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Klebold et al.

[11] **3,924,254**

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[54] **ANTI-INTRUSION ALARM SYSTEM**

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[51] **Int. Cl.** **G08b 13/02**

[58] **Field of Search** ..... 340/409, 280, 261, 214, 340/256, 253 B, 283, 276, 63, 65; 200/61.49

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[57] **ABSTRACT**

An anti-intrusion alarm system includes a source of power, a normally open, motion-sensitive switch remotely located with respect to said power source, a normally conducting circuit interrupting means located adjacent the power source, such as, the contacts of a relay, holding means operatively associated with the circuit interrupting means, located adjacent said power source and adapted to render the circuit interrupting means nonconducting, such as, the coil of the relay, an alarm means, a first alarm circuit connecting the alarm to the power source through the motion-sensitive switch, whereby the closing of the motion-sensitive switch energizes the alarm, a second alarm circuit connecting the alarm to the power source through the circuit interrupting means, and a third circuit connecting the holding means to the power source through the remote location adjacent the motion-sensitive switch, whereby the interruption of power between the power source and the holding means inactivates the holding means and permits the circuit interrupting means to conduct power from the power source through the alarm.

15 Claims, 4 Drawing Figures

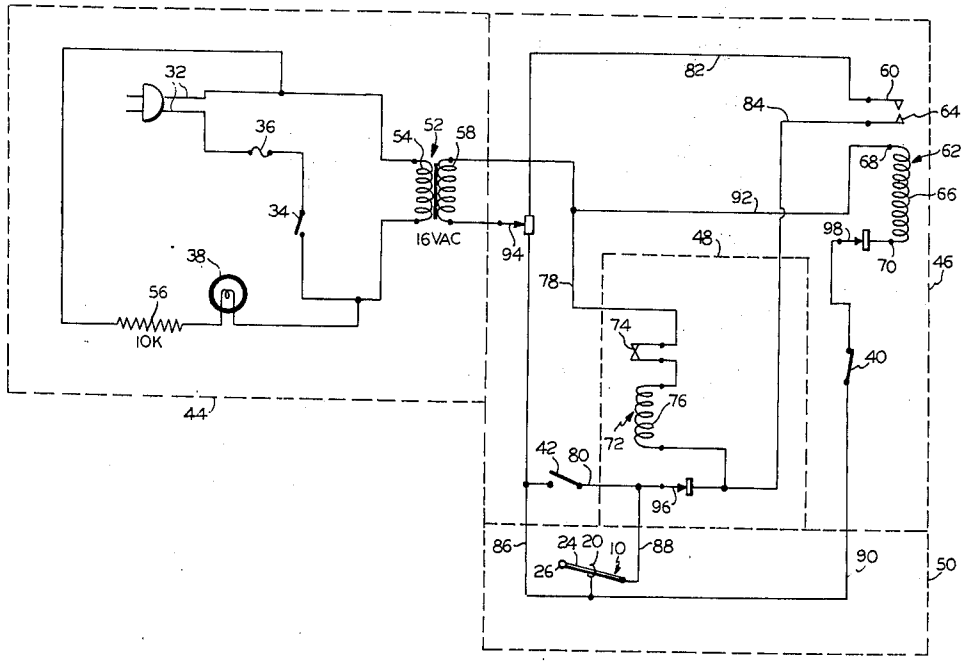


FIG. 1

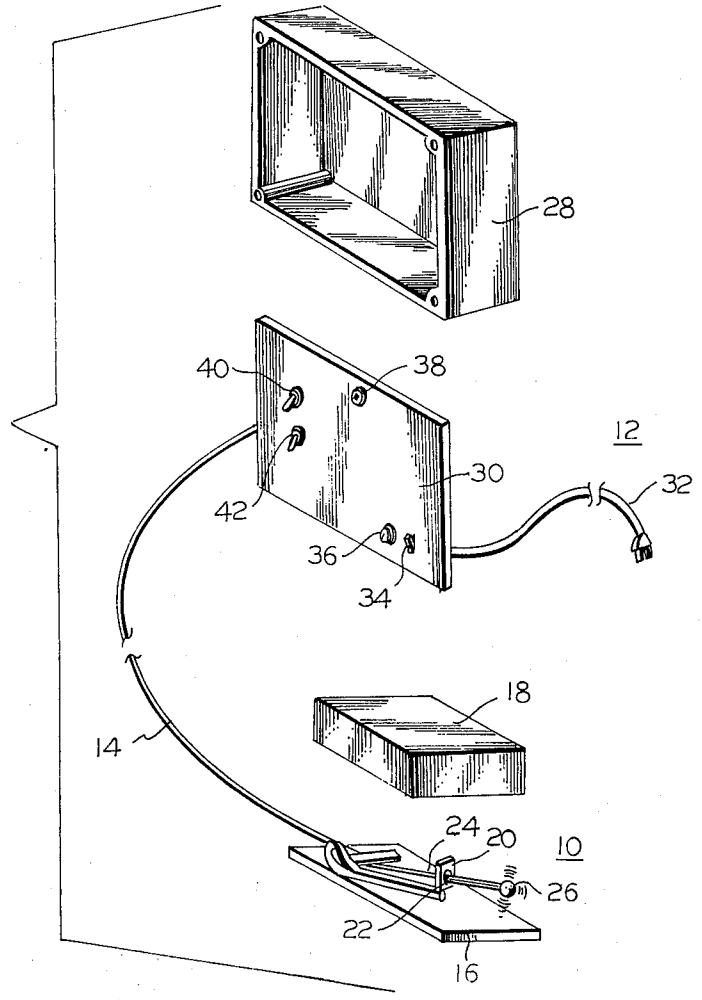
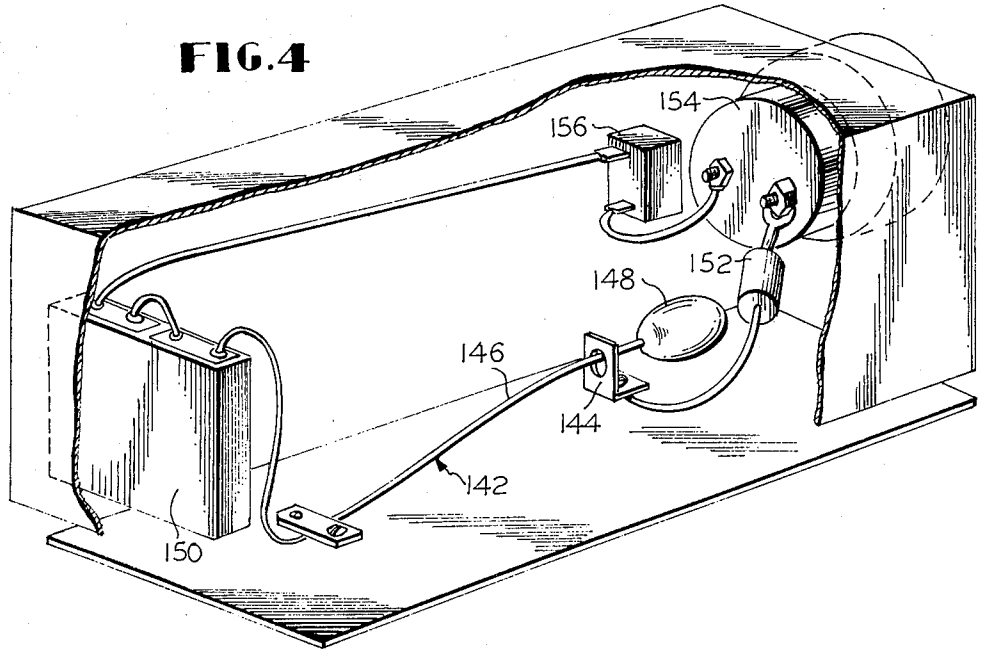

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FIG. 4


154
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148
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144
142
150

