

[54] **ELECTRONIC INTRUSION ALARM SYSTEM**

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

[58] Field of Search **340/274 R, 274 C, 164 R, 340/276, 149 A, 149 R, 156; 70/278, 284**

[56] **References Cited**

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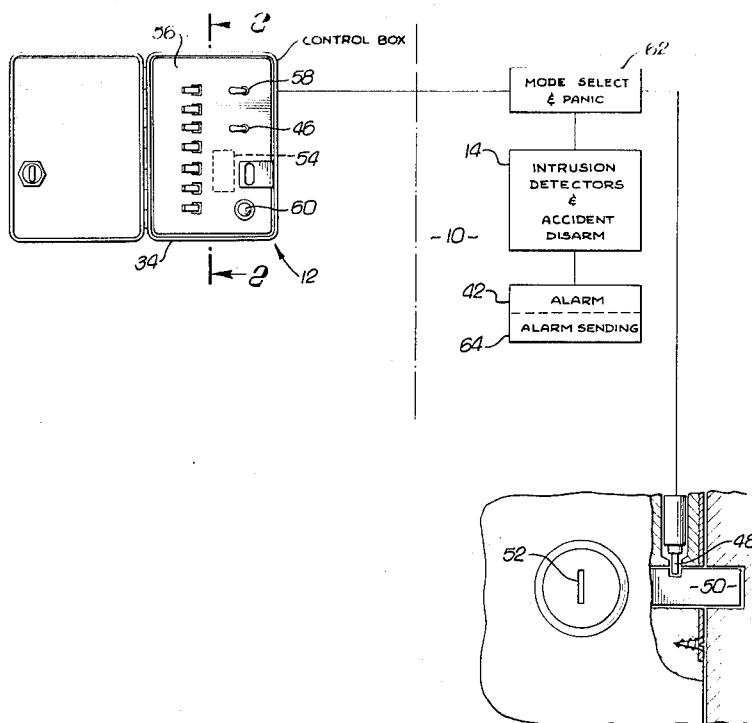
Primary Examiner—Harold I. Pitts

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[57] **ABSTRACT**

An intrusion alarm is linked with a remote monitoring station. To prevent false alarms, the security lock for the protected space has a slide bolt which itself is mechanically locked. In order to release the slide bolt, a control mechanism must be operated. The control mechanism includes an exteriorly accessible locked box itself containing a combination lock that must be set to the proper combination to release the slide bolt. Any attempt to tamper with the box or the combination lock triggers an alarm. Reset of the combination arms the various intrusion detectors in the protected space.

17 Claims, 9 Drawing Figures



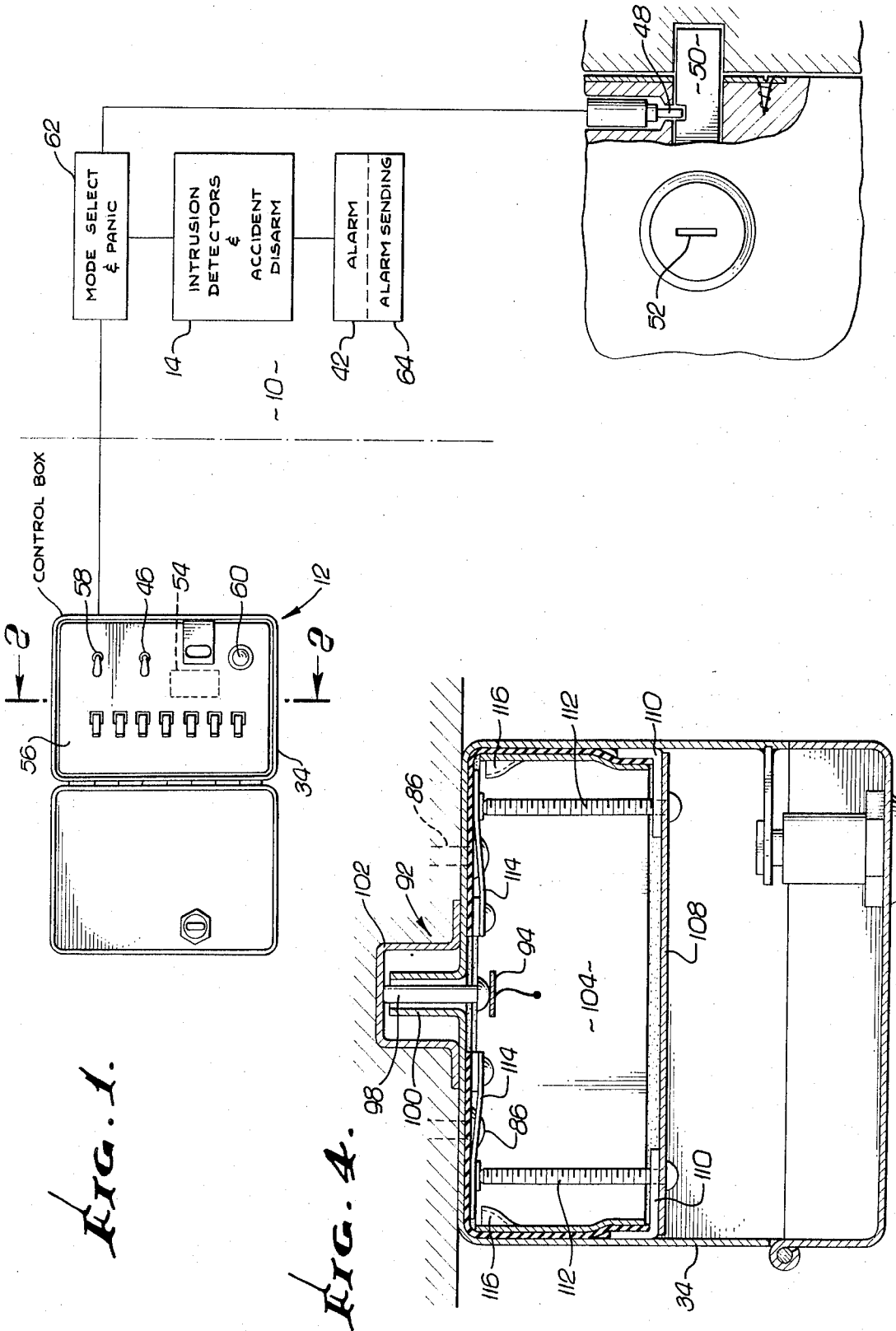


FIG. 3.

