

[54] **DETECTION SYSTEM FOR PROTECTED AREA WITH KEYBOARD INHIBITOR FOR RE-ENTRY**

[76] Inventor: **Robert S. Brodsky**, 7605 New Castle Dr., Annandale, Va. 22003

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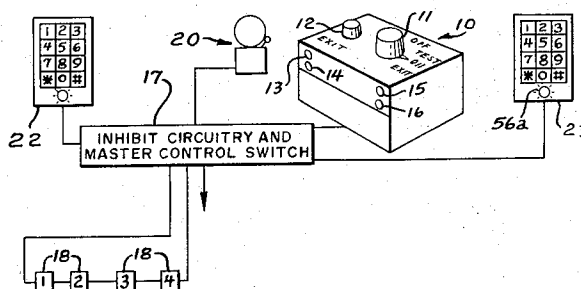
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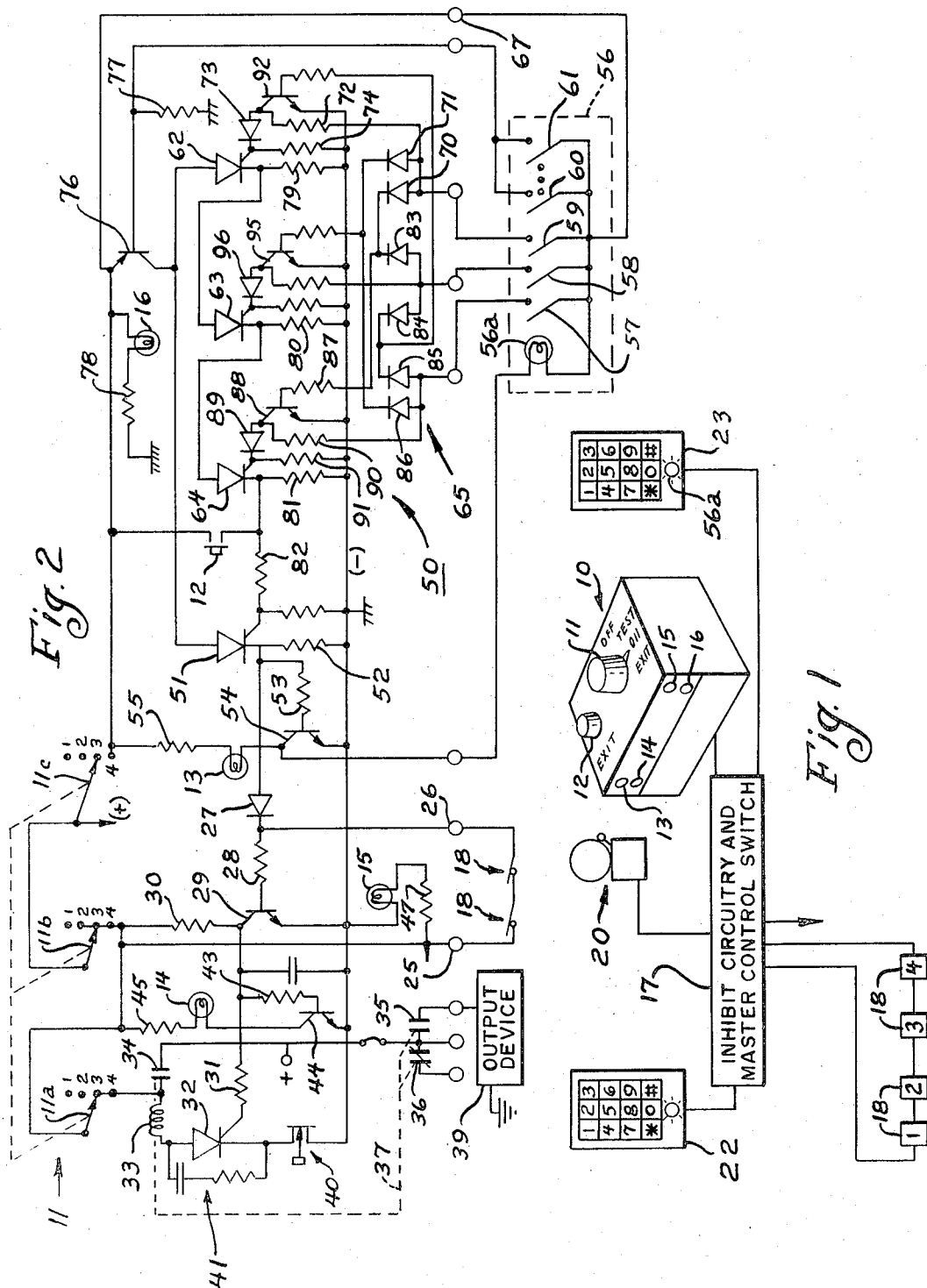
Primary Examiner—Harold I. Pitts
Attorney, Agent, or Firm—Dawson, Tilton, Fallon & Lungmus

