United States Patent [19]

Campman

[11] **3,896,427**

[45] **July 22, 1975**

[54] **MAGNETICALLY OPERATED ALARM**

[76] Inventor: **James P. Campman,** 12900 Broadmoor Rd., Silver Spring, Md. 20904

[22] Filed: **June 27, 1974**

[21] Appl. No.: **483,827**

[52] **U.S. Cl.** ..... **340/274 R;** 340/282

[51] **Int. Cl.**[2] **G08B 13/08**

[58] **Field of Search** ..... 340/274 R, 274 C, 282; 335/206

[56] **References Cited**

UNITED STATES PATENTS

2,877,361	3/1959	Chase	340/282
3,544,934	12/1970	Poliakoff	335/206
3,771,153	11/1973	Byrne	340/274 R
3,771,154	11/1973	Takei	340/274 R

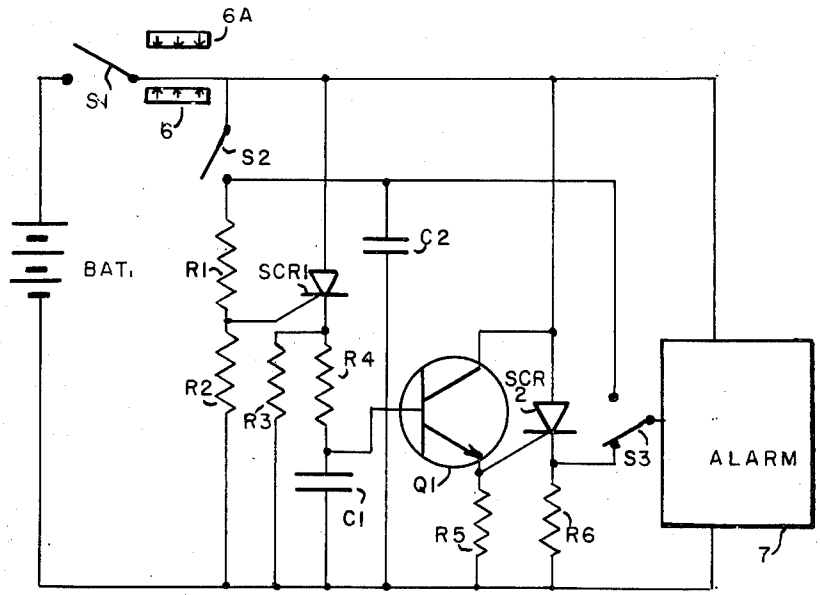
Primary Examiner—Glen R. Swann, III

[57] **ABSTRACT**

An alarm circuit is actuated in response to relative motion in one direction to arm the apparatus, and is actuated in response to motion in the opposite direction to initiate an alarm. The apparatus includes an actuating magnet mounted on one of two relatively movable objects, a pair of reed switches mounted on the other of the two relatively movable objects, one of which is magnetically biased towards a closed position and the other which is unbiased, whereby, relative motion in one direction between objects the actuating magnet causes the sequential operation of the reed switches, the unbiased reed switch to a momentary closure and the biased reed switch to a latched closure, and whereby relative motion of the objects in the opposite direction relative to the actuating magnet causes the unbiased reed switch to be momentarily closed while the biased reed switch is latched. The apparatus further includes an electronically operated switching means which is energized after a predetermined lapse of time after the simultaneous closure of both reed switches to cause an alarm to be sounded. For silencing the alarm a key magnet is positioned adjacent to the biasing magnet to nullify the same, permitting the reeds of the biased reed switch to open.

The apparatus further includes a third reed switch which when subjected to the magnetic flux of the key magnet, will convert the apparatus into an annunciator, whereby the alarm will be sounded for a short duration each time there is a relative motion between the objects in either direction.

