United States Patent

Pack

[15] **3,656,181**

[45] **Apr. 11, 1972**

[54] MAGNETICALLY OPERABLE MOMENTARY SWITCH ASSEMBLY

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[73] Assignee: **Teletype Corporation,** Skokie, Ill.

[22] Filed: **Oct. 20, 1970**

[21] Appl. No.: **82,245**

[52] **U.S. Cl.** **335/205,** 200/160

[51] **Int. Cl.** **H01h 5/00**

[58] **Field of Search** .....335/205, 206, 207, 188, 190, 335/153; 200/67 F, 160

[56] **References Cited**

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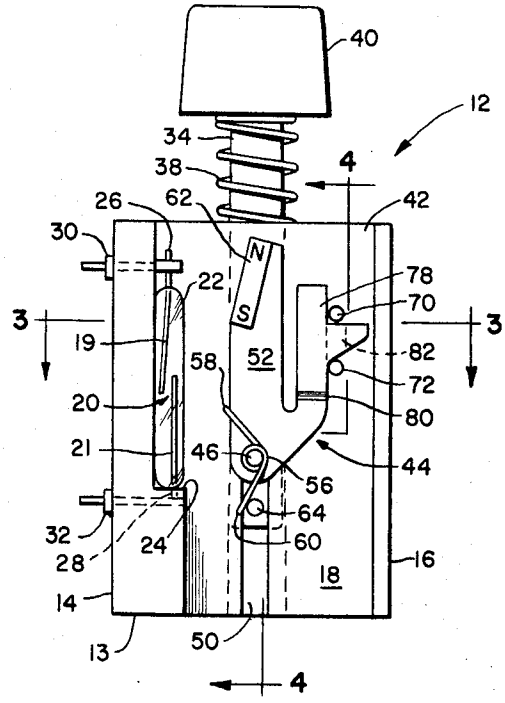
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[57] **ABSTRACT**

A magnetic flux field momentarily produces a first reed switch mode upon movement of a permanent magnet to a selected position and aspect in response to depression of a self-restoring manual member. Thereafter, during the depressing stroke, a spring which had been tensioned in response to depression of the manual member is released from a restraint. The untensioning force snaps the magnet to another aspect to effect a second reed switch mode. Cam means comprising the spring restraint also enables return of the permanent magnet from its end stroke position to its start stroke position without change of aspect, whereby the second mode of the reed switch is maintained.