[57] **ABSTRACT**

A detection system is designed so that any detected unauthorized entry into the protected area produces an output or alarm signal. The system includes a keyboard inhibitor accessible from outside the protected area. To leave the protected area without actuating the system, a person pushes an "EXIT" push button to inhibit actuation of the alarm signal. After he leaves the area, the system is actuated again by pressing a designated button on the keyboard. A subsequent entry without actuating the alarm signal can be made only by actuating certain designated switches on the keyboard in a predetermined sequence to, again, inhibit the alarm signal. Upon proper re-entry, the person resets the system to a normal operating condition.

10 Claims, 2 Drawing Figures





DETECTION SYSTEM FOR PROTECTED AREA WITH KEYBOARD INHIBITOR FOR RE-ENTRY

BACKGROUND AND SUMMARY

The present invention relates to detection systems, particularly of the type which sound an alarm or give some other output signal when an unauthorized entry into a protected area is detected. Such systems have been known and are in use. Normally, a switch sensor or other detector is associated with each possible entry location to the protected area such as a door or a window. These detectors are actuated whenever the associated entry location is breached.

Systems of this type must provide for an authorized breach of the alarmed boundary without producing an output signal both when a person is leaving the area and when returning. Many devices and techniques are used to permit the authorized exit and re-entry of personnel into the protected area, such as shunt locks, time delays, and so on.

Each of the methods for enabling authorized breach of the alarm boundary has presented disadvantages—for example, an extra key is needed if a shunt lock is used or, in the case of a time delay, a burglar will have access to the protected area prior to the sounding of the alarm, during which time he may be able to disable the system.

The present invention, then, is directed to a detection system of the type described which overcomes the disadvantages of prior systems and facilitates leaving and re-entering the protected area by authorized personnel. In the present invention, a master control switch, preferably a semi-conducted switch is connected in circuit with the various elements in the monitoring loop, such as magnetic switches, window tapes, or similar detecting devices. When a detector in the monitoring loop is actuated as a result of an unauthorized entry, the master control switch generates a signal representative of the fact that an unauthorized entry had been attempted or made. This signal may be used to sound an alarm, light appropriate indicator lamps, or it may be transmitted to a remote location, such as a police station, if desired.

The system includes a control unit which is located within the protected area, and it includes a switch which selectively places the system in one of four states: an OFF state, a TEST state, a SURVEILLANCE state, or an EXIT state. When the selection switch is placed in the SURVEILLANCE state, any breach of the alarmed boundary produces an output signal. The system also includes a keyboard including a number of separate momentary contact push switches which is accessible from a location outside the protected area, for example, on a wall next to a door leading into the protected area which, if opened, would produce an alarm.

When it is desired to leave the protected area with the system activated, a person places the selector switch to the EXIT position, and presses a separate momentary contact Exit push switch. The selector switch in the EXIT position couples power to Inhibit Circuitry, and the momentary Exit switch actuates the Inhibit Circuitry which prevents the master control switch from being energized. After the person has left the protected area by opening and closing one of the exits, he then actuates a selected switch on the keyboard, and this re-

sets the Inhibit Circuitry. This again permits actuation of the Master Control Switch, and leaves the system in an active state.

When it is desired to re-enter the protected area, the person having access to the keyboard from outside the area pushes a predetermined sequence of numbered switches on the keyboard. Decoding circuitry decodes the numbered switches pushed and the sequence in which they were pushed and if the numbers and sequence are proper, a signal is generated to inhibit the Master Control Switch once more, so that the person may enter the protected area without fear of sounding an alarm. When re-entry has been made, the system is reset to the SURVEILLANCE state for normal operation by the selection switch at the control unit. With the present system, then, the authorized leaving and re-entering of a protected area without sounding an alarm is greatly facilitated. No extra keys or time delays are involved. Visual or audible indication may be provided when the system is in the inhibited state.