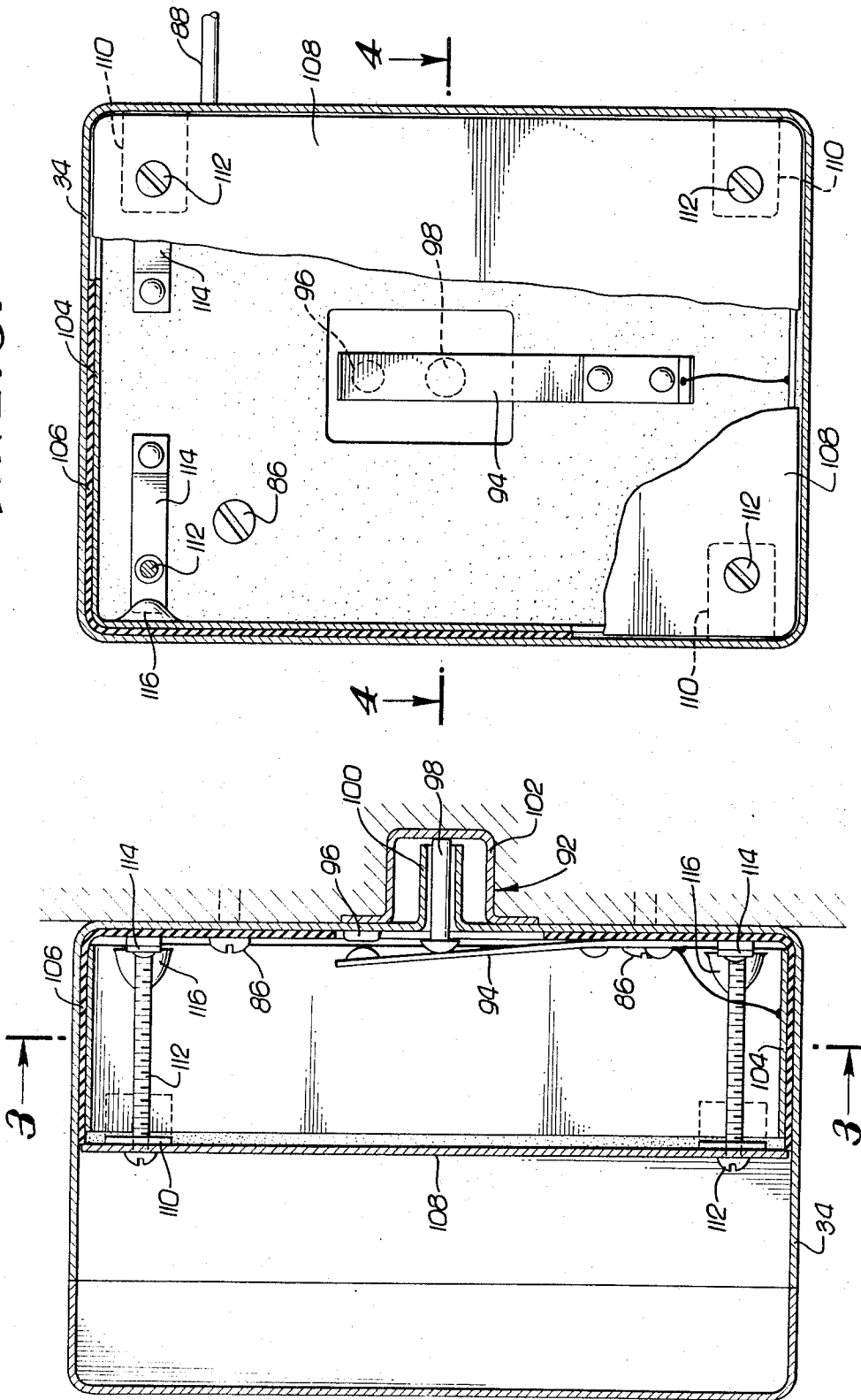


FIG. 5.

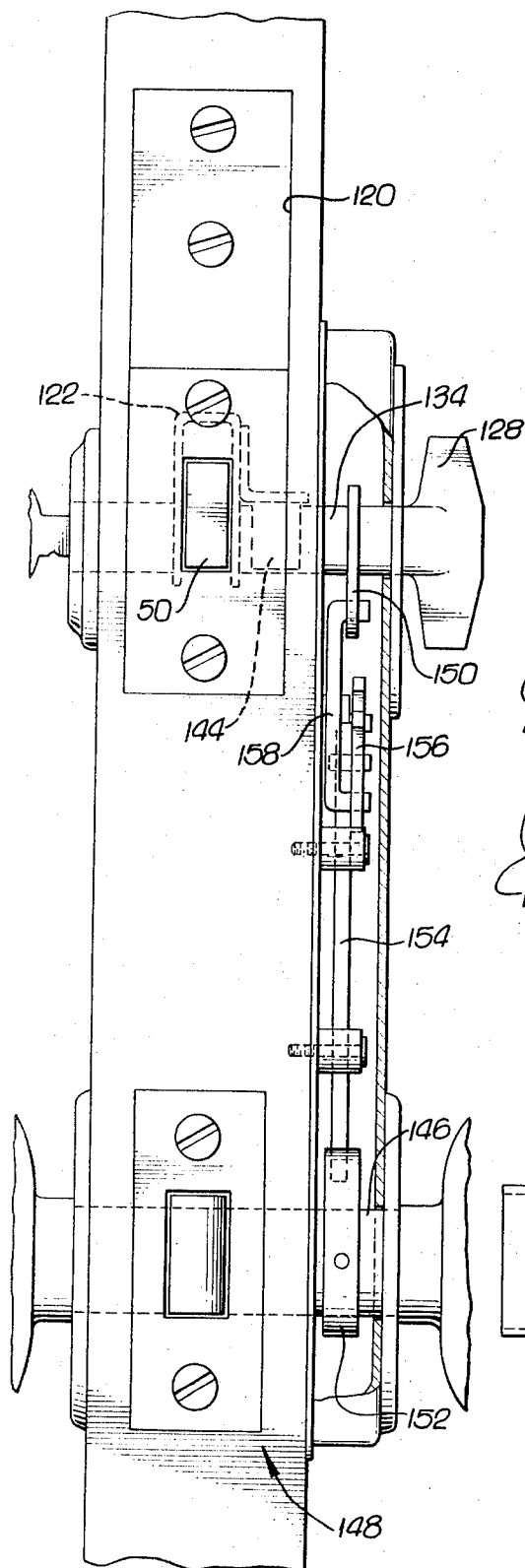


FIG. 6.

