seen that when the slide 25 is depressed by pressing the button 11 the upper wall of the lateral slot 37 will press down on the pin 36 and rotate the magnet mounting 27 about the pivot 28. Proportioning of the parts is made so that in the farthest depressed position the magnet 26 is turned from its transverse position, substantially normal to the axis of the slide to a position in alignment with the slide so that the magnetic field is arranged generally in alignment with the reeds 78 and 79 and thereby causes the reeds to move together into engagement and close the switch. The two positions are illustrated in FIGS. 7 and 8; FIG. 7 illustrating the slide in the same position as FIG. 5 and FIG. 8 in the actuated position with the magnet turned to a position 90° from that of FIG. 7. When the magnetic field is transverse to the reeds 78, the reeds are released and held apart and when a sufficient component of

the field lies along the axis of the reeds, they will be brought together into contact. Pressing of the button 11 thus provides a positive actuation of the reed switch. It will further be understood that the axis of the magnet 26 may be arranged either as illustrated or as at right angles to its positions in FIGS. 5 and 6 so that upon actuation the push button may be made to open the switch instead of closing it. Thus the push button switch may be made either of the normally open or normally closed type.

The construction of a push button switch as illustrated is such that the low inertia parts comprising the slide 25 and the magnetic assembly may be employed and very low inertial forces are present during vibration or shock, and there is little tendency to turn the magnet from its normal position. The magnet itself being pivoted on a stationary housing member 17 has no tendency to turn since it is symmetrical and is pivoted on the shaft 28 which is in the center of the magnet as clearly shown in FIGS. 10 and 11. The only offcenter element being the pin 36 which is of the light weight plastic material and has substantially no effect on the positioning of the magnet during vibration or shock. The spring 35 may be relatively light in view of the light weight characteristics of the slide 25, thus an effective low inertia switch requiring only a light touch on the push button 11 is provided for quick actuation and release of the switch.

I claim:

1. A push button switch comprising:
 - a housing having a slide mounted therein for movement along a fixed path between two positions,
 - a reed type magnetic switch mounted in said housing adjacent said slide with the reeds thereof lying in a plane substantially parallel to said path, a magnet,
 - a means for mounting said magnet in said housing adjacent said switch for rotation about a fixed axis transverse to said path of movement and to said plane,
 said mounting means and said slide having a pin on one and a slot in the other constituting a pin-and-slot connection between said slide and said mounting means arranged eccentric of said axis for rotating said magnet about said axis upon movement of said slide.
 said slide being movable from one end position to an opposite position,
- said magnet in one of said positions of said slide having its poles extending along a line substantially longitudinal of the reeds of said switch and in the other of said positions substantially normal to said reeds, whereby said switch is closed in said one position of said slide and open in the other.
2. A push button switch as set forth in claim 1, wherein said housing is cylindrical and comprises two separable, longitudinal halves, said switch being mounted in one of said halves and said magnet pivotally mounted on the other of said halves.
3. A push button switch as set forth in claim 2, wherein the mounting for said magnet includes a shaft fixed with respect to the magnet and pivoted on the wall of said other housing half, said slide having a longitudinal slot and said shaft passing through said slot and affording movement of said slide with respect to said shaft.
4. A push button switch as set forth in claim 2, wherein said housing has a longitudinal passage therein of rectangular cross section, and said slide is of complementary rectangular configuration.
5. A push button switch as set forth in claim 4, wherein said slide comprises one portion slidably engaging both said halves of said housing and a portion of reduced cross section engaging said other of said halves, said reduced portion of said slide and said magnet being contained wholly within said other half.
6. A push button switch as set forth in claim 1 including means for biasing said slide toward one of said end positions.
7. A push button switch as set forth in claim 5, wherein said housing is closed at one end and has a passage therein for said slide, said slide and passage being of complementary configuration, and said passage at the other end of said housing hav-

ing converging walls whereby said slide is retained against movement out of said passage, said slide having actuating means extending beyond said converging walls and into said housing for facilitating the moving of the slide against the force of said biasing means.

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8. A push button switch as set forth in claim 1 wherein said pin is fixed on said rotor and said slot is provided in said slide.

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