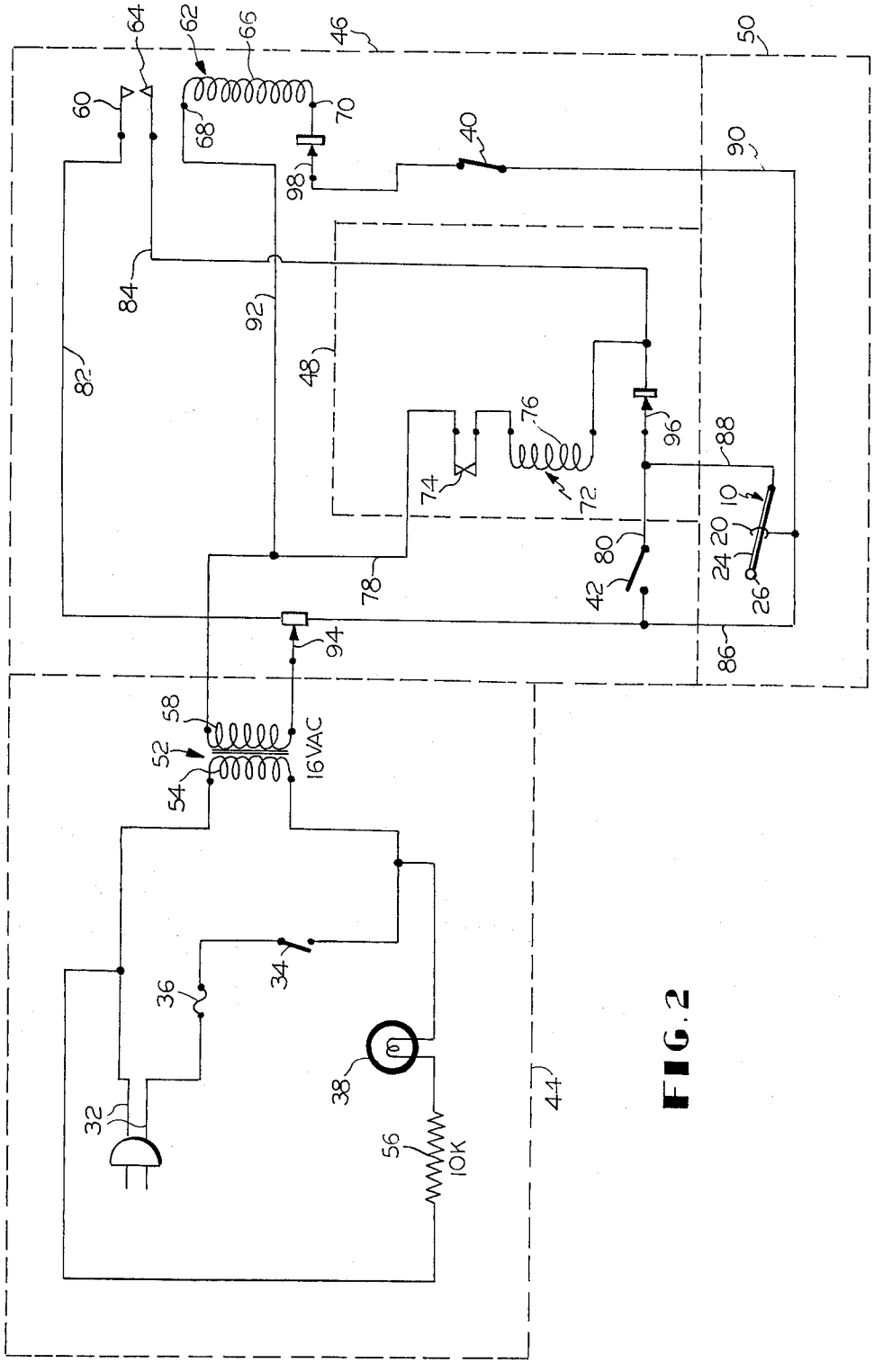

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66
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98
84
92
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76
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74
72
10
20
24
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80
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78
94
86
58
52
54
16VAC
34
36
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32
56
10K
44