16 Claims, 11 Drawing Figures



PATENTED APR 11 1972

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SHEET 1 OF 2

FIG. 1

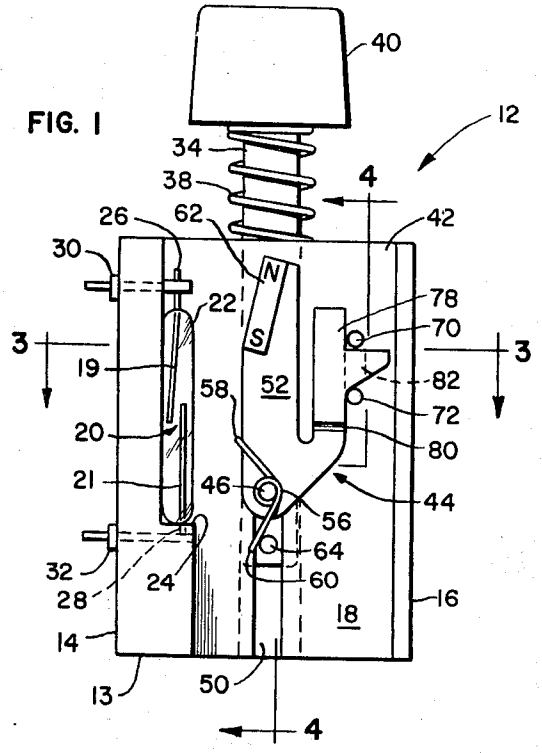


FIG. 2

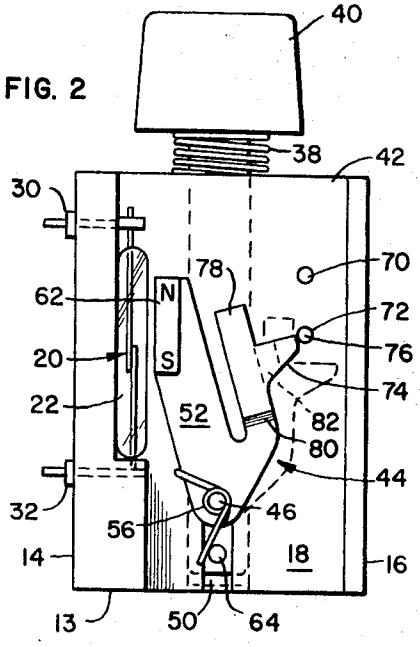


FIG. 3

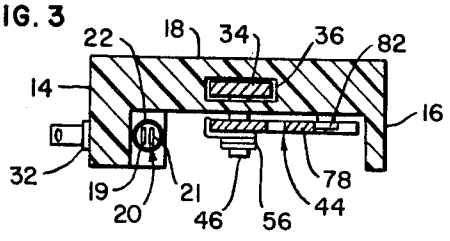


FIG. 4

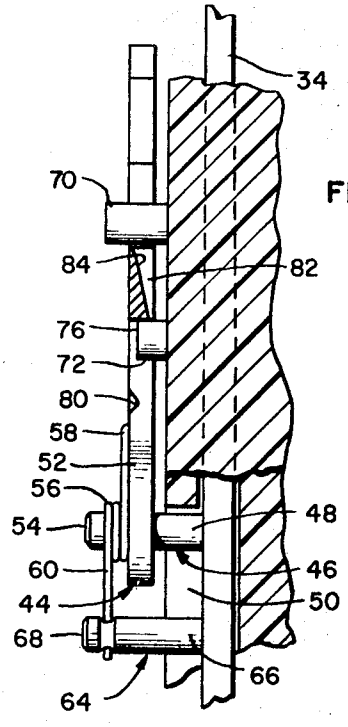


FIG. 5

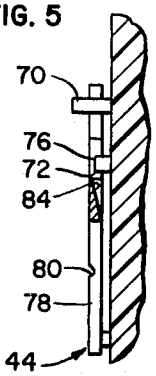
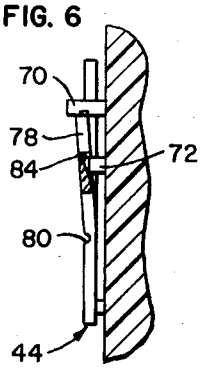


