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(54) **ALARM SWITCH**

(75) Inventor: **Randall Woods**, Prescott, AZ (US)

(73) Assignee: **Magnasphere Corporation**, Waukesha, WI (US)

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See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,051,962	A	*	2/1913	Lundquist	116/86
1,192,893	A	*	8/1916	Harvey	116/88
1,868,923	A	*	7/1932	Semon	116/88
3,516,036	A	*	6/1970	Lea	335/207
3,535,664	A	*	10/1970	Staar	335/153
3,630,168	A	*	12/1971	Findlay	116/74
3,650,347	A	*	3/1972	Campos	180/282
3,763,484	A	*	10/1973	Byers	340/669
3,816,680	A	*	6/1974	Suzuki et al.	200/61.51
3,842,377	A	*	10/1974	Barndt	335/207
4,042,796	A	*	8/1977	Zink	200/61.45 R
4,057,773	A	*	11/1977	Cohen	335/205
4,062,314	A	*	12/1977	Allen et al.	116/85
4,168,410	A	*	9/1979	Norris	200/61.45 R
4,275,391	A	*	6/1981	Okamura	340/571
4,293,860	A	*	10/1981	Iwata	343/715
4,326,196	A	*	4/1982	Plevy	340/545.5
4,336,518	A	*	6/1982	Holce et al.	335/205
4,450,326	A	*	5/1984	Ledger	200/61.45 M
4,456,897	A	*	6/1984	Holce et al.	335/205
4,553,134	A	*	11/1985	Holt	340/546
4,567,846	A	*	2/1986	Kurtz	116/86
4,628,160	A	*	12/1986	Canevari	200/61.45 R
4,656,458	A	*	4/1987	Iwata	340/669
4,733,324	A	*	3/1988	George	361/118
4,788,517	A	*	11/1988	Meister	335/205
4,982,058	A	*	1/1991	Schroeder et al.	200/61.62
5,192,839	A	*	3/1993	Imade et al.	200/61.45 R
5,248,861	A	*	9/1993	Kato et al.	200/61.45 M
5,248,959	A	*	9/1993	Chern	340/601
5,332,992	A	*	7/1994	Woods	340/547
5,530,428	A	*	6/1996	Woods	340/547
5,543,767	A	*	8/1996	Elenbaas	335/205
5,673,021	A	*	9/1997	Woods	340/547
5,867,082	A	*	2/1999	Van Zeeland	335/205
5,880,659	A	*	3/1999	Woods	335/207

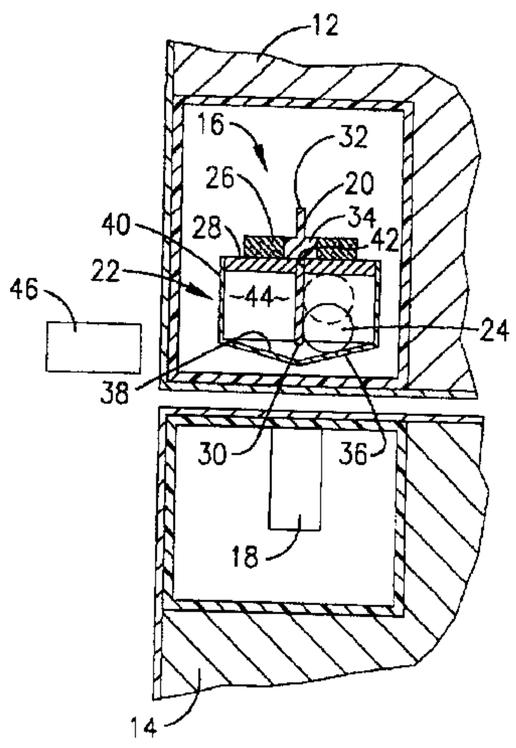
* cited by examiner

Primary Examiner—Van T. Trieu
(74) *Attorney, Agent, or Firm*—Hovey Williams LLP

(57) **ABSTRACT**

A magnetic switch apparatus (**10**) detects relative movement between first (**12**) and second (**14**) members and defeats attempted external magnetic manipulation of the apparatus. A rod-shaped, first switch element (**20**) is positioned transverse to and centrally aligned with a convex, second switch element (**22**) and spaced therefrom. A ring-shaped first magnet (**26**) is positioned about the first switch element (**20**) and spaced from the second element (**22**) in order to pull a ferromagnetic body (**24**) into a switch-open position out of contact with the second switch element (**22**) with these components mounted to the first member (**12**). A second magnet (**18**) mounted to the second member (**14**) is positioned and magnetically sufficient to pull the body (**24**) into a switch-closed position in contact with both of the switch elements (**20**, **22**) when the members (**12**, **14**) are in an adjacent position.

