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Reininger

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[54] **SAFETY ALARM SYSTEM AND SWITCH**

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[52] **U.S. Cl.**..... **340/274,** 200/61.79, 200/61.76

[51] **Int. Cl.** **G08b 13/08**

[58] **Field of Search** 340/283, 274, 309.1, 275, 340/280; 200/61.79, 61.8, 161

[56] **References Cited**

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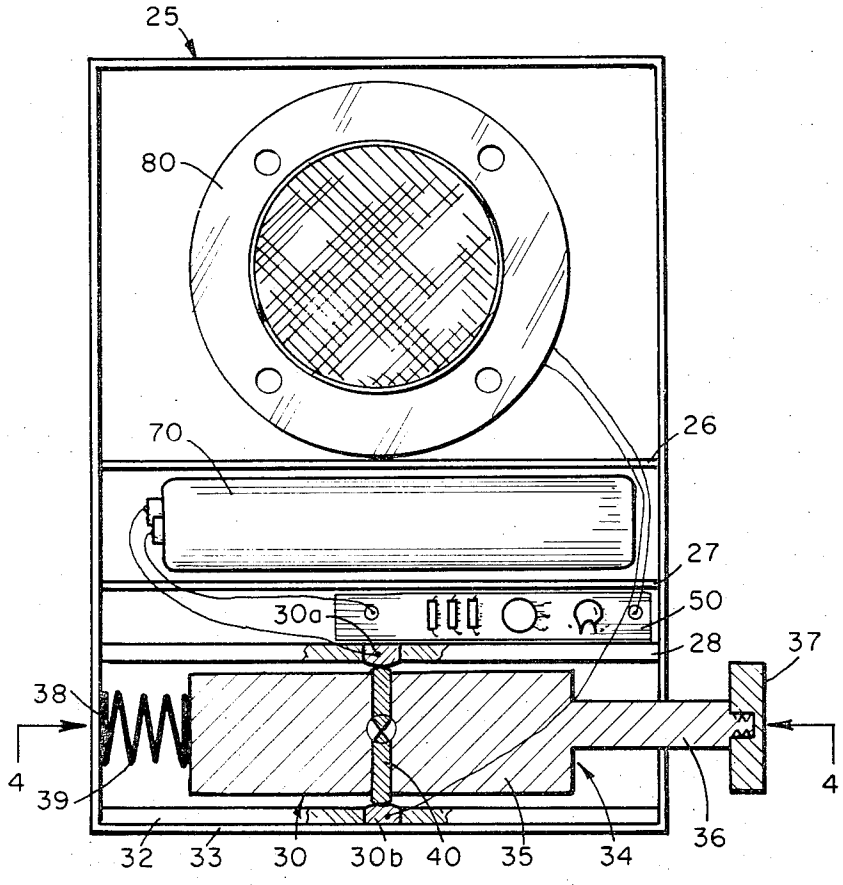
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Primary Examiner—John W. Caldwell
Assistant Examiner—Scott F. Partridge

[57] **ABSTRACT**

A safety alarm system adapted for placement in a cabinet to monitor uncontrolled entry into the cabinet by sounding an alarm when the door to the cabinet is left opened for more than a predetermined time. Conventional usage of the cabinet will not trigger the alarm, but when the cabinet door is left open for an inordinate period of time, as would by typical when an exploring child has entered, the alarm will sound. Also, provision is made for an adult to conveniently inactivate the alarm if the cabinet door need be left opened for a relatively long time. In such case, the ultimate closing of the cabinet door automatically resets the alarm.