FIG. 6



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FIG. 7

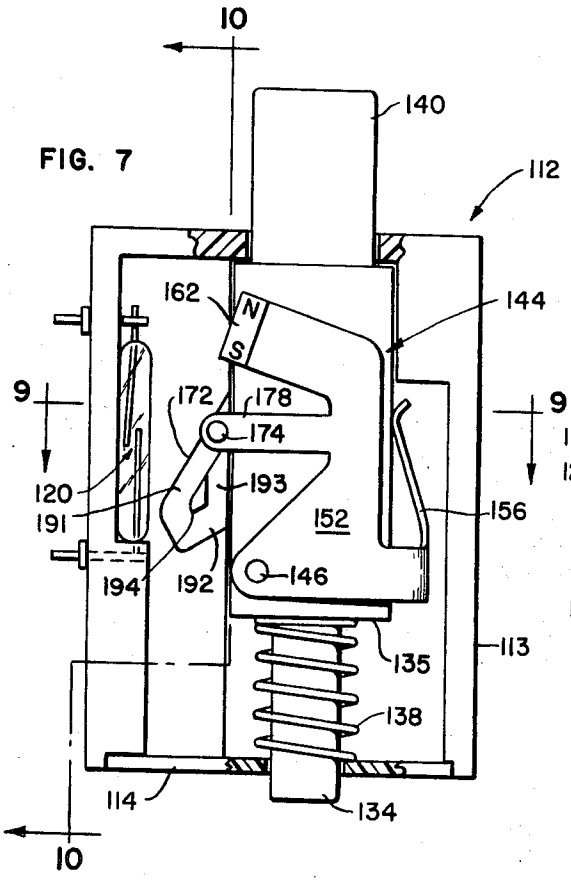


FIG. 8

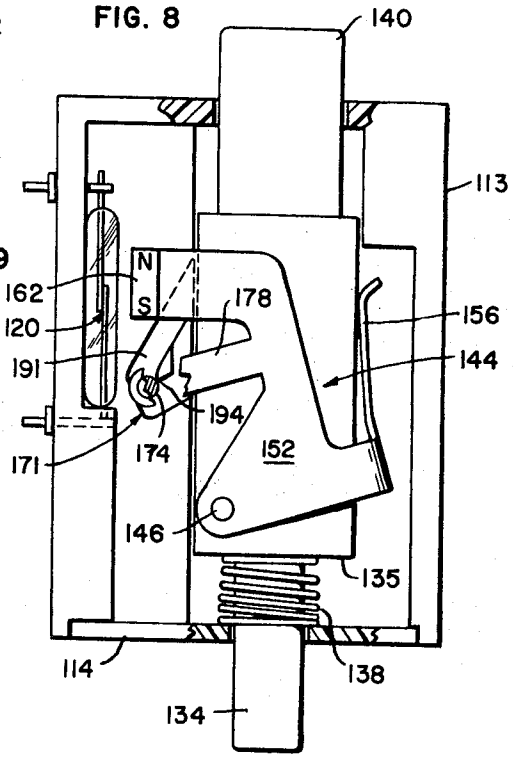
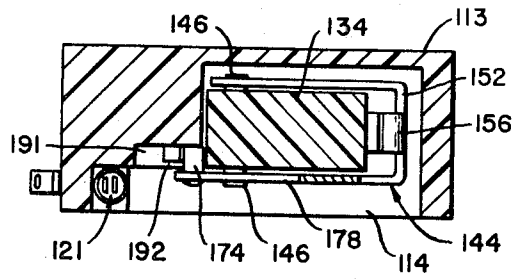


FIG. 9



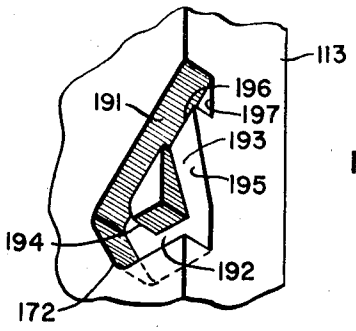


FIG. 11

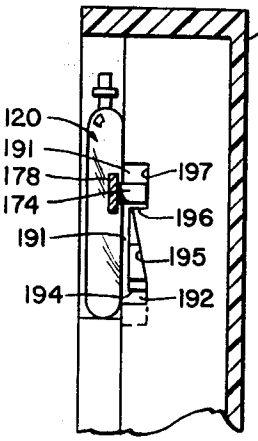


FIG. 10

MAGNETICALLY OPERABLE MOMENTARY SWITCH ASSEMBLY

BACKGROUND OF THE INVENTION

The present invention relates to momentary switches. Particularly, the invention relates to an electrical switch with a magnetic control for producing momentary switching.

In a telegraphic keyboard, a distinctive encoded electrical output is associated with each key for producing an analogous effect which may be mechanical. Each output results from momentary switching of at least one electrical contact between an electrically passive mode and an electrically conductive mode in response to key depression. Contamination of a contact may result in production of false outputs. However, such undesirable effects can be avoided by sealing each switch.

It is an object of the present invention to provide an improved switch assembly.

It is a further object of the invention to provide an improved assembly having a sealed switch adapted for a telegraphic keyboard.