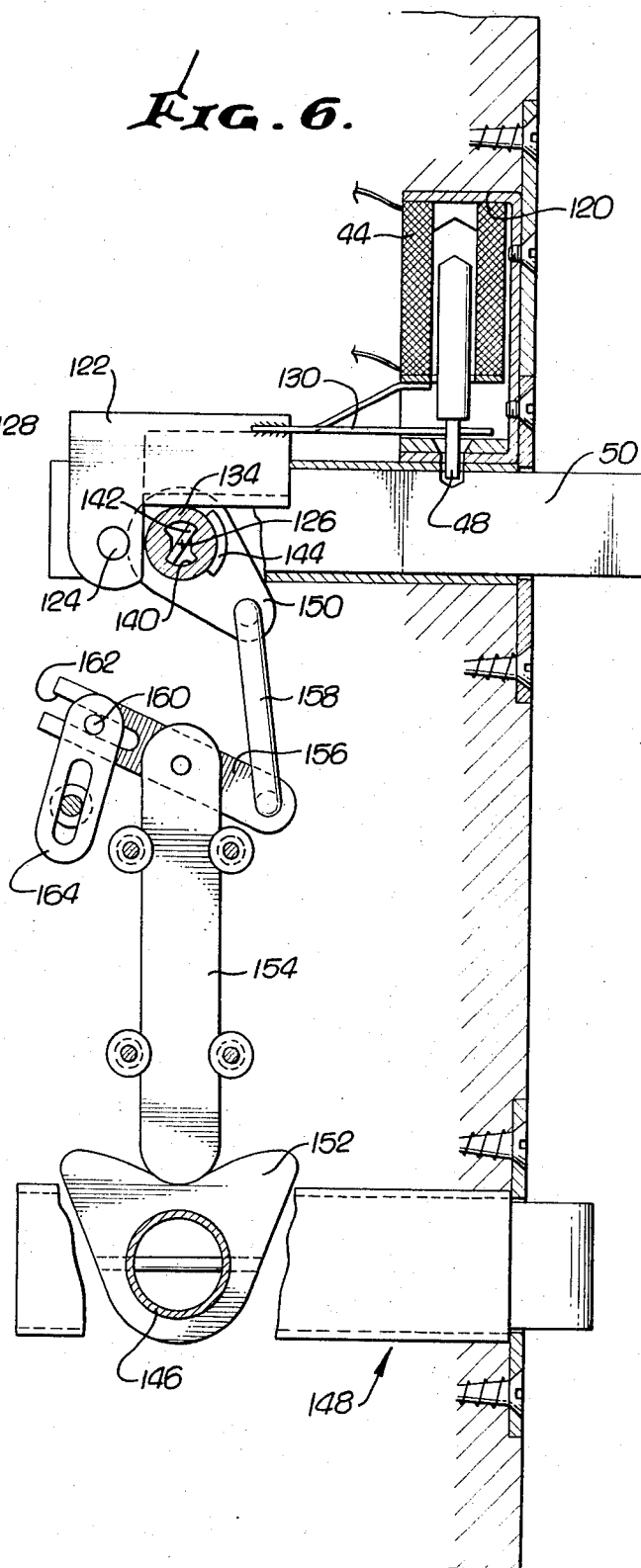
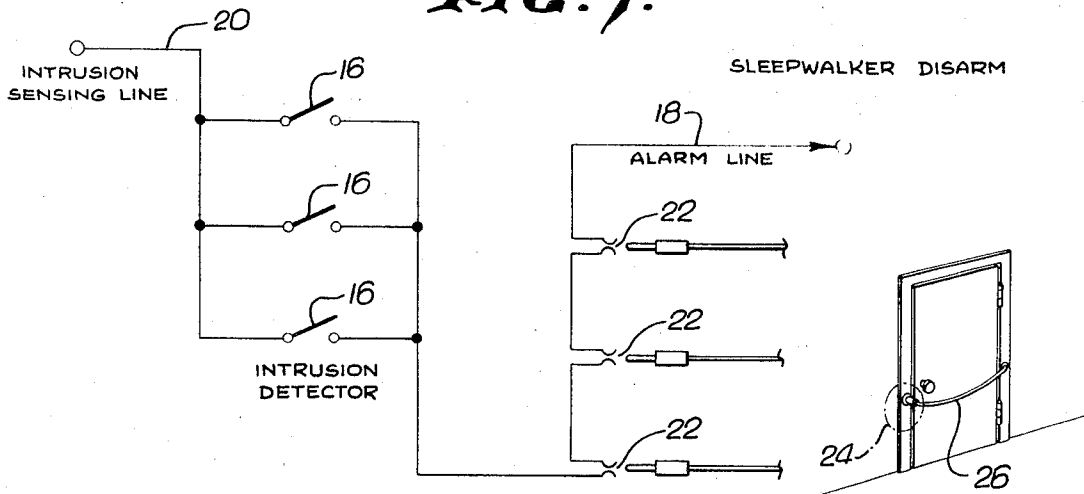


FIG. 7.



COMB. : 1,3,7.

FIG. 9.