2 Claims, 6 Drawing Figures



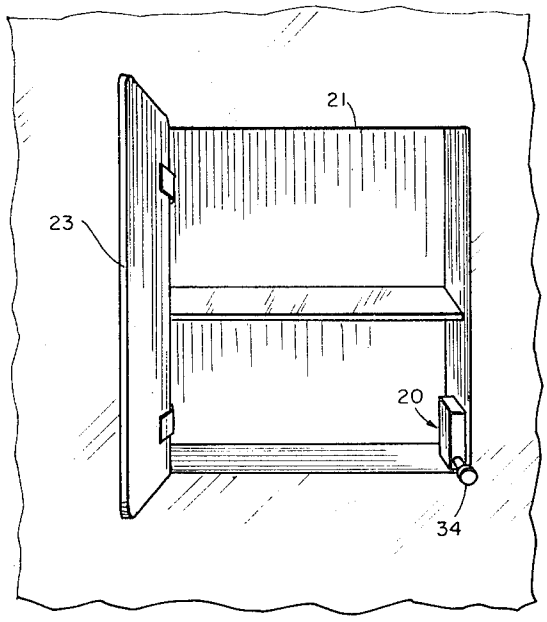

21
23
20
34

Fig. 1.

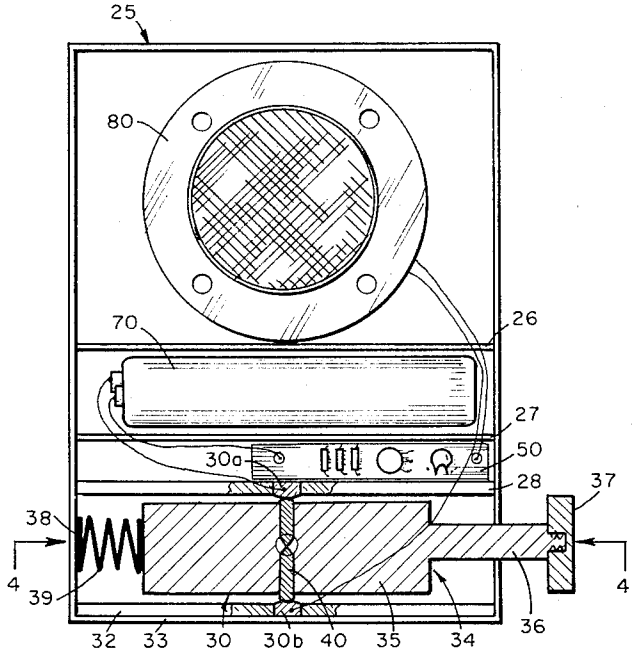

25
80
70
26
27
50
30a
28
37
38
4
39
4
32
33
30
30b
40
35
34
36

Fig. 2.

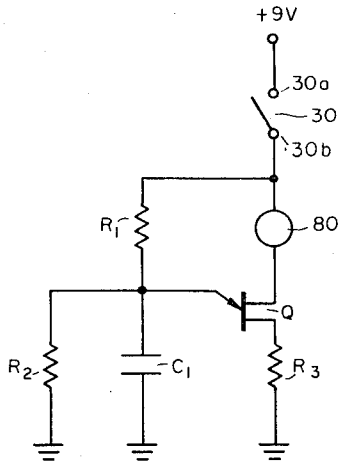


Fig. 3.

Fig. 4a.

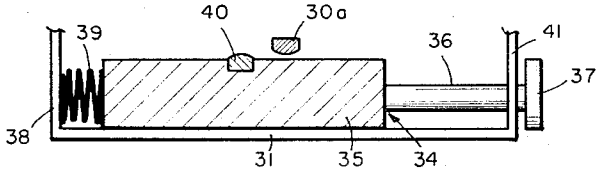


Fig. 4b.

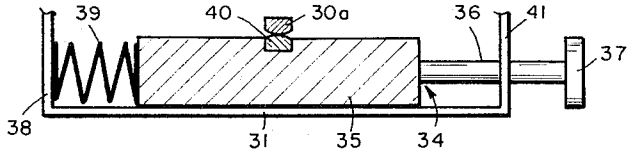
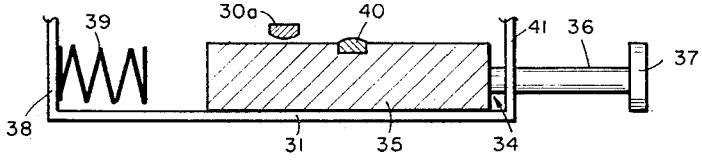


Fig. 4c.