FIG. 2

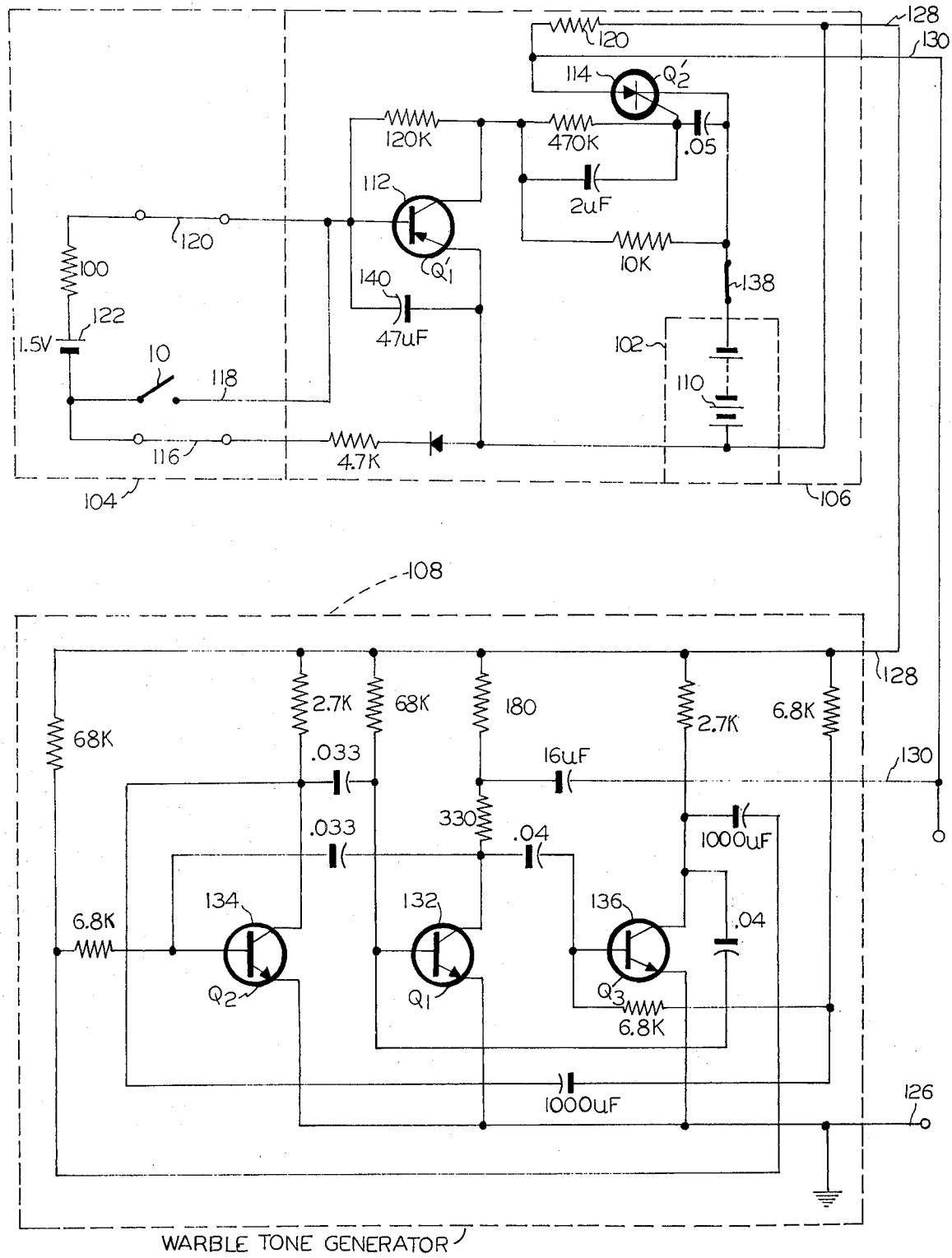

128
130
120
114
Q'2
120K
470K
.05
2uF
112
Q'1
120
100
140
47uF
10K
138
122
1.5V
10
118
102
110
116
4.7K
104
106
108
128
2.7K
68K
180
2.7K
6.8K
68K
.033
16uF
130
.033
330
.04
1000uF
134
132
136
.04
6.8K
Q2
Q1
Q3
6.8K
1000uF
126
WARBLE TONE GENERATOR