45 Claims, 1 Drawing Sheet



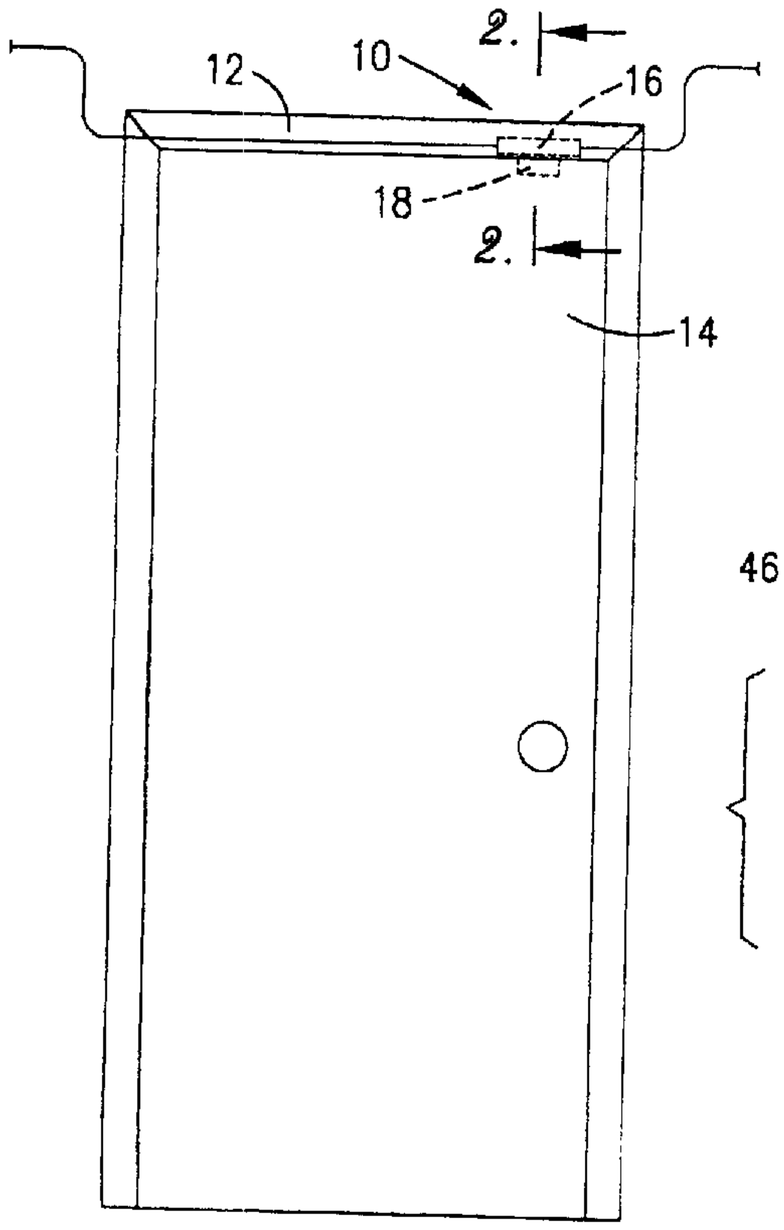


Fig. 1.