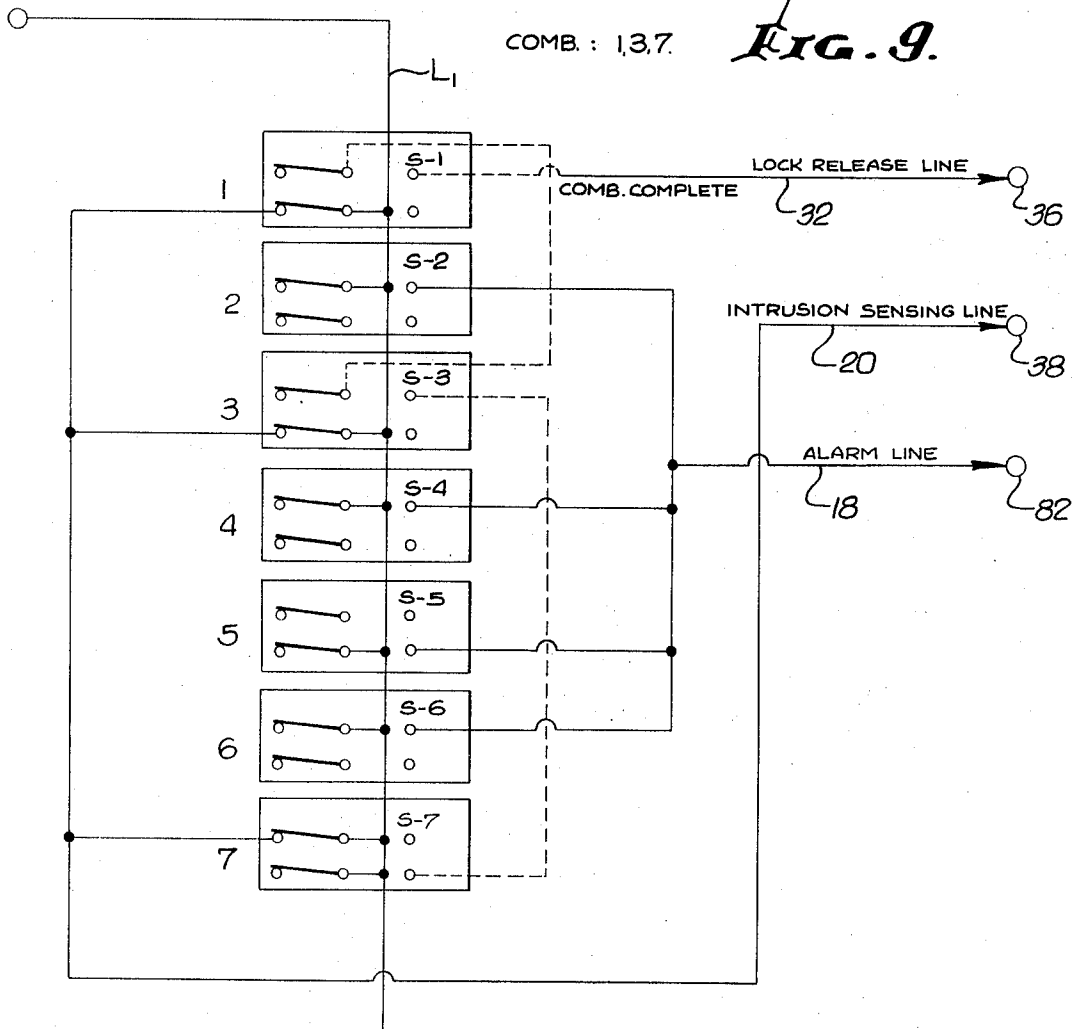
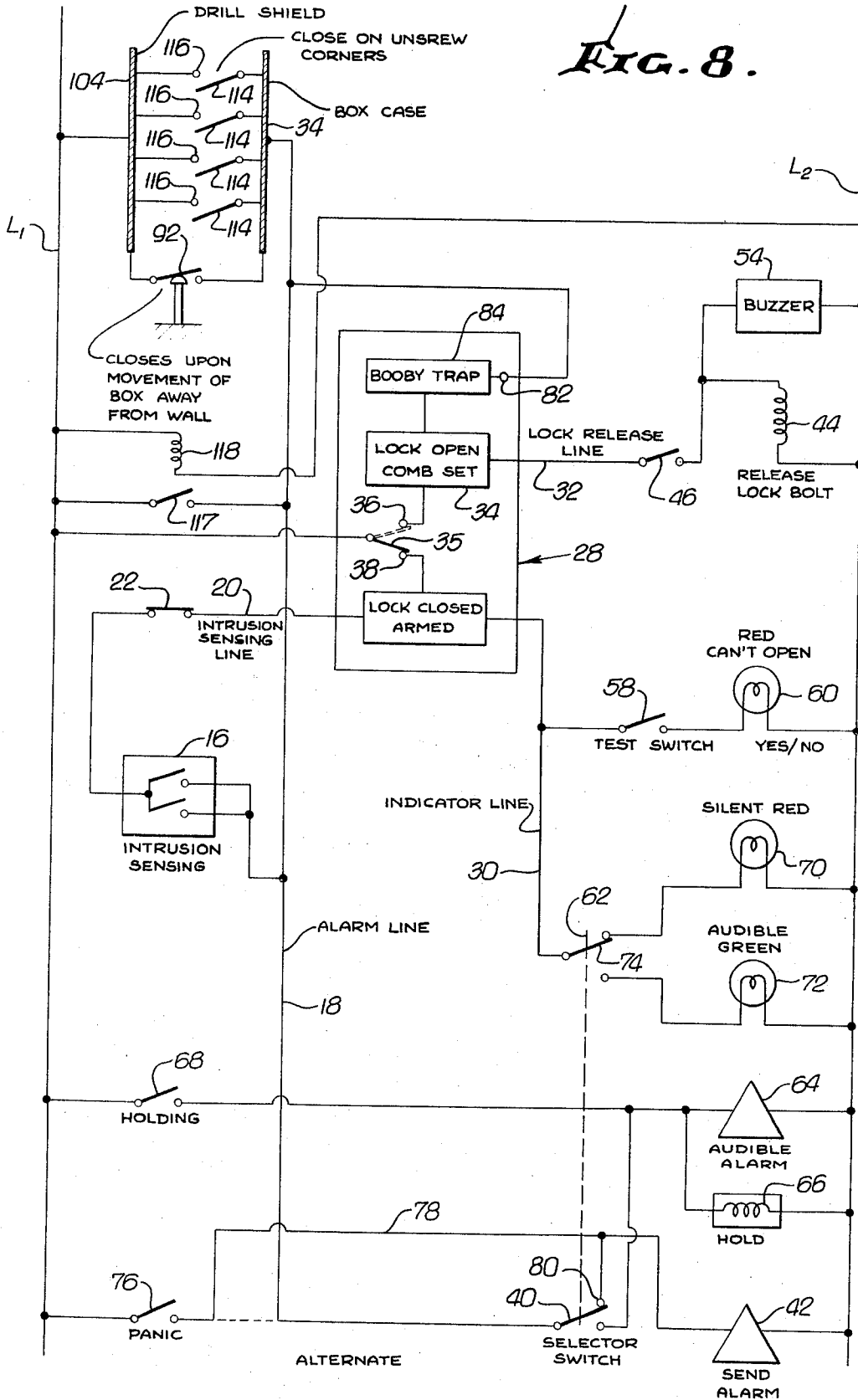