2 Claims, 5 Drawing Figures



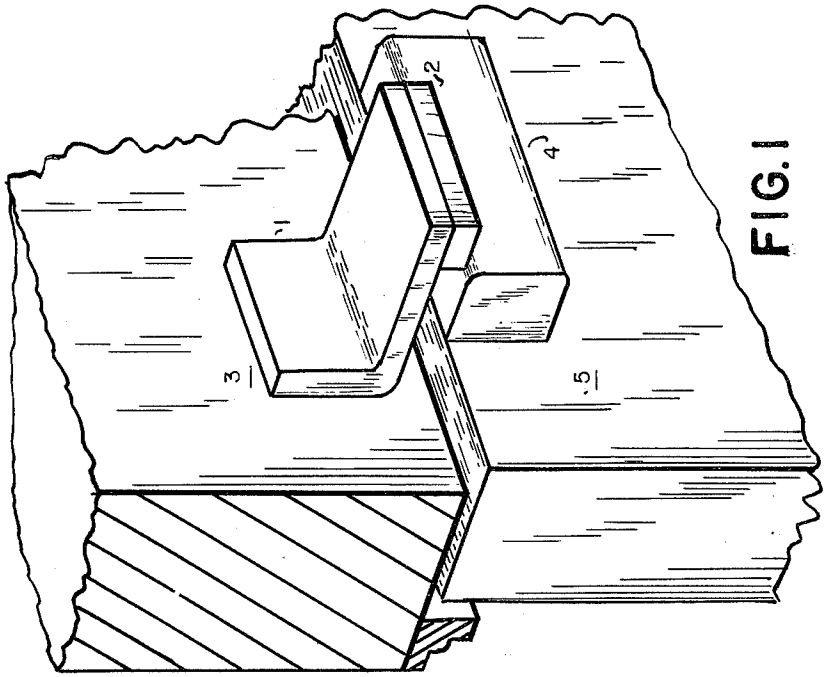


FIG. 1

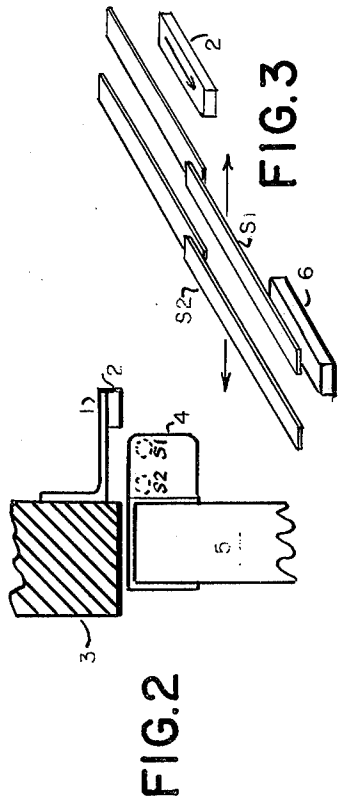


FIG. 3

FIG. 2

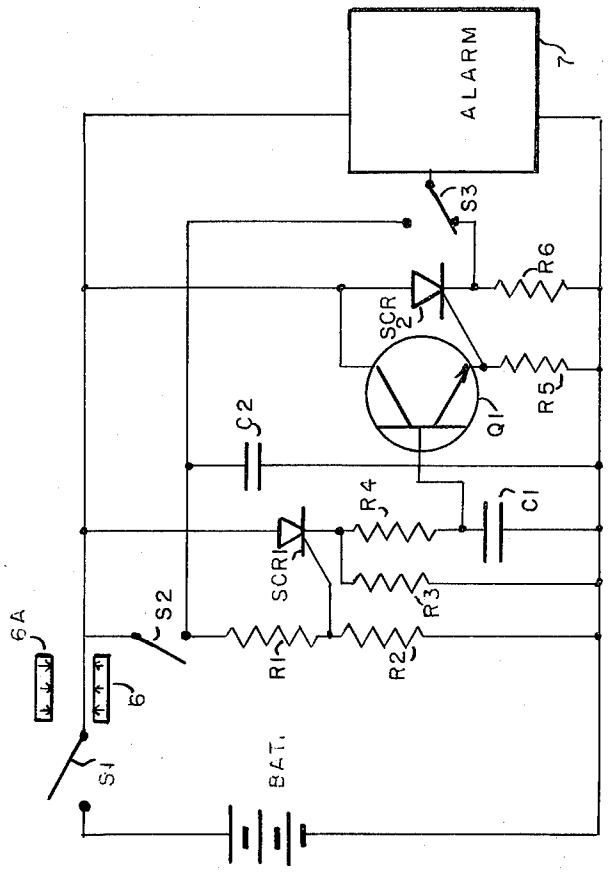


FIG. 4

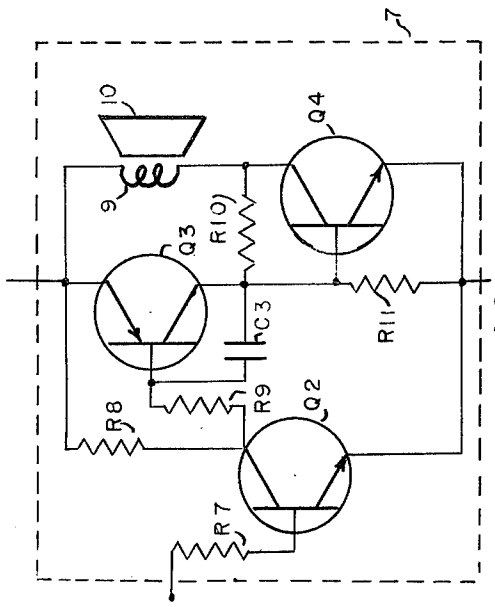


FIG. 4A

MAGNETICALLY OPERATED ALARM

BACKGROUND OF THE INVENTION

The present invention relates to an alarm apparatus which, in one of its modes of operation, will initiate the sounding of a continuous alarm to indicate the opening of a particular means of access and in another of its modes of operation will cause a momentary sounding of an alarm each time the means of access is opened and closed.

OBJECTS OF THE INVENTION

It is an object of the invention to provide an alarm apparatus of the above character, which may be made a part of a fixed installation or may be used as a portable means that can be transported from place to place and temporarily affixed to means of access such as a door, window or the like.

It is another object of the invention to provide an alarm apparatus, which is powered by batteries and which draws energy therefrom only while the alarm is being sounded thus to conserve the energy of the batteries.

Still another object of the invention is to provide an alarm apparatus, which when used as an intrusion detecting apparatus, cannot be turned off except by the placing of a properly oriented permanent magnet on a particular undesignated spot on the exterior of the casing of the apparatus, thus preventing everyone except authorized personel from turning off the alarm and disabling the same.

Another object of the invention is to provide for a short time delay between the opening of the access means and the sounding of the alarm to permit authorized personel to enter and to prevent the sounding of the alarm.