It is an additional object of the invention to provide a novel momentary switch assembly which is magnetically controlled.

SUMMARY OF THE INVENTION

To effect the foregoing, and other objects of the invention which will become apparent from ensuing description, a momentary switch assembly comprises a magnetically responsive switch having first and second modes. A magnetic flux field is reciprocative adjacent the switch past a medial station and between start stroke and end stroke positions in which said switch is in its first mode. The flux field is movable independently of reciprocation between a first aspect in which the switch is in its first mode and a second aspect in which the switch is in its second mode. Means are provided for reciprocating the flux field between its start stroke and end stroke positions. Means are provided for moving the flux field from its first aspect to its second aspect as it moves from its start stroke position to its medial position. Means are provided for snapping the flux field from its second aspect to its first aspect as it moves from its medial position to its end stroke position. Means are provided for returning the flux field from its end stroke position to its start stroke position while maintaining said switch in its first mode.

BRIEF DESCRIPTION OF THE DRAWINGS

In the ensuing detailed description, reference is had to the accompanying drawings in which:

FIG. 1 is an elevational view of a switch assembly embodying one form of the invention;

FIG. 2 is a view similar to FIG. 1, however, showing alternate conditions of the assembly in solid and dashed lines;

FIG. 3 is a view according to the line 3—3 in FIG. 1;

FIG. 4 is a view according to the broken line 4—4 in FIG. 1;

FIGS. 5 and 6 are views of camming means similar to FIG. 4, however, on a reduced scale and showing alternate conditions;

FIG. 7 is an elevational view showing a modified embodiment of said invention;

FIG. 8 is a view similar to FIG. 7, however, showing said modified assembly alternately conditioned;

FIG. 9 is a view according to the line 9—9 in FIG. 7;

FIG. 10 is a view according to the line 10—10 in FIG. 7, a permanent magnet having been omitted; and

FIG. 11 is a perspective view of a cam track included in said modified embodiment.

DETAILED DESCRIPTION OF THE INVENTION

Referring now more particularly to the embodiment illustrated in FIGS. 1–6, a switch assembly is generally designated 12. It comprises a frame or housing 13 having parallel side walls 14 and 16, and a rear wall 18. The housing may be arranged such that walls 14, 16, and 18 are vertically disposed (as shown in the drawings) relative to which all directions herein are described in an exemplary sense. A reed switch 20, whose electrical contacts or reeds 19 and 21 are hermetically sealed in an outer case or envelope 22, is supported against the inner surface of side wall 14 on a shelf or step 24 generated in the housing normally to said last side wall. Opposed leads 26 and 28 from reeds 19 and 21 project through opposite ends of the envelope 22. By means which may be conventional the leads are electrically connected to a pair of spaced posts 30 and 32 which provide electrical connection terminals exteriorly of housing 13.

A plunger 34, which is illustrated as rectangular in cross section (FIG. 3), is mounted in the housing for reciprocation between a place of beginning, or normal or start stroke position (FIG. 1) and an end stroke position (dashed line of FIG. 2) past a medial position (solid line of FIG. 2). To that end the plunger is slidably engaged in a slot 36 which is rectangular in cross section and formed in rear wall 18. A compression spring 38 disposed about the plunger has opposite ends bearing against a manual member 40 and the upper surface 42 of housing 13 for urging the plunger to its start stroke position.

A permanent magnetic assembly 44 is carried by the plunger 34 within housing 13 adjacent, though spaced slightly from, the inside surface of rear wall 18. It is carried from the plunger 34 in a plane parallel thereto by a pivot pin 46 and comprises a non-magnetic carrier 52 and a permanent magnet 62 which is rigidly secured to the top end portion of the carrier and to the flux field of which reed switch 20 is responsive in a conventional manner. One end portion 48 of the pivot pin is rigidly secured to the plunger from which said pivot pin projects normally through a vertical guide slot 50 in wall 18. The opposite end portion 54 (FIG. 4) of the pivot pin extends through the lower end portion of carrier 52 for which it provides a rocking axis.