SAFETY ALARM SYSTEM AND SWITCH

BACKGROUND OF THE INVENTION

This invention relates to alarm systems for monitoring uncontrolled entry to a cabinet and, more particularly, to an alarm system and switch therefor that is suitable as a safety system which gives warning of a child's entry into a medicine cabinet or other restricted cabinet.

There have been previously devised various types of alarm systems that monitor unauthorized or uncontrolled entry into a restricted area, room, cabinet or the like. The basic designs include a switch that is tripped by the opening of a door, the resultant completion of an electrical circuit causing a loud alarm to sound. In most instances, the systems are utilized as protection against thieves or vandals. In such environment, it is common to provide a delayed alarm with, say, a hidden inactivating switch. An authorized entrant can then, during the prescribed delay time (typically one minute or less), prevent a spurious sounding of the alarm by throwing the hidden switch.

The use of an alarm system for child safety rather than theft protection is feasible but presents different problems. For example, one could envision an alarm that would be triggered whenever a medicine cabinet is opened. This would prove highly annoying since the large percentage of entrants are "authorized." Also, if a proposed safety alarm system required constant setting, resetting, or inactivating, the lack of convenience would render it impractical for the large majority of the population. Thus, an ideal system should be convenient to use, should operate reliably and maintenance free over long periods of time, and, most importantly, be relatively inexpensive to purchase and easy to install.

It is accordingly an object of this invention to provide a safety alarm system which meets these requirements.

SUMMARY OF THE INVENTION

The present invention is directed to a safety alarm system adapted for placement in a cabinet to monitor uncontrolled entry into the cabinet by sounding an alarm when the door to the cabinet is left opened for more than a predetermined time. Conventional usage of the cabinet will not trigger the alarm, but when the cabinet door is left open for an inordinate period of time, as would be typical when an exploring child has entered, the alarm will sound. Also, provision is made for an adult to conveniently inactivate the alarm if the cabinet door need be left opened for a relatively long time. In such case, as will be seen, the ultimate closing of the cabinet door automatically resets the alarm.

In accordance with the invention there is provided a switch disposed for actuation by the cabinet door, the switch having a movable elongated plunger. When the door is opened, the plunger is normally spring biased to a "closed-switch" position, but is actuable against the bias in one direction by the closing of the door in an "opened-switch" position. The plunger is manually actuable in the opposite direction to a second opened-switch position when the door is opened. Means are provided for measuring the time that the switch is continuously closed. Further means are provided for generating an alarm when the measured time exceeds a predetermined time.

In a preferred embodiment of the invention the plunger is movable to its second opened-switch position free of spring bias.

Further features and advantages of the invention will become more readily apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of the invention positioned for operation within a medicine cabinet;

FIG. **2** is a side plan view of an embodiment of the invention with its cover removed;

FIG. **3** is a schematic circuit diagram of the system of FIG. **2**; and

FIG. **4**, comprising FIG. **4** (*a*), FIG. **4** (*b*) and FIG. **4**(*c*), shows cross sectional view of the switch of FIG. **2** as taken through arrows **4—4**, the switch being shown in its three basic operating positions.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. **1**, there is shown a sketch of the invented alarm system **20** positioned for operation within a medicine cabinet **21** that may be wall mounted. The system **20** may be of generally rectangular shape and proportioned to fit compactly in a corner of the cabinet interior. When the cabinet door **23** is opened, a plunger **34** protrudes through the plane defined by the front of the cabinet. The plunger **34** is slidable and has three basic positions: "depressed", "normally protruding," and "extended." As will be described, the plunger forms part of a switch, the mechanism of which is contained within the system **20.** With the door **23** closed, the plunger is depressed and the switch is in a non-conductive or "opened" state. When the door is opened, the plunger is biased to its normally protruding position and the switch is conductive or "closed." Also, with the door opened the plunger can be manually pulled to its more-protruding "extended" position which results in the switch being "opened."