FIG.3

ANTI-INTRUSION ALARM SYSTEM

BACKGROUND OF THE INVENTION

The present invention relates to an anti-intrusion alarm system. In a more particular aspect, the present invention relates to an anti-intrusion alarm system which is either normally actuated if a highly-sensitive switch is closed by an intruder or abnormally actuated if a line leading from the switch to the alarm and control portion of the system is cut or broken.

In the prior art, a wide variety of anti-intrusion alarm systems have been developed. For the most part, these systems are rather complex and expensive to install and maintain. One reason for the expense and complexity of such alarm systems is that several sources of power are required and quite often, several individual alarms are required.

Electrical alarm systems are generally of two types. In one type, a normally open circuit is closed in the alarm condition, and, in the other type, a normally closed circuit is opened in the alarm condition. The alarm condition is generally initiated by an intruder breaking a wire or other filament stretched across the area to be protected. Thus, in these types of devices, there is only one condition which will create the alarm condition.

On the other hand, systems have also been developed which include an anti-intrusion circuit operated by a switch or the breaking of a wire or filament and an anti-tampering section which sets off an alarm to the extent that a line leading from the protected area to the alarm and control area is broken or tampered with. However, in systems of this type, two separate power supplies are generally required, one to operate the normal switch or filament operated anti-intrusion section and a separate and distinct power supply to operate the anti-tampering section. Thus, these systems become unduly complex and expensive to the extent that they are in essence separate and distinct alarm systems, and there is really little or no connection between the two.

It is therefore an object of the present invention to provide an improved anti-intrusion alarm system. Another object of the present invention is to provide an improved anti-intrusion alarm system which is simple, inexpensive and readily installed. Yet another object of the present invention is to provide an improved anti-intrusion alarm system including a highly-sensitive, motion-actuated switch. Still another object of the present invention is to provide an improved anti-intrusion alarm system normally actuated by the closing of a switch and abnormally actuated by cutting an electrical connection between the switch and the alarm system proper. Another and further object of the present invention is to provide an improved anti-intrusion alarm system which requires a single power source for both normal operation of the alarm by an intruder and abnormal operation of the alarm by cutting the electrical connection between an intruder-operated switch and the alarm and control portion of the system.

These and other objects and advantages of the present invention will be apparent from the following detailed description when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded isometric view of the two major components of the alarm system;

FIG. 2 is an electrical schematic of the alarm system;

FIG. 3 is an electrical schematic of a solid state modification of the circuit of FIG. 2; and

FIG. 4 is an isometric view of a single unit embodying the alarm system.

SUMMARY OF THE INVENTION

In accordance with the present invention, an anti-intrusion alarm system is made up of a normally-open switch adapted to be closed by an intruder and a remotely located source of power, an alarm, and an anti-tampering section, in which, the alarm is normally activated by the power source when an intruder closes the contacts in the switch in a first alarm circuit and a normally open second alarm circuit connects the alarm to the power source when a line between the power source and the alarm is cut, broken or disconnected.