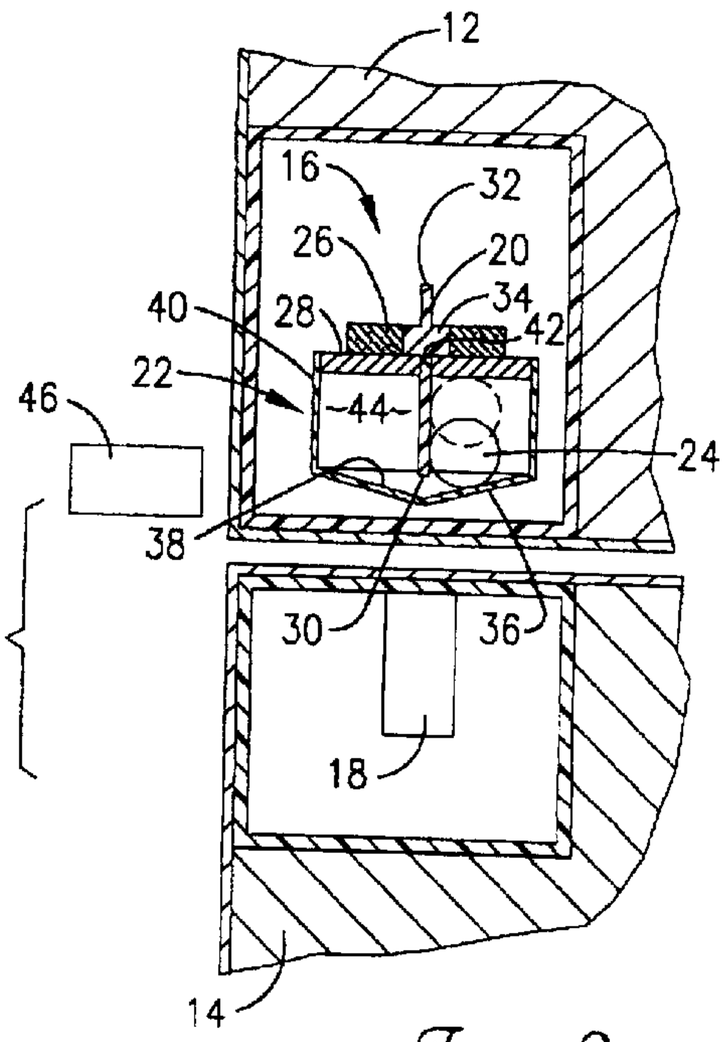


Fig. 2.

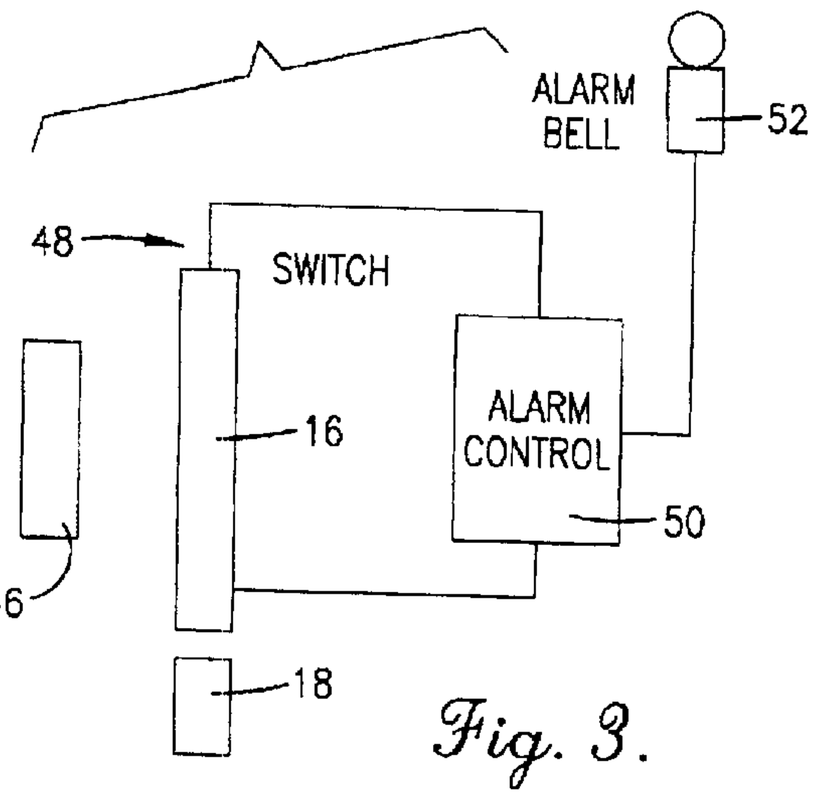


Fig. 3.

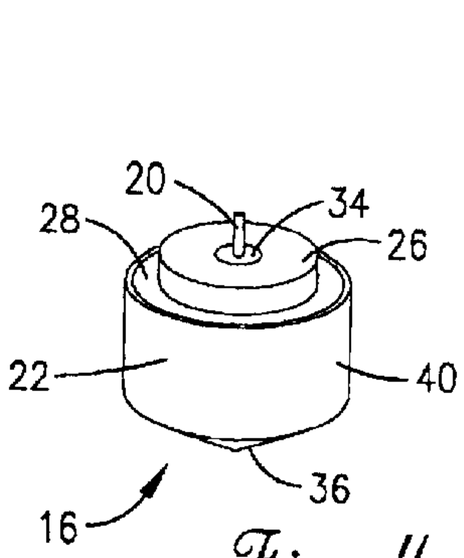


Fig. 4.

