United States Patent [19]

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[11] 3,769,556

[45] Oct. 30, 1973

[54] MAGNETIC ACTUATED SWITCH APPARATUS INCLUDING SHUNT

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[22] Filed: July 14, 1972

[21] Appl. No.: 271,863

[52] U.S. Cl. ..... 317/148.5 B, 340/274, 340/276

[51] Int. Cl. G08b 13/08

[58] Field of Search 317/DIG. 7; 307/93, 307/136; 340/274, 276

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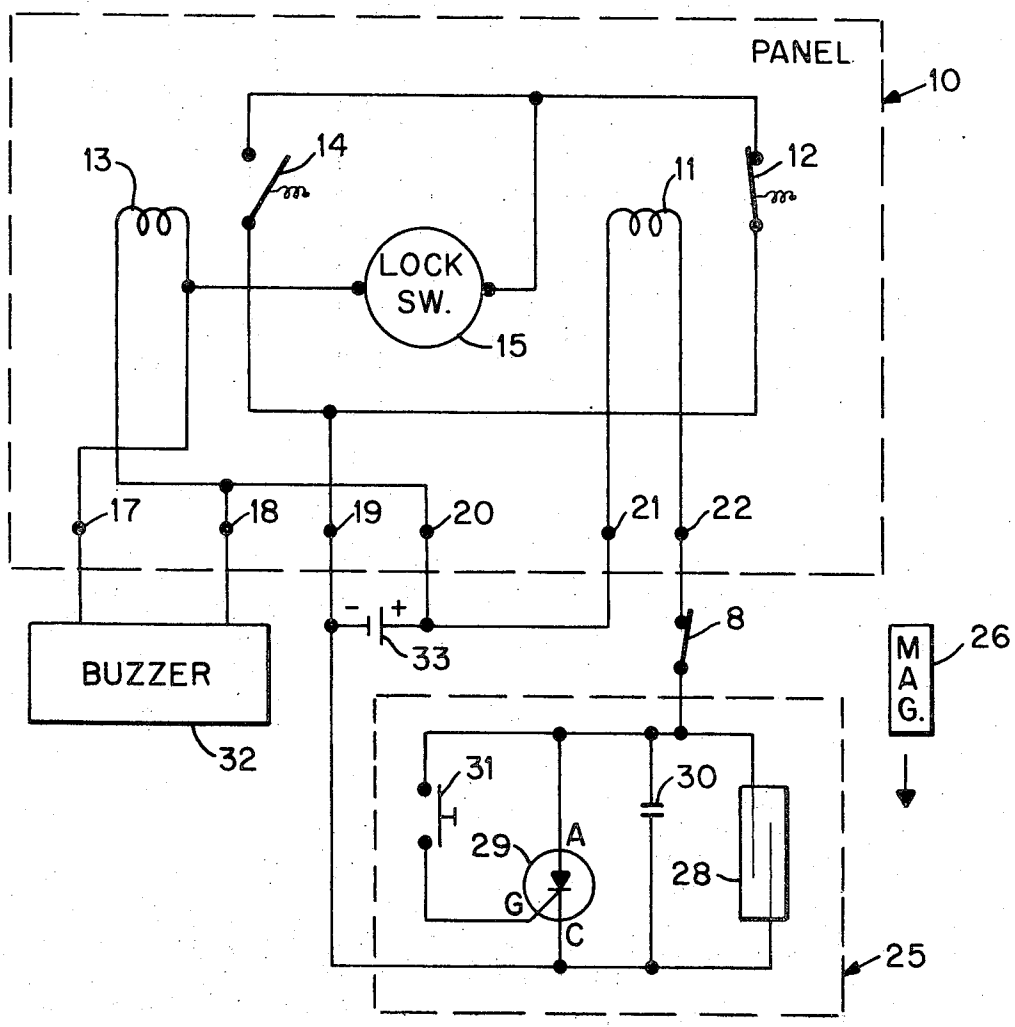
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[57] ABSTRACT

A magnetic actuated switch apparatus including a shunt circuit for temporarily bypassing the switch in the absence of the magnet is described. Such apparatus is especially adapted for burglar alarm systems which require arming without setting off the alarm while opening the door in the process of departing from the premises. The switch is solid state in nature utilyzing an SCR or TRIAC as the shunting element for a magentic reed, and also incorporates means for preventing turn-on of the SCR or TRIAC when the magnetic reed opens upon subsequent opening of the door to the premises.