Other features and advantages of the present invention will be apparent to persons skilled in the art from the following detailed description of a preferred embodiment accompanied by the attached drawing.

THE DRAWING

FIG. 1 is a diagrammatic view of a detection system incorporating the present invention; and

FIG. 2 is a circuit schematic diagram of the electronic circuitry for the system of FIG. 1.

DETAILED DESCRIPTION

Referring first to FIG. 1, reference numeral 10 generally designates a control unit or console which is located within the protected area. Mounted on the console 10 is a Selection Switch 11 capable of being turned to one of four positions, namely the OFF position, the TEST position, the ON or SURVEILLANCE position, or the EXIT position, as indicated. Also located on the control unit 10 is an Exit push button switch 12, a green lamp 13, a red lamp 14, an amber lamp 15, and an amber lamp 16. A reset switch (not shown in FIG. 1) is located beneath the control unit 10 and hidden from view.

The control unit 10 is associated with inhibit circuitry and a Master Control Switch (M.C.S.) functionally designated within the block 17. Each entrance or exit to or from the protected area is provided with a detection device, such as a magnetic switch, window foil, etc., and these are functionally designated by the blocks 18. The detecting elements 18 are connected in circuit with each other and the Master Control Switch of the block 17 to sound an alarm diagrammatically illustrated at 20 when one of the elements 18 detects a breach of the alarmed boundary of the protected area. Located outside of the protected area, there is at least one keyboard, two being shown in FIG. 1 and designated respectively 22 and 23. The keyboards 22, 23, or one of them in the event only one is used, feed into the inhibit circuitry 17 to inhibit the Master Control Switch in the manner to be described when it is desired to re-enter the protected area when the system is in an active state.

Turning now to FIG. 2, the circuitry within the block 17 includes the selection switch 11, and it includes three separate sections, designated respectively 11a, 11b, and 11c. The sections 11a, 11b and 11c are ganged

together mechanically so as to turn in unison to any one of four separate positions indicative respectively of the OFF state, the TEST state, the SURVEILLANCE or ON state, and the EXIT state. The movable contact of the second section or stage 11b is directly connected to the wiper arm or the third stage 11c and, in turn, to the positive terminal of a power supply. The power supply may be either a rectified AC current or it may be a battery. Preferably, it is desirable to provide a rectified AC current with a standby battery. In this case, the rectified voltage may be slightly larger than the battery voltage and the two are isolated by means of a diode (not shown). A trickle charge may be provided to the standby battery to keep it in a charged condition.

Position 2-4 of the second stage 11b of the switch 11 are connected together and position 4 is connected to the movable contact of the first stage 11a wherein fixed positions 3 and 4 are connected together. The detecting elements are again designated 18; and they are shown as normally closed switches connected in series between terminals 25 and 26. Terminal 25 is directly connected to positions 2, 4 and 4 of the second stage 11b of the selector switch 11, and terminal 26 is connected to the anode of a diode 27 and through a resistor 28 to the base of a transistor 29. The transistor 29 and its associated circuitry comprises the Master Control Switch. The collector of the transistor 29 is connected via a resistor 30 to the second, third and fourth positions of the second stage 11b of the selection switch 11 and by means of a resistor 31 to the gate lead of a silicon control rectifier 32.

The anode of the silicon control rectifier 32 is connected to one terminal of a coil 33 of a relay which controls a first pair of normally open contacts 34, a second pair of normally open contacts 35, and a pair of normally closed contacts 36 (interconnected by means of the dashed line 37). The junction between the coil 33 and the contacts 34 is connected to the third and fourth position of the first stage 11a of FIG. 11, and the other terminal of the contacts 34 is directly connected to the positive terminal of the power source, as indicated, as is the junction between the contacts 35, 36. An output device, indicated by the block 39 is energized by the contacts 35 when they are closed. The output device 39 may be the local alarm bell 20, discussed above.

The cathode of the silicon control rectifier 32 is connected through a normally closed reset switch 40 to the negative terminal of the power supply which is preferably grounded. A resistor-capacitor circuit generally designated 41 is connected across the power terminals of the silicon control rectifier 32 to prevent accidental triggering.