ALARM SWITCH

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

RELATED APPLICATIONS

Not applicable.

FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not applicable.

MICROFICHE APPENDIX

Not applicable.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is concerned with the field of magnetic switches. In particular, the invention is concerned with a magnetic switch apparatus that detects relative movement between first and second members and defeats attempted external magnetic manipulation of the apparatus.

2. Description of the Prior Art

Prior art security alarm systems use magnetic switches attached to doors and windows and integrated with the system for detecting unauthorized opening indicating an intruder. One common type of magnetic switch is a so-called reed switch. This type of switch is subject to manipulation by an external magnet. That is, an intruder can use a magnet to hold the read switch closed (or open depending upon the control scheme) and thereby open a door or window without triggering the alarm system.

SUMMARY OF THE INVENTION

The present invention solves the prior art problem discussed above and provides a distinct advance in the state of the art. More particularly, the alarm switch hereof is configured to defeat attempts at external magnetic manipulation.

The preferred embodiment includes a rod-shaped, first switch element positioned transverse to and centrally aligned with a convex, second switch element and spaced therefrom. A ring-shaped first magnet is positioned about the first switch element and spaced from the second element in order to pull a ferromagnetic body into a switch-open position out of contact with the second switch element. These components are mounted to the first member such as a door frame. A second magnet mounted to the second member, such as the door, is positioned and magnetically sufficient to pull the body into a switch-closed position in contact with both of the switch elements when the members are in an adjacent position, that is, when the door is closed.

When the second member is moved to a separating position relative to the first member such as when the door is open, the second magnet is no longer effective to hold the body against both switch elements and the first magnet pulls the body out of contact with the second switch element to trigger the alarm system. Any use of an external magnet pulls the ferromagnetic body away from the centrally located first element thereby simulating an open door condition and triggering the alarm system. Other preferred aspects of the present invention are disclosed herein.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates preferred magnetic switch apparatus (shown in dashed lines) in accordance with the present invention and shown in use with a door frame and door;

FIG. **2** is a sectional view taken along lines **2**—**2** of FIG. **1** and also showing an intruder magnet;

FIG. **3** is a schematic illustration of the preferred alarm system using the apparatus of FIG. **1** in accordance with the present invention; and

FIG. **4** is a top front pictorial view of the preferred magnet switch assembly of FIG. **1**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. **1** illustrates preferred magnetic switch apparatus **10** (dashed lines) in accordance with the present invention shown in use with a door frame **12** and door **14**. FIG. **2** more clearly illustrates the details of apparatus **10** which broadly includes switch assembly **16** and operating magnet **18**.

Switch assembly **16** includes first switch element **20**, second switch element **22**, a ferromagnetic body in the form of ball **24**, retraction magnet **26** and electrically insulating upper wall **28**. First switch element **20** has a generally rod-shaped configuration and presents lower end **30** and upper end **32** with flange **34** therebetween nearest upper end **32**. Element **20** is preferably composed of metal to be electrically conductive.

Electrically conductive, second switch element **22** is integrally formed of sheet metal such as by stamping and includes disk-shaped bottom wall **36** presenting contact surface **38** and further includes side wall **40** circumscribing bottom wall **36**. As illustrated in FIG. **2**, bottom wall **36** is shaped so that contact surface **38** presents a convex configuration and in particular, a reversed, conically shaped configuration.

Upper wall **28** is preferably composed of glass (or other insulating material) and electrically insulates switch elements **20**, **22** from one another. Upper wall **28** is spaced from contact surface **38** and is circumscribed by side wall **40**. The outboard face of upper wall **28** is flush with the upper edge of side wall **40**.

Upper wall **28** also includes central opening **42** defined therein for receiving the lower portion of first switch element **20** with flange **34** thereof engaging the outboard face of upper wall **28**. This positions first switch element **20** in alignment with the axis of contact surface **38** and spaces lower end **30** from contact surface **38**.

Upper wall **28**, bottom wall **36** and side wall **40** define switch chamber **44** with ferromagnetic ball **24** contained therein. As will be appreciated, ball **24** is electrically conductive and can be configured in other shapes such as a cube or cylinder, although the spherical shape is preferred.