Briefly, operation of the system is as follows: When the plunger is continuously in its normally protruding position for more than a predetermined time, for example about 15 seconds, a piercing alarm is sounded. This is achieved within the system **20** by circuitry that monitors the time the switch is continuously closed and generates a self-contained alarm when the switch is closed for more than the predetermined time of fifteen seconds. In normal usage of the medicine cabinet, the door will not be continuously opened for more than 15 seconds and the system **20** will not be activated. If, however, an exploring child has entered the medicine cabinet, it is highly likely that the explorations will take more than 15 seconds or, if not, that the door will be left opened after the child has taken something and departed. In either case, the alarm will sound in a relatively short time with the expected effect being the summoning of an adult and/or the scaring off of the child. In the event that it is necessary for an adult to leave the cabinet door opened for any substantial period, all that is necessary is that he pull the plunger to its extended position which opens the switch and prevents the alarm from being triggered.

FIG. **2** is a side plan view of the system **20** with its cover removed. A rectangular housing **25**, preferably of a hard plastic construction, is separated into four

compartments by plastic dividers **26, 27** and **28.** The compartments, from bottom to top, respectively contain a switch **30,** electronic circuitry **50,** a battery **70** and an alarm or siren **80.** Apertures or perforations in the cover (not shown) are provided to facilitate sound transmission from the siren. The battery **70** is preferably a small 9 volt cell that is widely available and the alarm is preferably of a compact disc type that is also commercially available. The electronic circuitry **50** consists of a small number of components that may be conveniently mounted on a piece of circuit board that is dimensioned to fit in the second lowest compartment. The switch **30** is also compact of design and with a minimum of parts to reduce expense, improve reliability and ease maintenance. As will be described, the switch **30** has a novel design that is particularly suitable for operation in the present system. A particular functional embodiment of the invention was constructed in a housing that measured about four inches high by about three inches deep by about one and a half inches wide.

FIG. **3** is a circuit diagram of the system shown in FIG. **2,** the components other than the battery, alarm, and switch being mounted on the small circuit board within housing **25.** The positive terminal of the battery (nine volts) is coupled, via switch **30,** to one terminal of the alarm **80** and also to one side of a resistor R_1. The other side of R_1 is coupled to the emitter electrode of a unijunction transistor Q and is also coupled to ground reference via an RC combination consisting of R_2 and C_1. The other terminal of alarm **80** is coupled to the "base **2**" electrode of the transistor Q. The "base **1**" electrode of Q is coupled through R_3 to ground. Operation is as follows: When the switch **30** is closed, the capacitor C begins to charge through the resistor R_1. If R_1 is relatively large, the charging time constant is approximately $R_1 C_1$. The transistor Q is normally off and remains off (i.e., essentially non-conductive as between its base electrodes) until the emitter voltage exceeds NV_{b2}, where N is the intrinsic standoff ratio of transistor Q (typically about 0.6) and V_{b2} is the voltage at the transistor base **2** electrode. Assuming N is about 0.6, the emitter voltage required for firing is about 5.4 volts. A predetermined trigger time of about 15 seconds can therefore be achieved by selecting R_1 and C_1 so that the time constant τ is approximately 15 seconds, since the voltage builds up to about six tenths of the final value in one time constant. If the switch **30** is reopened before Q has fired, C_1 will discharge through the relatively large resistor R_2. This discharge is relatively slow, but voltage retention by C_1 will not be a problem unless the cabinet is opened and closed in quick succession a number of times. The presence of R_2 will also slow the charging of C_1 somewhat so that the critical time is actually a few seconds above 15 seconds.

Referring to FIG. **4,** the switch **30** is shown in its three basic operating positions. A track for the switch is defined by the bottom **31** of housing **25** in conjunction with divider **28** (FIG. **2**) and another plastic member **32** that is mounted on sidewall **33** of housing **25.** A plunger **34** has a main body portion **36** that extends through an aperture in the front wall of housing **25.** The plunger body **35** is illustrated as being rectangular in shape to fit the rectangular track, but it will be appreciated that any suitable shape, for example, cylindrical, that is provided with a conforming track can be utilized. The plunger neck portion **36** is of sufficient length to extend substantially through the aperture and its end is threaded to receive a similarly threaded rubber disc **37.**

The plunger body **35** is spaced from the back wall **38** of housing **25** which closes the track at one end. A spring **39** is interposed between the end of the plunger body **35** and the back wall **38,** the spring preferably being mounted to the wall **38** such as by a screw. The spring could alternatively be mounted to the plunger body (only), or, could even "float" between the plunger body and wall. As will become clear, however, it is preferred that the spring not be attached at both sides.