11 Claims, 3 Drawing Figures



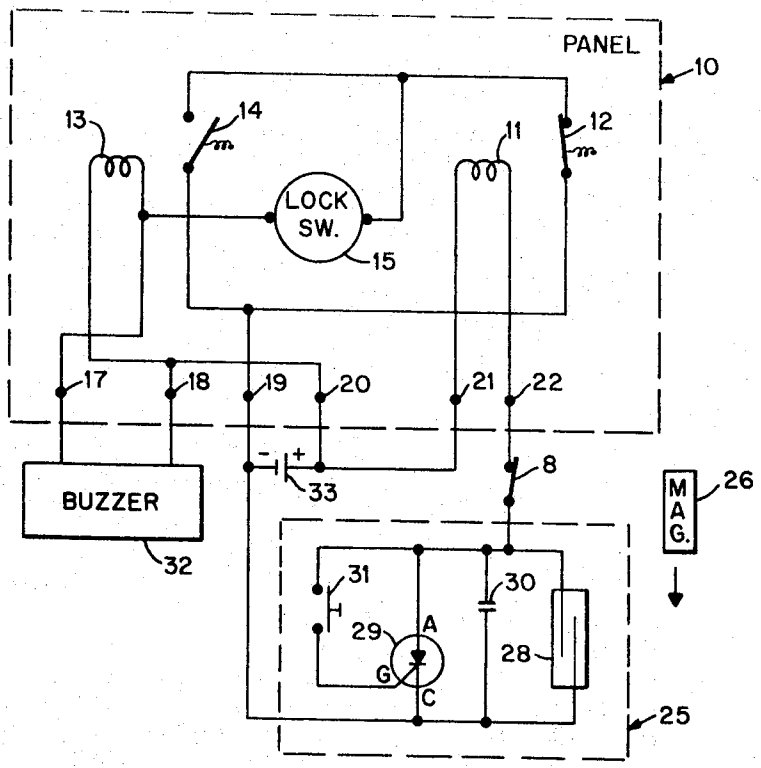


FIG. 1

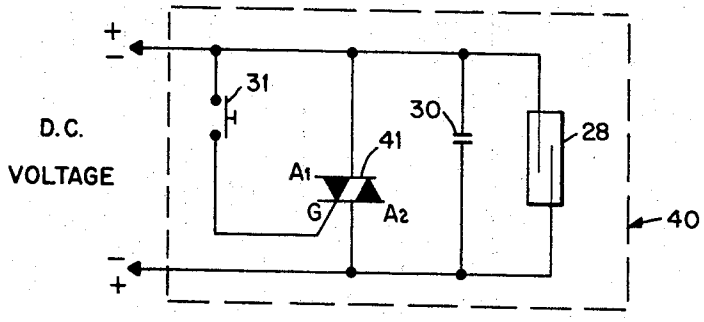
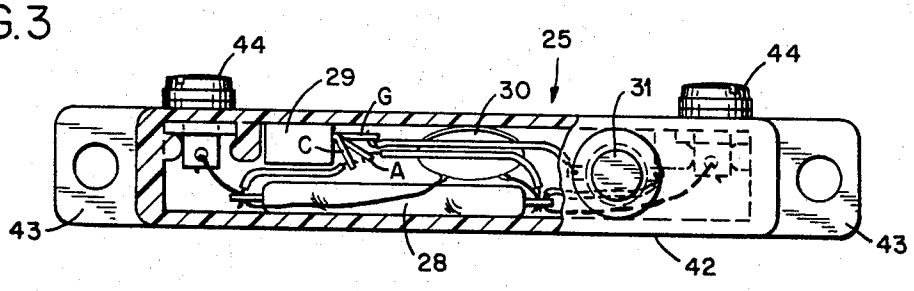


FIG. 2

FIG. 3



MAGNETIC ACTUATED SWITCH APPARATUS INCLUDING SHUNT

This invention relates to magnetic actuated switch apparatus including a shunting circuit for temporarily preventing opening of the switch.

Commerical establishments having an exit door that opens outwardly frequently employ a burglar alarm system that when set by the last person to leave the premises becomes fully operative by the final closing of the exit door. The conventional system which has been in wide use for many years employs a standard main panel containing a main protective relay with normally closed contacts, an alarm locking relay, often a key actuated lock switch to turn the system on and off, and various terminals for connecting an alarm, a suitable DC power source, switches for the various openings to be protected, and a magnetic shunt, which is mounted adjacent the final exit door for cooperation with a magnet on the door. In operation, the last person to leave turns the system on, and then, while opening the exit door, depresses a button on the magnetic switch. This permits him to leave and close the door without sounding the alarm. However, the next time the door is opened the alarm will sound.