A coiled torsion spring 56 having opposed outwardly projecting end extensions 58 and 60 is disposed about pin end portion 54 for urging assembly 44 about pin 46 clockwise with respect to FIG. 1. To that end, spring end extension 60 is bearingly tensioned against a boss fashioned as a pin 64. The inner end portion 66 (FIG. 4) of said pin is secured to plunger 34 perpendicular to which it projects outwardly through slot 50 below and in vertical alignment with pivot pin 46. The outer end portion 68 of pin 64 is aligned with the end portion 54 of pin 46 and provides a bearing against which spring end extension 60 tensionedly engages. Stop means comprised of an abutment 70 projects normally from wall 18 to the housing for limiting clockwise movement of assembly 44 and magnet 62 to a first aspect when the plunger is in its start position (FIG. 1). The flux field of the permanent magnet is such that when the magnet is in said first aspect reed switch 20 is in its first mode, herein shown as open.

Cam means comprising an external track 72 and a follower 74 controls the aspect of assembly 44. They are fashioned such that as the plunger 34 moves from its start stroke position to its medial position assembly 44 and said magnet will rock counterclockwise relative to FIG. 1 about pivot pin 46 from its first aspect in its first station toward its second aspect at its second station (solid line of FIG. 2) in which the effect of the flux field of magnet 62 causes switch 20 to assume its second mode, herein shown as closed.

Particularly, track 72 comprises the outer surface of a projection 76 from rear wall 18. The track is proportioned for engagement with follower 74 which is an extension of an arm 78, said arm being flexibly connected to carrier 52. In the exemplary embodiment, flexibility is imparted by reducing the thickness of the material along a line of thinness 80 (FIG. 4) between said arm and carrier 52 with which said arm is integrally formed.

The parts are arranged and proportioned such that as assembly 44 rocks from its first aspect toward its second aspect, spring 56 and said assembly are tensioned, cam 72 serving as a

restraint which prevents tension release. The arrangement is such, however, as the plunger continues to be depressed past its medial position for movement toward its end stroke position, follower **74** clears cam **72** and under spring tension which theretofore has been generated, the assembly **44** is snapped clockwise about pivot pin **46** (dashed line of FIG. **2**). During such last movement switch **20** becomes restored to its first mode; and thereafter, cam **72** functions as an abutment which engages arm **78** for limiting clockwise movement of assembly **44**. Furthermore, in such condition, follower **74** is now disposed below said cam.

Means are provided for preventing switch **20** from closing to its second mode, upon return of plunger **34** from its end stroke position to its start stroke position under the restoring action of spring **38**. Particularly, the under or housing proximate surface of follower **74** is provided with a vertical track **82** having a sloping surface **84** (FIG. **4**) which is fashioned to permit entry of cam **72** into said track and behind arm **78** (FIG. **5**). As assembly **44** rises (FIG. **6**), the profile of cam is accommodated, arm **78** bending along line of thinness **80** until the cam exits from said track. Thereafter, arm **78** snaps to an untensioned condition, in which entry of the cam into said track is prevented upon depression of plunger **34**.

In the modified switch assembly **112** (FIGS. **7–10**), a spring **138** is disposed about plunger **134** within a housing **113** and restoringly bears against a base **114** of the housing and an enlarged medial cylindrical section **135** of the plunger. Plunger movement from a start stroke position (FIG. **7**) to an end stroke position (not shown) past a medial position (FIG. **8**) is effected through depression of a manual member or boss **140** carried on the upper end of the plunger. A magnet assembly **144** comprised of a non-magnetic carrier **152** and a permanent magnet **162** secured to the carrier is rockably mounted on plunger section **135** for angular movement about pivot pin **146** between a first angular or normal aspect (FIG. **7**) and a second angular or tensioned aspect (FIG. **8**).