Ball **24** is shiftable within chamber **44** between a switch-open position and a switch-closed position. In the switch-open position, ball **24** is not in contact with both switch elements **20**, **22**. Such a position is illustrated by the dashed lines in FIG. **2** wherein ball **24** is in contact with only one of the switch elements, namely first switch element **20**. The switch-open position can occur also if ball **24** shifts along contact surface **38** toward side wall **40** and out of contact with switch element **20**. The switch-closed position is illustrated by the solid lines in FIG. **2** in which ball **24** is in contact with both switch elements **20**, **22**.

Retraction magnet **26** presents a ring-shaped configuration in the nature of a torus and is positioned adjacent the outboard face of upper wall **28** surrounding flange **34** and thereby in surrounding relationship with first switch element **20**. This arrangement positions magnet **18** spaced from contact surface **38**. The magnet field strength of magnet **26**

is sufficient to shift ball **24** to the switch-open position illustrated in FIG. **2** in the absence of other magnetic effects such as that of operating magnet **18** discussed further herein. It will be appreciated that magnet **26** can take other shapes such as a rod, cylinder or ball or any other shape that would fit above the switch unit and serve to shift ball **24**.

In use, switch assembly **16** is installed in door frame **12** and operating magnet **18** is installed in door **14** as illustrated in FIGS. **1** and **2**. With door **14** closed, frame **12** and door **14** are in an adjacent position with operating magnet **18** aligned with switch assembly **16**. Magnet **18** presents sufficient field strength to shift ball **24** to the switch-closed position.

When door **14** is open, door frame **12** and door **14** are in a separated position and operating magnet **18** is no longer aligned with switch assembly **16**. This allows retraction magnet **26** to shift ball **24** to the switch-open position.

FIG. **2** also illustrates intruder magnet **46** positioned adjacent the side of switch assembly **16**. Placement of intruder magnet **46** as shown causes ball **24** to shift along contact surface **38** toward side wall **40** in the direction of intruder magnet **46**. This is also a switch-open position and simulates the opening of door **14**. Thus, the use of an intruder magnet results in an alarm condition because of the structure of switch assembly **16**. In this way, apparatus **10** defeats the use of an intruder magnet which has been a problem with the prior art.

FIG. **3** is a schematic illustration of the preferred alarm **48** system using preferred apparatus **10**. System **48** includes conventional alarm control **50** and an alarm output such as alarm bell **52**. Apparatus **10** is used in system **48** as a contact switch triggering alarm control **50** whenever apparatus **10** is in the switch-open position, unless system **48** has been disarmed.

Having thus disclosed the preferred embodiment of the present invention, the following is claimed as new and desired to be secured by Letters Patent:

1. A magnetic switch apparatus for detecting relative movement between first and second members, said apparatus comprising:

a switch assembly for mounting to the first member, said assembly including

a first switch element presenting a generally rod-shaped configuration,

a second switch element presenting a generally disc-shaped configuration and having a contact surface,

structure positioning said first switch element generally transverse to said contact surface and spaced therefrom,

a ferromagnetic body shiftable between a switch-open position in which said body is out of contact with both of said first and second elements and a switch-closed position in which said body is in electrical contact with both said element and said contact surface; and

a first magnet spaced from said contact surface and positioned for magnetically shifting said body to said switch-open position; and

a second magnet for mounting to the second member and positioned on an opposed side of said contact surface relative to said first switch element, said second magnet being magnetically sufficient for shifting said body to said switch-closed position when the members are in an adjacent position, and for allowing said first magnet to shift said body to said switch-open position when the members are separated.

2. The apparatus as set forth in claim **1**, said contact surface presenting a generally convex configuration relative to said first switch element.

3. The apparatus as set forth in claim **2**, said contact surface presenting a generally reversed conically shaped configuration.

4. The apparatus as set forth in claim **1**, said contact surface presenting a central axis with said first switch contact generally aligned with said axis.

5. The apparatus as set forth in claim **1**, said second switch element including a side wall circumscribing said contact surface as a bottom wall.

6. The apparatus as set forth in claim **5**, said second switch element being integrally formed of metal.

7. The apparatus as set forth in claim **6**, said switch assembly including an electrically insulating top wall spaced from said contact surface and circumscribed by said bottom wall to define a switching chamber containing said body.