Still another object is to provide means within the apparatus, which when desired may permit its conversion to an annuciator, to sound an alarm each time the means of access is opened and closed.

DESCRIPTION OF DRAWING

FIG. 1 is a perspective view disclosing the apparatus mounted on a door and door frame.

FIG. 2 is an end elevational view disclosing the positioning of the parts of the apparatus.

FIG. 3 is a fragmentary view in perspective of the reed switches, biasing and actuating magnets.

FIGS. 4 and 4A taken together is a schematic view of circuitry of the apparatus.

DESCRIPTION OF INVENTION

The alarm apparatus is designed to be mounted on a door or window or associated with any two relatively movable means and to provide an audible alarm. It has two modes of operation, one in which the apparatus acts as an intrusion alarm in which the alarm is initiated and continues until the apparatus is reset or until the batteries are exhausted, the other, in which it acts as an annunciator, in which the alarm momentarily sounds each time the means of access is opened or closed.

The alarm apparatus comprises of two distinct parts, one a bracket 1 as shown in FIG. 1, fitted to the framing 3 of a door and upon which is mounted an actuating permanent magnet 2. In the present illustration, the actuating magnet 2 is polarized lengthwise. The second

part of the apparatus is a casing 4 that houses the circuitry and the alarm means, and it is mounted on the door 5 by any suitable means. As shown, the casing 4 is affixed to a U-shaped member that hooks over the top of the door. This provides for portability. The bracket 1 would in a similar instance be provided with an adhesive material on the side next to the framing so that it would adhere and yet be removable. While the actuating magnet is relatively fixed and the casing is relatively movable, they can, if desire by reversed so that the magnet is movable and the casing is fixed.