FIG. 8.



ELECTRONIC INTRUSION ALARM SYSTEM**FIELD OF INVENTION**

This invention relates to intrusion alarms of the type linked with a remote monitoring station such as a security office or police station. More particularly the invention relates to an alarm system designed to prevent false alarms which unduly burden the security officers with consequent cost penalties.

BACKGROUND OF THE INVENTION

By far the most popular security system for transmitting a remote signal is one in which the arming and disarming device is located within rather than without the protected space. A time delay mechanism allows the authorized entering person to unlock the door and then disarm the mechanism, and the authorized leaving person to arm the mechanism and then lock the door. This system results in numerous false alarms. Studies have shown in certain areas, as much as 80 to 90 percent of the alarms are false, having been triggered by a careless, forgetful or distracted occupant.

The primary object of the present invention is to provide a remote alarm system in which there is a direct interlock rather than an indirect time delay interlock, between the control mechanism or arming device and the security lock whereby forgetfulness or carelessness is not a factor. A direct interlock requires that the arming device be located exteriorly of the secured space. The companion object of this invention is to provide an exteriorly accessible control mechanism that is itself protected from tampering. Thus an alarm is triggered if there is any attempt to dislodge the mechanism, or to cut the control wires or to set the combination.

Another object of the present invention is to provide a simple mechanical arrangement to ensure proper logical system operation from the inside. Thus the action of turning the slide bolt operation knob by virtue of a lost motion mechanism first causes dog lock for the slide bolt to be lifted. A companion object of this invention is to provide a simple mechanical arrangement whereby turning of the inside spindle of the latch set causes the dog lock to be released and the slide bolt to be retracted whereby rapid exit from the space requires a single one handed operation all in case of hazard such as fire.

SUMMARY OF THE INVENTION

The foregoing objects are made possible by a plurality of structural arrangements and logic circuits interconnected in cooperative combination to achieve the desired results.

BRIEF DESCRIPTION OF THE DRAWINGS

A detailed description of the invention will be made with reference to the accompanying drawings wherein like numerals designate corresponding parts in the several figures. These drawings, unless described as diagrammatic, or unless otherwise indicated, are to scale.

FIG. 1 is a diagrammatic view of the alarm system incorporating the present invention.

FIG. 2 is a vertical sectional view of the control box taken along a plane corresponding to line 2—2 of FIG. 1.

FIG. 3 is a vertical sectional view taken along a plane indicated by line 3—3 of FIG. 2 which is parallel to the front opening of the control box.

FIG. 4 is a transverse sectional view taken along a plane indicated by line 4—4 of FIG. 3.

FIG. 5 is a side edge view of a door that carries a latch set as well as a keyed dead bolt.

FIG. 6 is a frontal elevation of dog lock and associated parts mounted on the inside of the door.

FIG. 7 is a diagram indicating the circuit interrelationship between the intrusion detectors and a "sleep-walker" disarming device.

FIG. 8 is a general wiring diagram for the system.

FIG. 9 is a wiring diagram of the combination lock.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

The following detailed description is of the best presently contemplated mode of carrying out the invention. This description is not to be taken in a limiting sense, but is made merely for the purpose of illustrating the general principles of the invention since the scope of the invention is best defined by the appended claims.

General Organization
The alarm system shown in FIG. 1 is designed to send or sound an alarm either upon entry of an unauthorized person into a locked space 10 or upon unauthorized tampering with an alarm control device 12, located exteriorly of the space.

Intrusion Sensing

Inside the space a number of intrusion sensing devices 14 are shown. Such devices may take a variety of forms. In the present instance, any devices upon sensing of an unauthorized entry, causes or permits closure of a switch to complete a circuit for the alarm. A series of switches 16 are illustrated in FIG. 7, all wired in parallel so that operation of any sensing device triggers the alarm. The switches 16 are interposed between an alarm line 18 and an intrusion sensing line. In a manner hereinafter to be described, the intrusion sensing line 20 is activated by the control device 12; the alarm line 18 when placed in circuit with the sensing line 20 by an intrusion detecting switch 16 causes the alarm to operate. Interposed in the circuit are a series of "sleep-walker" switches designed to prevent the authorized occupant of the locked space from operating one of the sensing devices. The switches 22 are all in series circuit, and are of the jack type that open circuit when the plug is removed. A jack may be placed on the jamb of a bedroom door at the area indicated by circle 24. The jack receives a plug at the end of a cord 26 tethered at the opposite jamb. Before retiring, the occupant inserts the plug at the end of the cord 26 into the jack. Plugs can be inserted as desired or required at this or other locations where authorized occupants are likely to be forgetful during nocturnal activities. Dummy plugs may be used at doors for unoccupied rooms.

Alarm Circuit Arrangement

The principal element of the control device 12 is a combination lock 28 (FIG. 8) that operates or activates the alarm line 18, an indicator line 30, the intrusion sensing line 20 and a lock release line 32. The combination lock is housed in a box 34 (FIGS. 1, 2 and 3) mounted preferably in an unobvious but exteriorly accessible position. The combination lock when "open" disables or disarms the intrusion sensing line and activates the lock release line 32. When the combination lock is "closed," the lock release line is deactivated and the intrusion sensing line is activated or armed. These alternative functions are indicated diagrammatically in

FIG. 8 by a switch arm 35 movable between opposed contacts 36 and 38 that form terminals for the lock release line 32 and the intrusion sensing line 20. In practice the switch arm 35 is a composite device to be described in detail more fully hereinafter.