The collector of the master control switch 29 is also connected by means of a resistor 43 to the base of a transistor switch 44, having its emitter grounded. The collector of the transistor 44 is connected to the filament of the red lamp 14 which is also connected by means of a resistor 45 to the second, third and fourth positions of the second stage 11b of the selector switch 11. The second, third and fourth positions of the second stage 11b of the selector switch 11 are also connected through a resistor 47 to the filament of the amber lamp 15, the other terminal of which is grounded. The lamps indicate the system status. Amber denotes "on" and red indicates an alarm signal is being generated.

Turning now to the right side of FIG. 2, reference numeral 50 generally designates inhibit circuitry for selectively inhibiting the operation of the Master Control Switch 29 even though there may be a breach in one of the switches 18, so as to permit an occupant of the protected area to leave it without sounding an alarm. The output stage of the inhibit circuitry 50 includes an SCR switch 51 having its cathode connected to a load resistor 52 and directly to the anode of diode 27. The cathode of the SCR 51 is also connected by means of a resistor 53 to the base of a transistor 54, the collector of which is connected to the filament of the green lamp 13. The other terminal of the green lamp 13 is connected to position 4 of the third stage 11c of the switch 11 by means of a resistor 55. The collector of transistor 54 is similarly connected to the filament of a green lamp 56a located in the keyboard assembly outside the protected area. The elements of the keyboard assembly illustrated in FIG. 2 are enclosed within the dashed box 56. Persons skilled in the art will be able to modify the circuitry illustrated to include a separate keyboard assembly, if desired, so that one could be located at each of two separate entrances. Also enclosed within the block 56 are the push switches, five of which are depicted and designated respectively 57, 58, 59, 60 and 61. There is, of course, one such switch for each position on the keyboard 22 or 23. The switches, as mentioned, are push switches which are normally biased in an open state.

The inhibit circuitry 50 includes a three-stage sequential decoder, the principal elements of which are three silicon control rectifiers designated respectively 62, 63, and 64. The output of the keyboard switches 57-59 are coupled to the silicon control rectifiers 62-64 by means of a diode isolating network generally designated 65.

In the illustrated embodiments, the switches 59, 58 and 57 represent the switches corresponding to a three-digit sequence that will override the sounding of an alarm by inhibiting operation of the master control switch 29. As will be appreciated more clearly below, the switches must be actuated in the proper sequence and without the actuation of any intermediary switch in order to properly override the sounding of an alarm. The diode isolation network is required in the illustrated embodiment in order to insure proper sequential operation of the silicon control rectifier stages 62, 63 and 64. That is, it prevents decoding if more than one switch is closed at a time. The switches 60, 61 schematically include all of the unused keyboard switches.

One contact of each of the keyboard switches 57, 61 is connected in common to all others, and this common junction is connected to the other terminal of the filament of the lamp 16 and directly to the fourth position (namely, the EXIT position) of the third stage 11c of the selection switch 11. The small circles such as the one designated 67 are indicated to show terminals in the packaging.

The other terminal of the switch 59 is connected to the anodes of diodes designated 70 and 71 in the isolation circuit 65 and by means of a resistor 72 to the anode of a diode 3. The cathode of the diode 73 is connected to the base of the silicon control rectifier 62 and to a bias resistor 74. The anode of the silicon control rectifier 62 is connected to the collector of a reset transistor switch 76 which is also connected to the anode of the silicon control rectifier 51. It will be observed

that when the selection switch 11 is placed in the fourth or EXIT position, power is coupled through the third stage 11c and the normally conducting reset transistor switch 76 to the anodes of silicon control rectifiers 51 and 62, the base of transistor 76 being grounded by means of a bias resistor 77. The filament of the amber lamp 16 is connected between the fourth position of the third stage 11c of the selection switch 11 and ground by means of a limiting resistor 78.

The cathode of the first-stage decoding silicon control rectifier 62 is connected to ground by means of a load resistor 79 and to the anode of the second-stage decoding silicon control rectifier 63. The cathode of the second stage decoding silicon control rectifier 63 is similarly connected to ground by means of a load resistor 80 and to the anode of the third-stage decoding silicon control rectifier 64. The cathode of the silicon control rectifier 64 is connected to ground by means of a load resistor 81 and to the gate of the output stage silicon control rectifier 51 by means of a coupling resistor 82. The junction between the cathode of the silicon control rectifier 64 and the coupling resistor 82 is connected to the fourth position of the third stage 11c of the selection switch 11 by means of the exit switch 12 which is located on the console 10.