As shown in FIG. 2, the casing 4 houses among other things, two reed switches, the ends of which are indicated in elevation by the dotted lines. The casing moves with the door under the actuating magnet 2 and relative thereto. As the door is being closed, first the switch S2 passes under the magnet 2 and the reeds thereof are caused to momentarily close one upon the other to close the circuit to which it is connected. Sequentially and following the operation of the switch S2 the switch S1 passes under the magnet 2 and its reeds are caused to close one upon the other to close the circuit in which it is connected. Instead of the reeds of switch S1 momentarily closing and remaining open, when they are closed one upon the other they will remain closed by reason of a biasing magnet 6 which produces enough flux to maintain the reeds closed but insufficient to actuate the reeds toward closed position. As seen in FIG. 3, the bias magnet 6 is associated with the reed switch S1 and is adjusted to provide just enough force between the reeds to maintain them closed or latched.

When the door is later opened, switch S1 is still closed and its passage under the magnet 2 has no effect upon it. However, when switch S2 passes under magnet 2, it is again actuated and momentarily closed. The momentary actuation of switch S2 while the switch S1 is latched closed is a condition provided by the structure of the apparatus for the sounding of the alarm as will more clearly appear later.

Referring to FIGS. 4 and 4A, a battery is connected through switch S1 to the upper buss. The lower buss is connected directly to the battery. Switch S1 is shown associated with magnet 6 so when closed it will remain closed and the busses will be energized. Magnet 6A is designated as the key magnet, which authorized personel has access to and may be placed over the bias magnet 6 to nullify the flux of the biasing magnet so that the switch with which it is associated will open unless the actuating magnet is juxtaposition with the switch. The magnets 6 and 6A are polarized transversely of their greater surface areas. Thus when the north poles are in juxtaposition the magnets oppose each other and the flux bridging the contacts of the switch S1 is decreased so that the reeds move apart under the influence of their own spring force.

Between the upper and lower busses is a circuit having the switch S2 and a voltage divider having the resistors R1 and R2. It is thus seen that both switches S1 and S2 must be simultaneously closed to effect operation of the voltage divider. The voltage divider is provided to furnish the proper voltage for triggering a time delay circuit also connected between the busses.

The time delay circuit is for the purpose of providing a small delay between the time the door is opened and the sounding of the alarm, which permits one entering who has the key magnet to place it where it will nullify the bias magnet 6 and prevent the alarm from being en-

ergized. The time delay circuit includes a silicon controlled rectifier SCR1, used as an electronically controlled switch, a resistor R4 for limiting the flow of current through the SCR1 and a capacitor C1. The resistor R3 shunts the resistor R4 and the capacitor C1 and has a higher resistance than that of resistor R4. It functions to bleed off the charge from the capacitor C1 after the switch S1 is opened by use of the key magnet 6A. The timing delay circuit is connected from the gate of SCR1 to the point between the resistors R1 and R2, whereby when both switches S1 and S2 are simultaneously closed the timing circuit is energized so that the capacitor C1 begins to charge.

The timing circuit is connected from a point between resistor R4 and capacitor C1 to the base of a switching transistor Q1. Transistor Q1 has its collector-emitter circuit connected in series with a load resistor R5 across the busses. The transistor Q1 has its emitter connected to the gate electrode of the silicon controlled recticier SCR2, which is connected between the busses in series with current limiting resistor R6. The silicon controlled rectifier is connected from its cathode to one terminal of a single pole double throw reed switch S3. The reed switch S3 is shown in its normally closed position, in the absence of an actuating magnetic flux. When SCR2 is triggered, it triggers the alarm 7. Alarm continues to sound until the switch S1 is opened by the positioning of the key magnet 6A adjacent to the biasing magnet 6. Note that the key magnet must be placed in a definite position relative to the biasing magnet 6 for the biasing flux to be nullified and for the switch S1 to be opened to turn off the power supply to the busses.

The structure of the alarm is shown in FIG. 4A. It consists of a base resistor R7 and a transistor Q2, the collector-emitter circuit of which is connected between the busses in series with a load resistor R8. The collector of the transistor Q2 is connected through resistor R9 to the base of transistor Q3, which is also connected with its collector-emitter circuit in series with resistor R11 across the busses. The base and collector of transistor Q3 are connected together through the capacitor C3, providing a feedback circuit, whereby the transistor operates as an audio oscillator.

The collector of transistor Q3 is connected to the base of transistor Q4, which has its collector-emitter circuit connected in series with the coil 9 of speaker 10. The collectors of transistors Q3 and Q4 are connected through resistor R10.