A reed switch **120** which is controlled by the flux field of permanent magnet **162** has a first mode herein shown with contacts separated (FIG. **7**) and a second mode herein shown with contacts closed (FIG. **8**). While the plunger is in its start stroke position assembly **144** is at its first station and in its first angular aspect, and switch **120** is in its first mode. As the plunger moves from its start stroke position to its medial position moving said assembly to its second station, cam means generally designated **171** causes the assembly to rock to its second angular aspect. The flux field of magnet **162** is such that when said last assembly is in said second angular aspect reed switch **120** will be in its second mode.

As the assembly **144** rocks from its first angular aspect to its second angular aspect, a band spring **156** which is secured from carrier **152** becomes tensioned against plunger **134**. Cam means **171** operates as a restraint to relaxation of spring tension during said last assembly movement. The cam means is further fashioned such that spring restraint is removed permitting untensioning of spring **156** as the plunger moves from its medial position (FIG. **8**) toward its end stroke position (not shown). In consequence thereof, assembly **144** will be snapped clockwise to its first angular aspect as it moves to its third station, below the level of FIG. **8**, whereby switch **120** will be restored to its first mode by reason of the changed effect of the magnetic flux field thereon.

Herein, cam means **171** comprises a cam track **172** formed as a groove in the wall of the housing **113** adjacent plunger **134**. The track is of generally triangular configuration and is proportioned for coaction with follower **174** which is fashioned as a pin and carried in the end of an arm **178**. The latter member projects outwardly from carrier **152** with which it may be formed integrally into said cam track. Moreover, said arm is flexible on said body, whereby the follower is adapted for accommodating the shape of the cam track.

Cam track **172** has three courses **191**, **192**, and **193**. The direction of course **191** is such that as the plunger **134** is depressed from its start stroke position, assembly **144** will be caused to rock counterclockwise with respect to FIG. **7**. The direction of course **192** is such that as follower **174** passes corner **194** of said cam (as the plunger moves away from its medial position toward its end stroke position) spring restraint of course **191** is removed and spring **156** relaxes tension whereby the carrier is snapped from its second angular aspect to its first angular aspect.

Upon restoration of the plunger from its end stroke position to its start stroke position, follower **174** will traverse return course **193**, with the free end of the follower engaged against floor **195** (FIG. **10**) of said last identified course. The floor slopes outwardly as it extends upwardly such that a shoulder **196** is generated at the juncture of courses **191** and **193**. At said juncture the depth of the cam track **172** is less in course **193** than in course **191**.

In consequence of the foregoing, as assembly **144** is restored to its start stroke position from its end stroke position, arm **178** will be flexed as the follower moves along sloping floor **195**. The tension generated by such flexion will relax as the follower passes beyond shoulder **196** which is generated at the juncture of course **191** and **193**. Such tension relaxation will drive the follower against floor **197** (FIG. **10**) of course **191**.

Upon an ensuing depression of plunger **134**, follower **174** will pass down course **191**, said follower being blocked from course **193** by shoulder **196**. It is appreciated, of course, that the direction of course **193** is such that assembly **144** will maintain substantially its first angular aspect, during its restoration from its third station to its first station.

As many modifications in the described construction could be conceived, and as many changes could be made therein without departing from the spirit and scope of the claims, it is intended that all matter contained in the accompanying specification shall be considered as illustrative only and not in a limiting sense.

I claim:

1. An electrical switch assembly comprising:

a switch having an electrical contact movable between first and second modes;

a permanent magnet arranged for movement between a first station and a second station spaced from said first station for moving said contact between said first and second modes;

means for moving said magnet from said first station to said second station to produce one of said modes;

means responsive to said moving means for urging said magnet to a third station in which said contact is in the other of said modes; and

means for returning said magnet to said first station from said third station.

2. A combination according to claim **1** wherein said urging means is arranged for tensioning as said magnet moves between said first station and said second station and characterized by a restraint associated with said magnet and arranged for releasing tension of said urging means.