DETAILED DESCRIPTION OF THE INVENTION

In accordance with FIG. 1 of the drawings, the alarm system of the present invention is made up of two basic units, namely; switch or sensor unit **10** and the alarm or control unit **12.** Units **10** and **12** are connected by a **75** amp, three conductor line **14.**

Switch or sensor unit **10** is made up of a base **16** and a cover **18.** Mounted on base **16** is a motion-sensitive, vibratory switch or sensor unit. The switch or sensor unit is made up of a vertically-disposed ring contact **20** having an aperture **22** formed through its center. The other contact of the switch comprises a resilient wire, resilient, flat metal arm or other spring-type or resilient arm **24** which is mounted on base **16** at one end and then passes through aperture **22** of ring contact **20.** Mounted on the free end of arm **24** is a weight **26.** The resilience of arm **24** and the mass of weight **26** are chosen such that arm **24** is normally balanced within the center of aperture **22** of ring contact **20** when the base **16** is in a generally-horizontal position or resting on a flat surface of some form. However, if the switch is disturbed in any manner, the mass of weight **26** and the resilience of arm **24** will cause the arm **24** to vibrate, thereby momentarily contacting the edges of aperture **22** of ring contact **20** and completing a circuit through the switch. Thus, a vertical disturbance will cause the arm **24** to vibrate vertically, thus causing a plurality of momentary contacts between arm **24** and ring contact **20.** On the other hand, again because of the resilience of arm **24** and the mass of weight **26** balancing the arm, if the unit **10** is turned on either side or upside down, arm **24** will be in continuous contact with either the sides or top, respectively, of the aperture **22** in ring contact **20,** thereby maintaining the switch in a continuously closed condition until the state of balance is again attained and maintained by placing the switch unit **10** in a perfectly horizontal, undisturbed position. Thus, it is obvious from the operation of switch unit **10** that any slight disturbance of the switch unit will cause at least a momentary closing of the switch, thereby closing the alarm circuit as hereinafter described.

As will also be hereinafter described in greater detail, a breaking or cutting of line **14,** connecting sensor unit **10** to control and alarm unit **12,** will also set off the alarm.

Further in accordance with FIG. **1,** the alarm and control unit **12** is made up of a base or casing **28** and cover plate **30.** Mounted in cover plate **30** is an indicator light **38** which shows when the system is on. For purposes of testing the various circuits, switches **40** and

42 are also mounted in cover panel 30. Switch 40 is designed to test the integrity or operability of the alarm and control unit 12, whereas switch 42 is designed to test the integrity and operability of the switch or sensor unit 10.

Referring now to FIG. 2 of the drawings, the electrical circuit for the alarm system is made up of four basic sections. Specifically, these sections include section 44 representing the power supply and power indicator control section, section 46 representing the anti-tamper section and the test sections, section 48 representing the alarm section and section 50 representing the detector or sensor section. As previously indicated in the description of FIG. 1, the indicator or sensor section represents one individual unit whereas the remainder of the circuit is all included within a second individual unit, and the two units are connected by a three wire electrical line.

110 Volts AC power is fed to transformer 52 through line 32. The power supplied to transformer 52 is switched off and on by means of line switch 34 which is in series with the primary 54 of transformer 52. Also in series with primary 54 of transformer 52 is line fuse 36. To indicate whether the power supply is on or off, indicator lamp 38 is connected in parallel with the primary 54 of transformer 52. Indicator lamp 38 is a neon pilot lamp protected through an appropriate resistor 56. Power is supplied to the entire circuit by the single power supply source through secondary 58 of transformer 52. Transformer 52 is preferably a step-down transformer which reduces the voltage to a value of about 16 volts AC. Having this low voltage operating the alarm system, it is obvious that the detector section 50 is completely safe and shockproof.

The anti-intrusion or sensor section 50 includes the motion-sensitive switch unit 10 which is remotely located with respect to the remainder of the circuit. The switch unit 10 is, of course, made up of ring contact 20 and arm contact 24. Power from the secondary 58 of transformer 52 is supplied to the switch through line 86, thence through the closed contacts 20 and 24 of the switch and from the switch through line 88 which leads to the alarm section 48. The alarm section 48 includes an appropriate multi-vibrator 72 having contacts 74 and coil 76. Power from the secondary 58 of the transformer thus passes through line 86, contacts 20 and 24 of switch 10, line 88, thence to the coil and contacts 76 and 74, respectively, of multi-vibrator 72 and back to the transformer secondary 58 through line 78. Accordingly, when switch 10 is closed either momentarily or continuously by a disturbance created by an intruder violating the area to be protected, power will be supplied through the switch 10 to the multi-vibrator 72, thus normally closing the alarm circuit and setting off the alarm. As previously indicated, switch 10 is remotely connected to the remainder of the system through a three wire electrical line. Two of these three wires comprise wires 86 and 88, which were previously referred to.