With the switch arm in the full line closed position illustrated, the system is armed, and a circuit is conditioned for operation as follows: Main power line L-1, lock switch arm 35, contact 38, intrusion sensing line 20, closed sleepwalker switches 22 (indicated in FIG. 8 by but a single switch), intrusion sensing switches 16 (similarly indicated), alarm line 18, one arm 40 of a selector switch, an alarm sending device 42 to the other main line L-2. The device 42 may be a wired or wireless link to a security station having the capability of completing the transmission of coded or uncoded information to a remote station.

Lock Release Mode

With the lock switch arm in the dotted line or open position, the alarm circuit just described as opened and consequently deactivated. The lock release line 32 is activated to condition a lock release solenoid 44. A circuit can be traced as follows: Main line L-1, switch arm 35, contact 36, lock release line 32, an operating bistable toggle switch 46, solenoid 44 to the other main line L-2. The operating switch 46 is located in the box 34 (FIG. 1). When moved to its stable closed position, the solenoid is operated to lift a dog lock 48 (also FIG. 1). This allows the authorized person to retract the latch bolt 50 by the use of a key at the lock 52. At the same time, the bistable switch 46 completes a buzzer circuit in order to remind the user that the solenoid 44 is on. A buzzer 54 (FIG. 8) parallels the solenoid 44 for this purpose. The buzzer 54 is located behind a mounting panel 56 (FIG. 1) in the control box 34. After the latch bolt is released and retracted, the user remembering, or hearing the buzzer 54, returns to open the bistable switch. The dog lock 48 then comes to rest on the surface of the latch bolt 50, ready to drop into place when the door is again bolted from the outside. The buzzer 54 at the same time, is silenced. The user closes and locks the box 34.

Alarm Arm Mode

If authorized persons are leaving the premises, the system is armed by first appropriately setting the sleepwalker switches 22 and intrusion sensing devices (if required) and then, second, by moving the lock to closed position so that, as diagrammatically indicated in FIG. 8, the switch arm 34 engages the contact 38. Optionally, if an authorized person is to remain in the premises, the system is armed in the reverse sequence, sleepwalker switches or dummy plugs being the last to set.

Upon leaving the premises, the user can verify that the system is armed by operating a second switch 58 (FIGS. 1 and 8) located inside the control box 34. This switch 58 is normally open; when depressed, a circuit is completed to illuminate an indicator lamp 60 if the lock is in the armed or closed position. So long as the lamp 60 can be turned on, the user is informed that the latch bolt 50 cannot be released by operation of the adjacent switch 46.

Alarm Mode Select and Panic

Inside the protected space, there is located a mode selector switch 62 (FIGS. 1 and 8) that places in operative relationship either the remote sending alarm 42 or an audible alarm 64. Thus the switch 62 has an arm that places the alarm line 18 in circuit either with the silent

alarm 42 or the audible alarm 64. In the full line position shown, the silent alarm 42 is in circuit as previously described. In the opposite position, the alarm line 18 is placed in circuit with the alarm 64 as well as with the paralleling holding circuit coil 66. A holding circuit for the audible alarm is provided through a relay switch 68 operated by the coil 66. The holding circuit in a well understood manner continues the energization circuit for the alarm 64 notwithstanding interruption of current via the alarm line 18. The holding circuit may be traced as follows: Main line L-1, holding switch 68, alarm 64 and parallel holding coil 66 to the other main line L-2. Lamps 70 and 72 located adjacent the selector switch 62 give visual indication of the alarm mode. Thus in the switch position illustrated, the lamp 70 is illuminated. A circuit may be traced through linked switch arm 74 of the selector switch 62 as follows: Main line L-1, lock switch arm 34, contact 38, indicator line 30, switch arm 74, and then either to lamp 70 or 72 according to the position of the switch 62. The lamps can be coded red and green or a suitable legend may be applied. Of course if the lock switch arm 34 is in open position, the circuit to indicator line 30 and both indicator lamps 72 will be interrupted, denoting that no alarm mode is in effect.

Adjacent the switch 62 is a panic switch 76 that dispatches an alarm to the remote station. The panic switch completes a circuit directly to the alarm 42 as follows: Main line L-1, panic switch 76, and a lead 78 to a junction point at terminal 80 of the selector switch 62, thence to alarm 42 and other main line L-2.

Combination Lock Details

The combination lock is illustrated diagrammatically and in detail in FIG. 9. FIG. 8 discloses terminals 36 and 38 that correspond to the like numbered switch contacts 36 and 38 of FIG. 8. Also shown in both FIG. 8 and FIG. 9 is a terminal 82 that connects with the alarm line 18. Main line L-1 is shown in FIG. 9.

The combination lock comprises a series of double pole double throw bistable switches S-1 through S-7. These switches logically interconnect the main circuit line L-1 to the operating terminals 36, 38 and 82. The open and closed or disarm (lock open) and arm (lock closed) functions of the combination lock has been heretofore described in general terms. The combination lock has an additional function which is operating the alarm in the event that the wrong combination is set. This function is diagrammatically indicated by a switch 84 labelled "BOOBY TRAP," in FIG. 8. As indicated in FIG. 8, this switch 84 (which actually is a composite to be hereinafter described), directly places the main line L-1 in circuit with the alarm line 18.

The switches S-1 to S-7 are all moved to the left to arm the device. The preselected combination (which, of course, may be changed by rewiring) is 1-3-7. Each of the switches S-1, S-3, and S-7 in the left position, has one of its two switch arms wired to connect the line L-1 to the terminal 38 and the intrusion sensing line 20. An "OR" connection is thereby established. Therefore, in order to disable or disarm the intrusion sensing line 20, all three of these switches must be moved to the right. At the same time, movement of these proper switches to the right activates the lock release line via terminal 36. For this purpose, the other switch arms of these keyswitches are serially of "AND" wired relative to the lock release line. Thus, as indicated by the dashed line code, a circuit is so established as follows: Main line

L-1, lower arm of switch S-7, upper arm (as it happens) of switch S-3, upper arm of switch S-1 to the terminal 36 and lock release line. Accordingly, unless all three switches of the correct combination are moved to the right, the dead bolt cannot be released.