One of the major problems in the use of such systems is the magnetic actuated shunt. Conventionally, it is a mechanical switch in which the button is mechanically held in its depressed position, maintaining a pair of contacts closed, until magnetically actuated by the closing door. The frequent opening and closing of the contacts will ultimately cause oxidation thereof and a build-up in resistance which in time renders the switch inoperative. In addition, the various mechanical parts of the switch do wear and the switch contacts can thus inadvertently open, causing a false alarm. As will be appreciated, false alarms are highly irritating, inconvenient, and even costly.

The main object of the invention is a magnetic shunt switch for use with the standard panel as above described as a burglar alarm system for premises with an outwardly opening door wherein the above-mentioned difficulties are substantially obviated.

This and further objects of the invention as will appear hereinafter are achieved with a magnetic actuated switch comprising sealed contacts, such as of the magentic reed type, shunted by a solid state bistable electronic switch, for example, an SCR or TRIAC, and with a push button switch connected when depressed to turn-on the electronic switch. A further feature of the invention is the provision of means for preventing turn-on of the electronic switch when the magnetic reed contacts open subsequent to the final closing of the door. In a preferred form, the last-named means comprises a capacitor connected in parallel across the electronic switch.

The construction of the invention is completely compatible with the existing equipment employed in the installation of such known alarm systems, especially in that the same standard panel can be used as in the known systems. Thus, the magnetic shunt of the invention is an exact substitute for the known mechanical construction, but, with the exception of the button, having no moving parts eliminates completely the difficulties above described with such known constructions. Moreover, since the contacts are sealed, build-up in resistance due to oxidation or dirt is substantially eliminated. Still further, the switch is smaller and of ligher weight then the known type, which is also advantageous.

Several exemplary forms of the invention will now be described in greater detail with reference to the accompanying drawings, wherein:

FIG. 1 is a circuit diagram showing one embodiment of the magnetic shunt of the invention connected in a burglar alarm system;

FIG. 2 is a circuit diagram of another embodiment of the magnetic shunt of the invention;

FIG. 3 is a plan view of the actual magnetic shunt corresponding to the FIG. 1 embodiment.

FIG. 1 illustrates a typical burglar alarm system employing one form of magnetic shunt in accordance with the invention. It comprises a standard panel **10**, which can be purchased as a unit from various suppliers, comprising a main protective relay having a coil **11** and normally-closed contacts **12**, an alarm locking relay having a coil **13** and normally open contacts **14**, and if desired a key-activated lock switch **15** with normally open contacts. The panel also comprises terminals **17, 18, 19, 20, 21,** and **22.** As shown, the protective relay coil **11** is connected to terminals **21** an **22**, the alarm locking relay coil **13** is connected to terminals **17** and **18**, the contacts **12** and **14** are connected in parallel between one side of the lock switch **15** and terminal **19**, the other side of lock switch **15** is connected to terminal **17**, and terminals **18** and **20** are internally connected. The standard panel **10** is enclosed in dashed lines. The serviceman need merely mount the panel near the exit door of the premises, after which he installs a magnetic shunt switch generally on the door jamb. A suitable magnet is then mounted on the door such that when the door is in the closed position, the magnetic switch is actuated, whereas when the door is in an open position, the magnetic switch is deactivated. In FIG. **1**, the magnetic switch is designated **25** and enclosed in dashed lines, and the activating magnet is schematically illustrated at **26.**

The magnetic switch **25** comprises a normally-open magnetic reed switch **28**, a silicon controlled rectifier (SCR) **29** having anode A, cathode C and gate G terminals, a capacitor **30** connected across the anode and cathode of the SCR, and a push-button switch **31** temporarily connecting when actuated the SCR gate to its anode. The cathode-anode circuit of the SCR is connected in parallel with the reed switch **28**, one end of which is connected to terminal **22** and the other end of which is connected to terminal **19.** The circuit is completed by connecting a suitable alarm, such as a buzzer or bell **32**, to terminals **17** and **18**, and a DC voltage source **33**, such as a battery or rectified AC, across terminals **19** and **20.** As is usual in such systems, the various openings to the premises, such as other doors, windows, skylight, etc., are each protected by an electrical switch which is normally closed and which is connected in series with the magnetic shunt **25** and the relay **11** via terminal **22**, all of these protective switches have been represented by the single switch **8** in FIG. **1.**