8. The apparatus as set forth in claim **7**, said first switch element including an extended portion extending outwardly through said top wall.

9. The apparatus as set forth in claim **8**, said first magnet being ring-shaped and positioned adjacent said top wall and surrounding said extended portion.

10. The apparatus as set forth in claim **9**, said body presenting a generally spherical configuration.

11. The apparatus as set forth in claim **1**, said body presenting a generally spherical configuration.

12. The apparatus as set forth in claim **1**, said switch-open position being an electrically open switch position, said switch-closed position being an electrically closed switch position.

13. The apparatus as set forth in claim **1**, said switch elements being located so that said body shifts to a switch-open position when the members are in the adjacent position and when an external magnet is applied in the vicinity of the first member in an attempt to manipulate magnetically said apparatus.

14. A magnetic switch apparatus for detecting relative movement between first and second members, said apparatus comprising:

a switch assembly for mounting to the first member, said assembly including

a first switch element presenting a generally rod-shaped configuration,

a second switch element presenting a generally disc-shaped configuration and having a convex contact surface presenting a central axis

an electrically insulating top wall spaced from said contact surface, centrally receiving an extension portion of said first switch element therethrough, and positioning said first switch element generally aligned with said axis of said contact surface and spaced therefrom,

a ferromagnetic ball shiftable between a switch-open position in which said body is out of contact with both of said elements and a switch-closed position in which said body is in electrical contact with both said element and said contact surface, said switch-open position being an electrically open switch position, said switch-closed position being an electrically closed switch position, and

a ring-shaped, first magnet surrounding said extension portion and positioned for magnetically shifting said body to said switch-open position; and

a second magnet for mounting to the second member and positioned on an opposed side of said contact surface relative to said first switch element, said second magnet being sufficient magnetically for shifting said body to said switch-closed position when the members are in an

adjacent position, and for allowing said first magnet to shift said body to said switch-open position when the members are separated.

15. An alarm system for activating an alarm upon shifting of first and second members from an adjacent position to a separated position and upon attempted manipulation by an external magnet of the alarm system when the members are in the adjacent position, said system comprising:

a switch apparatus; and

an alarm control coupled with said switch apparatus and responsive to a change in state thereof for activating an alarm, said switch apparatus including

a switch assembly for mounting to the first member, said assembly including

a first switch element presenting a generally rod-shaped configuration,

a second switch element presenting a generally disc-shaped configuration and having a contact surface,

structure positioning said first switch element generally transverse to said contact surface and spaced therefrom,

a ferromagnetic body shiftable between a switch-open position in which said body is out of contact with both of said elements and a switch-closed position in which said body is in electrical contact with both said element and said contact surface,

a first magnet spaced from said contact surface and positioned for magnetically shifting said body to said switch-open position,

a second magnet for mounting to the second member and positioned on an opposed side of said contact surface relative to said first switch element, said second magnet being sufficient magnetically for shifting said body to said switch-closed position when the members are in an adjacent position, and for allowing said first magnet to shift said body to said switch-open position when the members are separated,

said switch elements being located so that said body shifts to a switch-open position when the members are in the adjacent position and when an eternal magnet is applied in the vicinity of the first member in an attempt to manipulate magnetically said apparatus.

16. A method of detecting the relative movement between first and second members from a close position where the members are adjacent, and an open position where the members are separated, said method comprising the steps of:

installing a switch assembly on said first member, said switch assembly including a first elongated switch element, a second switch element disposed in spaced relationship to the first element and a ferromagnetic body located adjacent the first and second switch elements;

when said members are in said close position, using a magnetic field of sufficient strength to maintain the ferromagnetic body in a first switch orientation in simultaneous contact with said first and second switch elements;

in response to relative movement of the members from said close to said open position, magnetically shifting said ferromagnetic body to a second switch orientation out of contact with said second switch element; and

generating a signal when said ferromagnetic body is shifted.

17. The method of claim 16, including the further step of using a magnet located in said second member to provide said magnetic field of sufficient strength.

18. The method of claim 16, said first switch element being in a generally upright orientation, with said second switch element spaced below the first switch element, said maintaining step comprising the step of maintaining the ferromagnetic body in a lower first switch orientation, said magnetic shifting step comprising the step of shifting the ferromagnetic body upwardly to said second switch orientation.

19. The method of claim 18, including the step of shifting said body upwardly using a retraction magnet located above said first element.