The other terminal of the keyboard switch 58 is connected to the anode terminal of a first diode 83 and a second diode 84; and the other terminal of keyboard switch 57 is connected to the anodes of first and second diodes 85 and 86. The cathode terminals of the diodes 70 and 83 are connected in common; and this common junction is connected by means of a coupling resistor 87 to the base of a transistor 88 having its emitter grounded and its collector coupled to the gate of silicon control rectifier 64 by means of a diode 89. The collector of the transistor 88 is also connected by means of a resistor 90 to the anode terminals of diodes 85 and 86; and the junction between the cathode of the diode 89 and the gate lead of silicon control rectifier 64 is coupled to ground by means of a resistor 91. The function of the transistor 88 and the diode matrix 65 will be disclosed in detail subsequently. However, briefly, without this circuitry, it would be possible in the illustrated embodiment (although not in all conceivable embodiments) to energize the three silicon control rectifiers 62, 63 and 64 and thereby actuate the inhibit circuitry by simultaneously pressing the three switches 57-59. This would substantially reduce the probability necessary to actuate the inhibit circuitry because in the illustrated embodiment, the proper sequence of the three predetermined switches as well as the numbers of the switches must be known and followed.

Each of the other two silicon control rectifiers includes similar circuitry. That is, a transistor 92 has its base connected by means of a coupling resistor to the anode terminals of diodes 84 and 85 and its collector connected to the anode of diode 73. A transistor 95 has its base connected to the anode terminals of diodes 71 and 86 and its collector connected to the anode terminal of a diode 96, the cathode of which is connected to the gate terminal of the silicon control rectifier 63. The other terminal of switch 58 is connected by means of a resistor to the junction between the collector of transistor 95 and the anode of diode 96.

OPERATION

When the selector switch 11 is turned to the first or

OFF position, none of the circuitry is actuated. When the selector switch 11 is turned to the second or TEST position, power is fed by means of the second stage 11b to the collector of the Master Control transistor switch 29 and to the filament of the amber light 15. Power is also fed through the normally closed detection switches or elements 18 to the base of the master control switch 29, causing it to be in a normally conducting state and holding the potential of the collector of the transistor 29 at approximately ground potential.

An occupant of the area may then go to any of the doors or windows at which the sense elements 18 are located and open it, thereby opening the base circuit of the master control switch 29 and causing its collector voltage to go positive. This will cause the normally non-conducting transistor 44 to conduct, energizing the red lamp 14 and indicating that this portion of the system is operative without signalling or sounding an alarm. No alarm is sounded because power is not fed to the anode terminal of the silicon control rectifier 32 when the selector switch 11 is in the second position (see the first section 11a). This switch position is also used to monitor the condition of the sense elements or detectors to assure that the system is secure to avoid a false alarm when the unit is placed in the SURVEILLANCE condition.

When the selector switch 11 is turned to the third or SURVEILLANCE position, the operation of the master control switch 29, lamps 14 and 15 and the sensing devices 18 is the same as has already been described. However, in addition, power is fed to the anode of the silicon control rectifier 32 via the coil of relay 33. Hence, if the protected area or alarmed boundary is breached with the selection switch in the SURVEILLANCE state, the collector of the master control switch 29 goes positive as already described, thereby causing the silicon control rectifier 32 to conduct and energizing the coil of relay 33. The relay 33 will be latched by means of the normally open contacts 34, and it can be reset only by opening the reset button 40 which, as mentioned, is preferably hidden from ordinary view of the console 10. The silicon control rectifier 32 cannot be permanently reset, of course, unless the sensing device 18 that had been opened is returned to a closed position, or the selection switch 11 is placed in the OFF position. It will be observed that in the SURVEILLANCE state, the inhibit circuitry and the keyboards are not in circuit with the master control switch 29 (see position 3 of the third stage 11c of the selector switch 11).