The operation is as follows. As will be observed, the buzzer **32** obtains power from the battery **33** via the lock switch **15.** Hence, so long as the latter is off, the alarm can not be sounded. When the premises are to be locked up for the night, the last person to leave inserts a key into the lock switch **15** in order to turn on the alarm. If the final exit door is closed, the magnet **26** is adjacent the reed switch **28**, which closes, thereupon

completing the circuit to the protective relay coil 11, which opens the contacts 12, thereby maintaining the buzzer circuit open. Typically, the coil 11 has a resistance of about 300 ohms, and the battery is 3–6 volts. It requires about 4 mA to activate the relay 11. If the door were now opened to permit the last person to exit from the premises, the reed contacts 28 would open due to removal of the magnet 26, which would open the protective relay coil 11 circuit, closing the contacts 12 which would then complete the circuit to the alarm buzzer 32. Simultaneously, the alarm holding relay 13 is activated closing contacts 14. Thus the alarm continues to sound even if the door is closed again and up until the lock switch 15 is actuated to turn off the system.

The magnetic shunt 25 prevents sounding of the alarm when the door is opened as the last person leaves by shunting the reed switch 28. This is accomplished by actuating the push button 31 as the door is opened. This action temporarily puts anode potential on the gate turning on the SCR and maintaining the protective relay coil 11 circuit closed. Bistable electronic switches, as a SCR or TRIAC, have the characteristic that once turned on it remains on unit the anode-cathode potential is reduced below its holding potential. This is accomplished when the front door is closed by the closing of the reed switch 28 shorting out the SCR anode-cathode. Thus the SCR extinguishes, the last person has left the premises without sounding the alarm, and the alarm is armed and ready to be activated whenever the front door is reopened or any of the other openings to the premises forced thus opening switch 8. However, it has been found that when the door is opened after arming of the alarm, the alarm does not sound as it is supposed to. In accordance with a feature of this invention, proper operation is achieved by means of the capacitor 30 connected across the reed switch 28. What apparently happens without the capacitor 30 is that, when the door opens opening the reed switch 28 and thus interrupting the relay coil 11 circuit, a voltage is temporarily induced across the relay coil 11. This voltage is in additive relationship to the battery 33, with the result that the anode-cathode breakdown voltage of the SCR 29 is exceeded and the SCR turns on again shunting the reed switch and maintaining the relay 11 circuit closed, thus preventing sounding of the alarm. What the capacitor 30 apparently accomplishes is to short out the SCR for this temporary induced voltage and thereby prevent unwanted triggering or turn-on of the SCR. Thus, opening of reed switch 28 will sound the alarm. For this purpose, capacitor 30 should have a minimum amount of capacitance, to wit, at least 0.02 μfd. A value of 0.04 μfd has proven satisfactory.

In the embodiment illustrated in FIG. 1 employing an SCR or thyristor, it is essential that the magnetic switch 25 be connected to terminals 19 and 22 such that the positive side of battery 33 is connected to the SCR anode, and the negative side to the SCR cathode. The magnetic switch 40 in accordance with the invention illustrated in FIG. 2 eliminates the foregoing requirement. The parts of the circuit that are the same as in FIG. 1 bear the same reference numerals. The sole difference is the substitution of a TRIAC 41 for the SCR. TRIACs have bi-directional characteristics, and can be operated and turned on by a voltage of either polarity. The TRIAC otherwise behaves similarly to an SCR. Thus, the polarity of the applied voltage, or the connections to the battery, become unimportant. This simplifies wiring of the system.

FIG. 3 illustrates a suitable package for the magnetic switch 25 illustrated in FIG. 1. It comprises an elongated rectangular casing or can 42, for example of plastic, provided with lugs 43 for mounting same on the door jamb. On the side of the casing are terminals 44 to which are connected the various circuit components which are all housed within the casing, as shown. The components may be potted in a suitable plastic. The magnet to activate the reed would generally have a similar configuration. The push-button of the switch 31 protrudes through the top casing wall and is thus readily accessible for manual activation.

In a typical circuit, the SCR is of the low current size of the order of a few watts since it need not dissipate much power, it being conventional to employ as the battery 33 a 3 volt source. Thus all of the switch components are easily fitted within a single casing 42 having dimensions of approximately 2½ inches long, with a cross-section of about ½ inches square. The resultant switch is thus of small size and weight. Moreover, it is quite inexpensive to manufacture, employing as it does only a few inexpensive components. Nevertheless, it provides performance that far exceeds that of the conventional mechanical magnetic shunt. The switch of the invention has a much longer lifetime, due to the sealing of the reed contacts. Moreover, the absence of mechanical parts substantially eliminates false alarms due to mechanical wear and tear. Still further, the spacing of the actuating magnet to the shunt is less critical than in the known construction. Finally, these important improvements are obtained with a magnetic shunt that is completely compatible with the existing panels thus avoiding the need for rewiring of the latter.