If a would-be intruder happens to move any switch other than one of the correct combination switches to the right, the alarm line 18 is activated. The non-combination switches are wired in "OR" array. Thus, for example, a circuit may be traced from line L-1, the upper arm of switch S-2 to a common lead and terminal 82. Similar parallel circuits may be traced through the other non-combination switches S-4, S-5 and S-6. If the would-be intruder moves all of the switches to the right, the lock release circuit will be conditioned for operation while the alarm is sent or sounded; but he still must know that the switch 46 operates the solenoid 44. The system provides quite reasonable security.

Tamper Proof Box

The structural details of the externally accessible control box 34 are shown in FIGS. 2, 3 and 4. The box 34 is fastened to a wall by stove bolts 86 (FIG. 4) or other suitable means. A cable 88 passes through the bottom of the box which places the box in logic circuit arrangement with the mode select panel 62, alarm devices 42, 64 and with the power sources L-1, L-2.

One of the leads in the cable includes a wire directly connected to, or forming a part of, the alarm line 18. Other leads in the cable includes the lines L-1 and L-2. If the cable is cut by wire cutter tool, a circuit will be completed through the conductive metal of the wire cutter tool itself between or among these leads. Before a current overload time delayed breaker trips out, a circuit will be established to the alarm line 18; an alarm will be sent or sounded through means of a circuit separate from lines L-1 and L-2.

If an attempt is made to pull or pry the box from the wall, the alarm circuit 18 is activated. For this purpose, a switch 92 (FIGS. 2, 4 and 8) is provided. The switch 92 includes a spring arm 94 (FIGS. 2 and 4) engageable with a contact button 96 mounted on the bottom of the box. When the box is in place, an actuator plunger 98 moves the arm 94 away from the contact. For this purpose, the plunger is guided in a sleeve 100 projecting rearwardly of the box. The sleeve in turn enters a cup or shield 102 mounted in a recess in the wall. The plunger 98 engages the bottom of the cup when the box is in place, causing the arm 94 to move away from the contact 96. If the box is moved away from the wall, the switch closes before the plunger 98 is accessible for override. Closure of the switch operates the alarm line 18. For this purpose, the switch arm 94 is connected to line L-1 and the box case is connected to the alarm line 18. The contact 96 is directly wired to the line 18 through the cable 88. The arm 94 indirectly wired to line L-1; thus it is connected to a conductive shield 104 that extends entirely around the inside of the peripheral wall of the box. The circuit is depicted in FIG. 8 and may be traced from line L-1, shield 104, arm 94, contact 92 to box and alarm line 18. Thin insulation material 106 electrically separates the shield 104 from the box.

Any attempt to drill through the side walls of the box result in the alarm line 18 being activated. Thus the tool itself will complete a circuit as soon as contact is made with the shield 104.

If the lock to the box 34 is successfully picked, the task of disarming the device by an unauthorized person will still be frustrated. For this purpose, the wiring is accessible only behind a mounting panel 108. Thus the panel 108 must first be removed. The panel is secured at its four corners to ears 110 extending inwardly from the side walls of the box. Screws 112 are provided for this purpose. The end of each screw depresses a corresponding spring switch arm 114 to hold it away from a corresponding contact 116. These switch elements 114 and 116 are respectively connected to the box and the alarm line 18 on one side, and to the drill shield 104 and the power line L-1 on the other side. Thus, if any one of the screws is turned in a direction to release the mounting panel 108, contact is made and the alarm is sent or sounded.

A knowledgeable or informed unauthorized person can drill through the panel 108, then block the switch 92/94, then remove the box, then carefully disconnect the alarm line 18, then throw the switches S-1 through S-7 to the right, then force the lock bolt 50 and then finally open the latch set from the outside. The devices as manufactured may contain traps specific to each installation. Additionally, normally closed relay contacts 117 serve to operate the alarm in the event that the leads are cut. The leads for the relay coil 118 are in the cable leading to the control box 12; the coil itself and the contacts 117 are remote from the cable and inside the secured space.

Mechanical Lock Mechanism

The mechanical lock mechanism is shown in detail in FIGS. 5 and 6. The solenoid coil 44 and the dog lock 48 are accommodated in a recess 120 that extends inwardly from the side surface of the door. A rocker arm 122 straddles the inner end of the latch bolt 50 and is pivoted for angular movement about a pin 124 located at one side of the axis 126 of movement of the inside release knob 128. Upon angular movement of the rocker upwardly, the dog lock 48 is lifted. For this purpose, the rocker is connected to the solenoid plunger on which the dog lock is formed. The connection is made by the aid of a leaf spring 130 that projects under a shoulder of the plunger. The spring 130 allows overtravel of the rocker as the plunger reaches the limit of its retracting movement. A pair of leaf springs 132 acting between the rocker 122 and the solenoid case bias the rocker for return movement over the dead bolt 50.

Before the dead bolt 50 can be moved, the dog 48 must be first lifted. In order to cause this sequence of operation by the aid of the knob 128, a lost motion connection between the retracting pinion 134 and the knob 128 is provided. During the lost motion, the rocker 122 is moved angularly. For these purposes, the pinion 134 has an hourglass shaped slot 140 in which the tongue 142 of the operating knob 128 projects. The tongue carries a crank projection 144 that engages beneath a projecting part of rocker.

In the present instance, the dead bolt 50 is automatically retracted by operation of the inside spindle 146 of a latch set 148. This ensures simple one handed operation of all lock mechanisms to prevent delay in the event of fire or other hazard. For this purpose, the inside spindle is connected to the operating knob 128 or shaft.