Thus, when the silicon controlled rectifier SCR2 fires and continues to conduct so long as the switch S1 is closed the base of transistor Q2 is energized through switch S3, which is normally closed as shown. The speaker 10 produces an audio tone depending on the frequency of the oscillator Q3.

In this mode of operation, when the door is opened, the alarm is triggered on and will continue to sound until the switch S1 is opened by the positioning of the key magnet 6A adjacent to the bias magnet 6. The switch S1 when opened deenergizes the busses, which shuts off the energy to the SCR1, SCR2 and the alarm 7. The capacitor C1 is then discharged through the resistor R3. The alarm when once silenced in this manner remains silenced until the key magnet 6A is removed from the region of the biasing magnet 6 and the door is closed and subsequently opened.

The closure of the door causes the switch S1 to close and be latched. However, since the silicon controlled rectifiers SCR1 and SCR2 will not be triggered to an "on" state until the switch S2 is closed, and the alarm circuit is non-conductive until this occurs, the electronic circuit does not draw current from the battery even though the switch S1 is closed. When both switch S1 and S2 are closed by the opening of the door, the alarm is again energized and the circuit draws current from the battery and only then.

In the second mode of operation, the switch S1 remains closed, but the key magnet is then placed adjacent to the switch S3 to cause it to closed in its upper position, as viewed in FIG. 4. The upper terminal of the switch S3 is connected to the voltage divider at a point between switch S2 and resistor R1. A capacitor is also connected to upper terminal of switch S3 and to the lower buss. When the switch S3 is in its upper position, the timing circuit, SCR1, SCR2, and transistor Q1 are shunted and the switch S2, operates to turn the alarm on and off for the moment the switch passes the actuating magnet. Since the switch remains closed such a short time, the capacitor C2 is provided for storing enough energy to continue the operation of the alarm for a short time after the switch S2 is opened.

Thus, with the key magnet 6A placed in a position to actuate the switch S3, the apparatus operates as an annunciator. When the magnet 6A is removed from the region of the reed switch S3 the apparatus is again converted to an intrusion alarm.

The apparatus is thus suitable for use during the night hours as an intrusion alarm and as an annunciator during the day hours to alert those in attendance to the opening and closing of the door.

In its portable use, it can be carried by the traveler and used on the door of the hotel or motel to awaken when the door is opened. The same structure is suitable for use in other environments where there are two relatively movable objects and it is desired to alert one to the relative motion of the objects in a particular direction.

Having disclosed my invention, its mode of operation, and utilization, what I consider to be my invention is set forth in the following claims:

I claim:

1. An alarm apparatus responsive to the relative motion between two objects in one of two substantially parallel directions comprising:

an actuating magnet mounted on one of said objects;

a pair of magnetically actuated reed switches mounted on the other of said objects, arranged in parallel to each other and spaced from each other in the direction of motion whereby said reed switches sequentially move into juxtaposition with said actuating magnet and are actuated thereby to their closed positions;

a biasing magnet associated with the reed switch which secondly arrives in juxtaposition to said actuating magnet when the said objects are moved in the other of two substantially parallel directions and arranged to produce a magnetic flux across the reeds thereof insufficient to close said reeds but strong enough when said reeds are closed to hold said reeds closed;

electrically operable switching means actuated into its "on" state when both said reed switches are simultaneously in their closed positions and actuated into its "off" state when said biased reed switch is opened;

means energized by said electrically operable switching means to continually sound the alarm while said electrically operable switching means is in its on state; and

a key magnet, similar to the biasing magnet in polarity which, when placed in juxtaposition with said biasing magnet with its magnetic flux in opposition to the flux of said biasing magnet, for opening said biased reed switch to silence said alarm and to condition said apparatus to again be armed when the objects are moved in the opposite direction relative to each other.

2. Apparatus as set forth in claim **1** further including:

a third magnetically operable reed switch spaced away from said pair of reed switches and away from said actuating magnet for shunting said electrically operable means when said key magnet is placed in juxtaposition thereto, whereby said alarm will be sounded for a short duration when said parallel reed switches are moved in either direction relative to said actuating magnet, for indicating the actuations of said relatively movable objects.

* * * * *