While only the door actuated reed switch 28 and one other switch 8 are shown, it is understood, as is well known, that other door and window switches can be connected in series with the relay coil 11 such that the unauthorized opening of any of these will interrupt the relay circuit sounding the alarm.

While my invention has been described in connection with specific embodiments thereof, those skilled in the art will recognize that various modifications are possible within the principles enunciated herein and thus the present invention is not to be limited to the specific embodiments disclosed.

What is claimed is:

1. A magnetic actuated switch with incorporated shunt circuit for use in alarm systems, comprising normally-open contacts which will close in response to a locally provided magnetic field, a bistable electronic switch having main terminals and a turn-on connection, the main terminals of the electronic switch being connected in parallel with the normally-open contacts, a source of D.C. voltage, means for connecting the D.C. source to the normally-open contacts whereby closing of the contacts enables application of D.C. voltage to an external load circuit, means for temporarily connecting the electronic switch turn-on connection to the D.C. source for turning on the electronic switch to shunt the normally-open contacts allowing application of the D.C. voltage to the external load circuit, said electronic switch turning off when the normally-open contacts close in response to the magnetic field whereby the D.C. voltage continues to be applied to the external load circuit, the next removal of the magnetic

field which reopens the normally open contacts interrupting the load circuit and creating a temporary condition tending to turn-on the electronic switch, and means operatively coupled to the electronic switch for preventing turn-on thereof when the normally-open contacts reopen to thereby prevent undesired reclosing of the interrupted load circuit.

2. A magnetic actuated switch as set forth in claim 1 wherein the turn-on preventing means for the electronic switch comprises a capacitor connected in parallel with the switch main terminals.

3. A magnetic actuated switch as set forth in claim 2 wherein the capacitor has a capacitance of at least 0.02 μfd.

4. A magnetic actuated switch as set forth in claim 2 wherein the electronic switch comprises an SCR having anode and cathode main terminals and a gate connection, the capacitor is connected across the anode and cathode, and a push button is provided for temporarily connecting the gate to the anode.

5. A magnetic actuated switch as claimed in claim 2 wherein the electronic switch comprises a TRIAC having two anode main terminals and a gate connection, the capacitor is connected across the two anodes, and a push button is provided for temporarily connecting the gate to one of the anodes.

6. A magnetic actuated switch as set forth in claim 3 wherein the normally-open contacts are part of a magnetic reed switch.

7. A magnetic actuated switch as claimed in claim 6 and further comprising a housing having two terminals and a push-button, said reed switch being inside the housing with its normally-open contacts connected to the housing terminals, said capacitor being inside the housing and being connected to the housing terminals, said electronic switch being an SCR or TRIAC having main terminals and a gate turn-on connection and being inside the housing with its main terminals connected to the housing terminals and with its gate connected to one side of the push button, the other side of the push button being connected to one of the housing terminals.

8. A burglar alarm system comprising a magnetic actuated switch as claimed in claim 1, in combination with a panel comprising a protective relay havng a coil and normally closed contacts which are maintained open upon energization of the coil, said protective relay coil being connected in series with the magnetic actuated switch normally open contacts and constituting the said external load circuit, said D.C. source being connected in series with the said coil and the magnetic actuated switch, an outwardly opening door, and a magnet mounted on the door and adapted to close the normally-open contacts when the door is in a closed position.

9. A burglar alarm system as claimed in claim 8 and further including an alarm device connected in series with the contacts of the protective relay and causing an alarm when the latter close in reponse to interruption of the load circuit.

10. A burglar alarm system as claimed in claim 9 and further including on the panel a holding relay for the alarm device and adapted to maintain the alarm device circuit closed when actuated to sound the alarm.

11. A burglar alarm system comprising a magnetic actuated switch as claimed in claim 7, in combination with a separate panel comprising a protective relay having a coil and normallyclosed contacts which are maintained open upon energization of the coil, said protective relay coil being connected in series with the magnetic actuated switch and the D.C. source and constituting the external load circuit, an outwardly opening door, a magnet mounted on the door and adapted to close the normally-open contacts when the door is in a closed position, an alarm device connected in series with the contacts of the protective relay, and a holding relay on the panel for the alarm device and adapted to maintain the alarm device circuit closed when actuated to sound the alarm.

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