The mechanism includes various links mounted on the inside of the door. The knob shaft carries an arm 150 that is rotated upon movement of the latch set

spindle 146 in either direction. The spindle 146 carries a cam 152 having an intermediate depression in which a lifter 154 rests. The lifter 154 is suitably guided for vertical movement. The upper end of the lifter 154 operates a lever 156 connected to the knob connected arm 150 by a link 158. The proper retracted position of the lever 156 is set upon installation by an adjusting pin 160 that works in a slot 162 of the lever. The position of the pin 160 is adjustably determined by a suitable bracket 164. If desired, the arm 150 and the mechanism interconnecting the inside latch set spindle to the dead bolt can be deleted, in which case two separate or co-joining operations or manipulations are required to open the door.

SUMMARY

The control device containing the combination lock being located exteriorly rather than interiorly, a direct functional interlock is provided between the arm/disarm device and the latch bolt. A time delay mechanism that would be required if the control device were inside, is thus avoided. Consequently, the source of many false alarms is eliminated. The control device, contained as it is within a booby trapped box, cannot easily be tampered with by unauthorized persons. While other lock mechanisms could be provided, the bank of double throw, double pole switches are especially suitable for achieving the desired functions. The door mechanism is easily installed as an add-on, only slight changes being required in conventional lock devices.

Intending to claim all novel, useful and unobvious features shown or described, I make the following claims:

1. A system for transmitting an alarm to a monitoring station to signal intrusion or attempted intrusion into a locked space, said system including:

- a. a main lock mechanism for permitting access to said space by authorized personnel;
- b. an auxiliary lock for preventing opening of said main lock mechanism;
- c. a set of intrusion detectors;
- d. an alarm transmitter;
- e. arming means for placing said intrusion detectors in condition to operate said alarm transmitter;
- f. auxiliary lock releasing means for permitting said main lock mechanism to be opened by authorized personnel;
- g. a control mechanism both for said arming means and for said auxiliary lock releasing means, said control mechanism being accessible exteriorly of said locked space for first and final access respectively upon entering and leaving said locked space, said control mechanism including operating means having two mutually exclusive modes corresponding respectively to operation of said arming means and operation of said auxiliary lock releasing means; said arming means being operable only in one of said two modes, and said auxiliary lock releasing means being operable only in the other of said two modes; and
- h. lock means for controlling access to said control mechanism.

2. The system as set forth in claim 1 together with means for operating said alarm transmitter upon tampering with said control mechanism.

3. The system as set forth in claim 1 in which said operating means includes a combination lock; and

means for operating said alarm upon false operation of said combination lock.

4. The system as set forth in claim 1 in which said operating means includes a combination lock;

means for operating said alarm upon false operation of said combination lock; and

means forming a space for said combination lock access to which is secured by said lock means.

5. The system as set forth in claim 1 in which said operating means includes a series of individual switches, a preselected number of which, less than the total number of switches, must be operated in order to place said control mechanism in its said other mode; and

means for operating said alarm upon operation of any of said other of said switches.

6. The system as set forth in claim 1 in which said operating means includes a series of individual bistable switches which, when correspondingly moved to first positions determining said one mode of said operating means in which said system may be armed; said second mode being determined upon movement of predetermined combination coded switches to their second positions.

7. The system as set forth in claim 1 in which said operating means includes a series of individual bistable switches which, when correspondingly moved to first positions determining said one mode of said operating means in which said system may be armed;

said second mode being determined upon movement of predetermined combination coded switches to their second positions; and

means for operation of said alarm upon movement of any of the other of said switch to their second positions.

8. The system as set forth in claim 1 in which said operating means includes a series of individual bistable switches which, when correspondingly moved to first positions determining said one mode of said operating means in which said system may be armed;

said second mode being determined upon movement of predetermined combination coded switches to their second positions;

means for operation of said alarm upon movement of any of the other of said switch to their second positions; and

means forming a space for said bistable switches access to which is secured by said lock means.

9. The system as set forth in claim 1 in which said operating means includes a series of individual bistable switches which, when correspondingly moved to first positions determining said one mode of said operating means in which said system may be armed;

said second mode being determined upon movement of predetermined combination coded switches to their second positions;

means for operation of said alarm upon movement of any of the other of said switch to their second positions;

means forming a space for said bistable switches access to which is secured by said lock means; and

means for operating said alarm transmitter upon tampering with said lock means for the space forming means.

10. The system as set forth in claim 1 together with means forming a space for said control mechanism which is secured by said lock means; and

means for operating said alarm transmitter upon tampering with said space forming means or said lock means.

11. The system as set forth in claim 1 together with means forming a space for said control mechanism which is secured by said lock means;

means for operating said alarm transmitter upon tampering with said space forming means, including

a. means sensing the projection of an object, such as a drill bit, through the side walls of said space forming means;

b. means sensing the removal of said space forming means from its place of attachment; and

c. means sensing the attempted disassembly of components within said space forming means.

12. The combination as set forth in claim 1 in which said auxiliary lock releasing means includes an actuator, a signalling device operated whenever the actuator is operated and a bistable switch for operating the signalling device and said actuator, said signalling device serving to remind the authorized user that said actuator is on.

13. The combination as set forth in claim 1 together with audible alarm means, and selector means for conditioning said audible alarm means for operation.

14. The combination as set forth in claim 1 together with a series of resettable sleepwalker switches in dependent operational relationship with said intrusion de-

tectors for disabling said intrusion detectors upon movement of authorized personnel from his place of retirement to other portions of the locked space, said sleepwalker switches comprising a part of said arming means.

15. The combination as set forth in claim 1 together with indicator means for said control mechanism to denote the mode of its said operating means.

16. The combination as set forth in claim 1 together with an operator located inside said locked space for opening said main lock mechanism; and

a lost motion connection between said inside operator and said auxiliary lock for overriding said auxiliary lock releasing means and for releasing said auxiliary lock in advance of movement of said auxiliary lock to its released position.

17. The combination as set forth in claim 1 together with a lock set paralleling said main lock mechanism, and having an inside spindle;

a connection between said inside spindle and said main lock mechanism for opening said main lock mechanism, if not already open, upon operation of said inside spindle; and

a lost motion connection between said spindle and said auxiliary lock for advance release of said main lock mechanism.

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