When it is desired to exit the protected area, or to allow the entry of authorized persons, the selector switch 11 is placed in the fourth or EXIT position, and the operation of the master control switch 29, the sensing elements 18, the lamps 14 and 15, the silicon control rectifier 32 and the relay 33 are the same as has already been described except that the inhibit circuitry is now rendered operative. Initially, the silicon control rectifier 51 of the inhibit circuitry 50 is non-conducting. However, pressing the Exit push switch 12 will place a positive voltage on its gate lead and cause it to conduct, power being transmitted to its anode terminal by means of the normally on transistor 76. When the silicon control rectifier 51 conducts, a positive voltage will appear at its cathode terminal, causing the transistor 53 to conduct (thereby lighting the green lamp 13) and the diode 27 will similarly conduct.

Hence, when the person exits and breaks the connection of the associated sensing device 18, the master control switch 29 will not be affected because it will be held in a saturated or conducting condition by means of the conducting silicon control rectifier 51 and the diode 27.

When the person has left the protected area and re-closed the associated sensing device 18, he then goes over to the keyboard and presses any of the switches other than those involved in the unlocking sequence (namely, switches 57-59.) Preferably, in order to avoid confusion, it may be best to designate one of the positions such as the one indicated by the (*) as the exit re-entry switch. When this switch is closed, it shorts the base and collector terminals of the transistor 76, thereby driving it momentarily to cut off and removing power from the anode terminal of the silicon control rectifier 51. The inhibit circuitry thereupon resets. It will be observed that the same action will reset the first decoding stage silicon control rectifier 62. It will also be observed that with the selector switch 11 in the fourth position, the amber lamp 16 is lighted.

When it is desired to re-enter the protected area, the master control switch 29 must again be inhibited from operation, and this is accomplished by pushing the appropriate numbers on the switchboard in the predetermined sequence, namely, closing the switches 59, 58 and 57 in order. Closing the switch 59 couples power directly from the fourth position of the third stage 11c of the selection switch 11 to the gate lead of silicon control rectifier 62 by means of the resistor 72 and diode 73, thereby causing it to conduct. Power will already have been coupled to the anode of silicon control rectifier 62 by means of the normally conducting transistor 76.

When silicon control rectifier 62 conducts, power is coupled through it to the anode terminal of the second decoding stage silicon control rectifier 63. Hence, subsequent closing of the switch 58 will couple power through the diode 96 to the gate of the silicon control rectifier 63 and cause it to conduct, thereby coupling power to the anode of the third stage silicon control rectifier 64.

It will be observed that if any of the switches 60, 61 had been closed subsequent to the closing of the first sequential digit associated with switch 59, the transistor 76 would have been driven to cut off and power would have been removed from the first stage silicon control rectifier 62, causing it to reset so that the sequence would have to be begun over.

Finally, closing of the third sequential digit 57 causes the silicon control rectifier 64 to conduct by means of the diode 89, and when it conducts, its cathode terminal goes positive, thereby causing the final silicon control rectifier 51 to conduct and to inhibit cutoff of the master control switch 29 when one of the sensing devices 18 is subsequently opened for re-entry. The system is reset upon gaining re-entry by turning the selection switch 11 back to the SURVEILLANCE position. In this aspect of the invention, the primary purpose of the switch 11 is, then, to reset the system to the active state from the re-entry state, and other means than the one just mentioned could equally well be employed toward this end.

As mentioned previously, the diode matrix 65 and the transistors 88, 95 and 92 insure that the silicon control rectifier 62, 63 and 64 must be operated in the

proper sequence in order to activate the inhibit circuitry. For example, if the switches 59 and 58 were pressed simultaneously, power would be coupled through the switch 58 and the diode 84 to the base of transistor 92 causing it to saturate and clamping the anode of diode 73 to ground potential, thereby inhibiting operation of the first sequential switch 59.

When the selector switch 11 is in either the third or the fourth position, the system is said to be in an "active" state even though the sounding of an alarm may be inhibited, as disclosed.

Having thus described in detail a preferred embodiment of the invention, persons skilled in the art will be able to modify certain of the circuitry and structure which has been illustrated and to substitute equivalent elements for those disclosed while continuing to practice the principle of the invention; and it is, therefore, intended that all such modifications and substitutions be covered as they are embraced within the spirit and scope of the appended claims.