3. A combination according to claim **2** wherein said moving means is arranged for reciprocation between a first position in which said magnet is disposed at said first station, a second position in which said magnet is disposed at said second station and a third position in alignment with said first and second positions in which said restraint has released spring tension.

4. A combination according to claim **1** wherein said moving means comprises a plunger arranged for linear reciprocation between a first position in which said magnet is at said first station and a second position in which said magnet is in said second station, and characterized by:

a carrier for said permanent magnet pivotally secured from said plunger; and

means for rocking said magnet between first and second angular aspects as said plunger moves between first and second positions.

5. A combination according to claim 4 wherein said urging means comprises a spring associated with said carrier and arranged for tensioning as said plunger moves from said first position toward said second position.

6. A combination according to claim 5 wherein said plunger is arranged for movement between said second position and a third position and said rocking means comprises a camming assembly associated with said magnet for releasing spring tension as said plunger moves toward said third position from said second position.

7. An electrical switch assembly comprising:

a housing;

a manually operable self-restoring plunger mounted for depression in said housing;

a magnetic assembly including a permanent magnet mounted for movement responsively to depression of said plunger;

a reed switch supported such that at a selected station of said permanent magnet the mode of said switch will change in response to the flux field of said permanent magnet; and

cam means for tensioning said magnetic assembly as said magnet is moved toward said selected position and for releasing tension thereon to restore said switch as said plunger is depressed after said magnet reaches said selected position.

8. A combination according to claim 7 wherein said cam means comprises:

a fixed track;

a follower engaging said track for moving said magnet between a first angular aspect and a second angular aspect at said selected station as said plunger is depressed; and

a spring associated with said magnetic assembly for moving said magnet away from said second angular aspect as said plunger is further depressed.

9. A combination according to claim 8 wherein said magnetic assembly is rockably carried from said plunger, said follower secured from said magnetic assembly.

10. A combination according to claim 9 wherein said track is of substantially triangular configuration and has a first course through which said follower moves as said magnet moves between said first angular aspect and said second angular aspect and a return course disposed at a level different from said first course for preventing follower movement therein as said plunger is depressed following plunger restoration.

11. A combination according to claim 10 wherein said magnetic assembly comprises a carrier for said magnet and mounted from said plunger, said combination further characterized by a flexible arm carried from said carrier for supporting said follower, said follower having a channel, said track comprising a projection adapted for passage through said channel to enable restoration of said plunger following release from depression.

12. A combination according to claim 10 wherein said magnetic assembly comprises a carrier for said magnet and rockably mounted from said plunger, said combination further characterized by a flexible arm secured from said carrier and supporting said follower in said track, said arm bendable in response to variations in elevations of said courses.

13. A momentary switch assembly comprising:

a magnetically responsive switch having first and second modes;

a magnetic flux field arranged for reciprocation adjacent said switch between start stroke and end stroke positions in which said switch is in said first mode past a medial position in which said switch is in said second mode; said flux field arranged for movement independently of reciprocation between a first angular aspect at which said switch is in said first mode and a second aspect in which switch is in said second mode,

means for reciprocating said flux field between said start stroke and end stroke positions;

means for moving said flux field from said first angular aspect and to said second angular aspect as it moves from its start stroke position to its medial position;

means for rocking said flux field from said second angular aspect to said first angular aspect as it moves from said medial position to said end stroke position; and

means for returning said flux field from its end stroke position to its start stroke position.

14. A combination according to claim 13 further characterized by means for preventing change of switch mode as said flux field moves from said end stroke to said start stroke position.

15. A combination according to claim 14 wherein the rocking means comprises the tension of a spring arranged for generation in response to movement of said flux field from said start stroke position to said medial position.

16. A combination according to claim 15 wherein said moving means comprises a cam having a course fashioned for generating said tension and fashioned for release of said tension as said flux field moves from said medial position toward said end stroke position.

* * * * *