Mounted transverse the plunger body is a conductor strip **40** having ends that extend to points adjacent the track-defining members **28** and **32.** A pair of contacts, designated **30***a* and **30***b* (FIG. **3**), are located at a prescribed position on the track on the members **28** and **32.** When the conductor **40** is at the prescribed position, the contacts are effectively shorted and the switch **30** is closed. The prescribed position is selected as corresponding to the position to which the spring **39** would bias the plunger **34** in the absence of external forces.

FIG. **4A** illustrates the situation when the door **23** (FIG. **1**) is closed. The door **23** depresses the plunger **32** to compress the spring **39** and the conductor **40** is moved away from contacts **30***a* and **30***b*. In such case, the switch **3** is opened. When the door **23** is opened, the situation is as illustrated in FIG. **2** and FIG. **4B.** The spring **39** biases the plunger **34** to a normally protruding position where the conductor **40** engages contacts **30***a* and **30***b* and, consequently, the switch **30** is closed. FIG. **4C** illustrates the third situation where the plunger has been manually pulled to an extending position. Again, the conductor **40** moves away from the contacts and the switch is opened. The plunger body **35** can move, free of spring bias, up to the point where the body engages the front wall **41** of housing **25.** During operation any degree of movement that breaks electrical contact is sufficient.

In operation of the system **20,** the capacitor C_1 (FIG. **3**) charges only when the cabinet door **23** is opened and the switch **30** is in the position illustrated in FIG. **4B.** If it is necessary to leave the cabinet door opened for a relatively long period, the plunger **37** can be easily pulled to the extended position shown in FIG. **4C.** The absence of spring bias obviates the need for any special twisting, setting or the like to achieve the extended switch position. Also, since there is little resistance against the plunger in pulling it to the extended position, it is not necessary that the housing be mounted to the cabinet **25,** the weight of the assembly being sufficient to hold it in place. Mounting can be implemented if desired, however. Also, it is not necessary to reset the switch from the extended position since the closing of door **23** returns the switch to the position of FIG. **4A.**

The assembly has been described with reference to a particular embodiment, but it will be appreciated that many variations are possible within the spirit of the invention. For example, the electronic means for measuring the time the switch is closed could comprise conventional digital circuitry. If desired, the assembly could be built into a cabinet wall with only the plunger visible. In such a setup it would be feasible to use

stepped-down house voltage as a power supply. Also, additional switch contacts could be implemented to achieve a faster discharge of the capacitor when the switch is closed. Finally it should be printed out that the assembly is adaptable for use in the type of cabinet that employs sliding rather than hinged doors.

I claim:

1. An alarm system for placement in a cabinet to monitor uncontrolled entry into the cabinet by sounding an alarm when a door to the cabinet is left in an opened position for more than a predetermined time, said alarm being capable of temporary manual inactivation, comprising:

a. a switch disposed for actuation by said cabinet door, said switch having a movable elongated plunger, said plunger being normally spring biased with said door opened to a closed-switch position, and actuable against said bias in one direction by the closing of said door to an opened-switch position, said plunger being manually actuable in the opposite direction, free of spring bias, to a second opened-switch position when said door is opened;

b. means for measuring the time that said switch is continuously closed; and

c. means for generating an alarm when the measured time exceeds a predetermined time.

2. A switch comprising:

a. a housing having a receiving track that is closed at one end and contact means mounted adjacent said track;

b. an elongated plunger slidably fitted in said track, said plunger having a conductor mounted thereon for engagement with said contact means when said plunger is in a prescribed position in said track, said plunger extending substantially from the opened end of said track; and

c. means for biasing said plunger toward the opened end of said track and to said prescribed position, said plunger being free of said bias for travel past said prescribed position and further toward the opened end of said track, whereby said plunger is actuable against said bias to a non-engaging position toward said closed end and actuable free of said bias to another non-engaging position toward said opened end.

* * * * *