I claim:

1. A detection system for a protected area comprising: a plurality of sensing elements, connected in circuit, each operatively associated with an access to said area for detecting an unauthorized breach of said area, master switch means adapted to be enabled or inhibited and responsive to said sensing elements only when enabled for generating an output signal when one of said elements indicated an alarm condition in said area; a manual selection switch, selectively settable to one of a SURVEILLANCE position and an EXIT position; said master switch means being enabled when said manual switch is set to said SURVEILLANCE state; a keyboard having a plurality of switches including unlock switches accessible external to said protected area; inhibit circuit means responsive to the actuation of predetermined unlock switches of said keyboard switches when said manual switch is set in said EXIT position for inhibiting said master switch means whereby an authorized re-entry may be made into said protected area without generating said output signal; and EXIT switch means located within said protected area for de-activating said inhibit circuit means when it is desired to leave said protected area without sounding an alarm; and reset circuit means responsive to at least one of said keyboard switches other than said unlock switches for re-activating said inhibit circuit means after a person has left said protected area, whereby said system is left in an active state but capable of being inhibited when said keyboard unlock switches are actuated in proper combination.

2. The system of claim 1 wherein said inhibit circuit means includes a plurality of decode circuits, one associated with each of said predetermined keyboard unlock switches, each decode circuit being actuated only when its associated unlock switch is actuated in the desired sequence; circuit means responsive to keyboard switches other than said unlock switches for resetting any of said decode circuits if actuated, said system being further adapted to disable said inhibit circuitry when said selection switch is positioned in said surveillance state upon re-entry.

3. The system of claim 1 further comprising first indicator light means within said protected area for indicating when power is supplied to said control switch.

4. The system of claim 3 further comprising second indicator lamp means for indicating when said control

switch is sounding an alarm, said system further comprising alarm circuit means responsive to said control switch for sounding an alarm, said manual selection switch further comprising a test position wherein energy is supplied only to said control switch circuitry and not to said output alarm circuitry.

5. The system of claim 1 further comprising third indicator lamp means within said protected area for indicating when said inhibit circuitry is energized.

6. The system of claim 5 further comprising fourth indicator lamp means for indicating when said inhibit circuitry has been actuated to inhibit said control switch.

7. The system of claim 1 further comprising indicator means for indicating when said inhibit circuitry is actuated.

8. A detecting system for a protected area comprising: a plurality of sensing elements connected in circuit and establishing circuit continuity when all of said elements are in a first state representative of a secured area; a manual selection switch having a plurality of positions including an EXIT position and a SURVEILLANCE position; a source of electrical power; a control switch connected in circuit with said sensing elements for generating an output signal when any of said elements indicates an alarm condition; output circuit means connected in circuit with said selection switch and said power source responsive to said alarm signal for transmitting an alarm when said control element is actuated and said selection switch is in said SURVEILLANCE position; inhibit circuitry for inhibiting the operation of said control switch when actuated; said manual switch coupling power to said inhibit circuitry only when said switch is in said EXIT position; an exit switch in said protected area for actuating said inhibiting circuitry; only when said selection switch is in said EXIT position; a plurality of switches external to said pro-

ected area and including a plurality of sequential unlock switches and other switches, one of said other switches resetting said inhibit circuitry to an inactive state when pushed to override said exit switch; said inhibit circuitry being responsive to the proper sequential actuation of said unlock switches for inhibiting said control switch to permit the entry without sounding an alarm.

9. The system of claim 8 wherein said inhibit circuitry includes matrix circuit means connected in circuit with said unlock switches for preventing actuation of said inhibit circuit when more than one of said unlock switches are actuated simultaneously.

10. A detection system for a protected area comprising a plurality of detectors connected in circuit, each operatively associated with an access to said area and actuated upon entry to said protected area; a master switch responsive to the actuation of any of said detectors for generating an output signal when said detector indicates an alarm condition in said area; a manual switch selectively settable to one of a SURVEILLANCE position and an EXIT position; circuit means for setting said master switch to an enabled state when said manual switch is set to said SURVEILLANCE position; keyboard means having a plurality of unlock switches accessible external to said protected area; and inhibit circuit means responsive to the actuation of predetermined unlock switches of said keyboard means when said manual switch is set to said EXIT position for inhibiting said master switch means whereby an authorized re-entry may be made into said protected area without generating an output signal; said system being further responsive to said manual switch's being set to said SURVEILLANCE position after re-entry for inactivating said inhibit circuit means and for resetting said master switch means to an active state.

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