20. The method of claim 16, said first switch element comprising an elongated, rod-like member.

21. The method of claim 16, said second switch element being generally disc-shaped.

22. The method of claim 16, said body being spherical in shape.

23. A magnetic switch apparatus for detecting relative movement between first and second members from a close position where the members are adjacent, and an open position where the members are separated, said apparatus comprising a switch assembly for mounting to the first member, including a first, elongated switch element and a second switch element in spaced relationship to said first switch element, and a magnet assembly including a ferromagnetic body adjacent said first and second switch elements, said assembly operable to shift said ferromagnetic body in a first switch orientation in simultaneous contact with said first and second switch elements when said members are in said close position, and to shift said ferromagnetic body to a second switch orientation out of contact with said second switch element in response to relative movement of the members to said open position.

24. The apparatus of claim 23, said body being spherical.

25. The apparatus of claim 23, said first switch element being generally rod-shaped in configuration.

26. The apparatus of claim 23, said second switch element being generally disc-shaped.

27. The apparatus of claim 26, said second switch element including a contact surface presenting a generally reversed conically shaped configuration.

28. The apparatus of claim 23, said magnet assembly further including a first magnet disposed above said first contact, and a second magnet for mounting to the second member.

29. The apparatus of claim 23, said first switch element being in a generally upright orientation, with said second switch element disposed below the first switch element.

30. A method of detecting the relative movement between first and second members from a close position where the members are adjacent, and an open position where the members are separated, said method comprising the steps of:

installing a switch assembly on said first member, said switch assembly including a first elongated switch element, a second switch element disposed in spaced relationship to the first element, and a shiftable body movable between a first position in simultaneous contact with said first and second switch elements, and a second position out of said simultaneous contact;

when said members are in said close position, using a magnetic field of sufficient strength to maintain said body in one of said first and second positions;

in response to movement of the members from said close to said open position, magnetically moving the body to the other of said first and second positions; and

generating a signal when said body is moved.

31. The method of claim 30, said magnetic moving step comprising the steps of using a magnetic field developed between said body and a first cooperable component on said first member.

32. The method of claim 31, said first component comprising a ring-shaped magnet.

33. The method of claim 30, said magnetic field of sufficient strength being developed between said body and a second cooperable component on said second member.

34. The method of claim 33, said second component comprising a magnet mounted on said second member.

35. The method of claim 30, said first switch element being in a generally upright orientation, with said second switch element spaced below the first switch element, said maintaining step comprising the step of maintaining the ferromagnetic body in a lower first switch orientation, said magnetic moving step comprising the step of shifting the ferromagnetic body upwardly to said second switch orientation.

36. A method comprising the steps of:

providing a switch assembly including a first elongated switch element, a second switch element disposed in spaced relationship to the first element and a shiftable body movable between a first position in simultaneous contact with said first and second switch elements, and a second position out of said simultaneous contact;

using a magnetic field of sufficient strength to maintain said body in one of said first and second positions; and

magnetically shifting the body to the other of first and second positions in response to a change of magnetic condition proximal to the switch assembly.

37. The method of claim 36, including the step of mounting said switch assembly on a first member, said change of condition comprising moving a second member relative to the first member.

38. The method of claim 37, said second member being equipped with a magnet, said magnetic moving step occurring by virtue of the magnetic attraction between said body and said second member magnet.

39. A switch assembly comprising:

a first wall, a second wall, and a circumscribing side wall cooperatively defining a switch chamber;

a first switch element, at least portion of which extends into said switch chamber; and

a shiftable body located within said switch chamber; and

a component associated with one of said first or second walls;

said body and component cooperatively formed to be magnetically attractive so that the body is magnetically moved within said chamber by virtue of the presence of said component.

40. The switch assembly of claim 39, said second wall and said side wall comprising a second switch element.

41. The switch assembly of claim 40, said body being shiftable between a first position in simultaneous contact with said first and second switch elements and a second position out of said simultaneous contact.

42. The switch assembly of claim 41, said component comprising a magnet.

43. The switch assembly of claim 42, said body retained in said second position by virtue of the magnetic attraction between said body and said component and shiftable to said first position in response to a change of magnetic condition proximal to the switch assembly.

44. The switch assembly of claim 39, said first switch element presenting an elongated, rod-like configuration which is oriented in a substantially upright manner.

45. The switch assembly of claim 39, said component secured to said first wall.

* * * * *