The anti-tampering section of the system, specifically section 46, comprises a normally closed switch which is held in its open position by power being supplied to the switch and which automatically closes when the power is interrupted. In a specific instance, as shown, this switch comprises a normally closed relay 62. The relay 62 can be substituted for by an equivalent semiconductor device. In any event, power is supplied to the coil 66 of relay 62 through line 86, line 90 and line 92. Thus, so long as power is being supplied to points 68 and 70 of coil 66 of relay 62, the relay will be held in its open position. Contacts 60 and 64 of relay 62 are connected to the power source through the alarm or buzzer 72. Specifically, this circuit includes line 82, contacts 60 and 64, line 84, alarm 72 and line 78. Consequently, if the power to relay 62 is interrupted for any reason, the moving contact 64 of relay 62 will be released and close the relay contacts 60 and 64, thus completing a circuit through the alarm 72. Specicically, if the power to relay 62 is interrupted by cutting or breaking either line 86 or line 90, the relay contacts will be released, the relay will close and power will be supplied to the buzzer or alarm circuit, thus indicating that someone has broken or cut the line from the sensor switch 10 (FIG. 1) to the control section 12 (FIG. 1). The switch unit 50 is conveniently connected to the remainder of the system by means of single contact jack and plug units 94, 95 and 98. Obviously, if either plug 94 or 98 is pulled, the alarm will indicate such tampering also. As a matter of convenience, particularly so that line 88 cannot be individually disconnected, a single plug can be utilized for jacks 94, 96 and 98.

In order to test the anti-intrusion portion of the circuit, a normally open, momentary, single pole, single throw test switch 42 is closed. This bypasses switch 10 and completes a circuit through alarm 72, thus setting off the alarm and checking its operability. Similarly, normally closed, momentary, single pole, single throw test switch 40 is opened to test the anti-tampering section and its operability. Opening switch 40 will cut off the power to relay coil 66, thus closing relay contacts 60 and 64 and completing this circuit through the alarm 72. This, of course, assures that the anti-tampering section is operable and will set off the alarm if lines 86 or 90 are cut.

In the operation of the alarm system, it becomes quite obvious that any disturbance of the switch 10 will close contacts 20 and 24 of switch 10 at least momentarily. Actually, because of the resilience of arm 24, only a single contact is extremely unlikely or almost impossible since the weight on the end of arm 24 will cause the arm to vibrate a number of times once it is disturbed. In any event, when switch 10 is closed, the secondary 58 of transformer 52 supplies power to the buzzer or alarm 72 through lines 86, 88 and 78, thus completing the circuit through the alarm and setting off the alarm or buzzer.

However, aside from the alarm condition which occurs during normal operation, when switch 10 makes contact, there is another condition which will set off the alarm even without the closing of switch 10. Specifically, as previously indicated, when voltage is lost across points 68 and 70 of coil 66 of relay 62, the alarm will be set off. Consequently, if either lines 86 or 90 are cut between the switch and the control and alarm section, contacts 60 and 64 of relay 62 will close, thus supplying power to the alarm 72 through lines 82, 84 and 78, thereby indicating that someone has tampered with the line between the switch 10 and the alarm section. Such tampering can, of course, also include the pulling of one of plugs 94, 96 or 98.

FIG. 3 of the drawings shows an alternative circuit to that of FIG. 2. FIG. 3 includes the same basic components as the system of FIG. 2 with the exception that solid state means have been substituted for the electromechanical components of the system of FIG. 2. Specifically, FIG. 3 contains a power supply 102 which is

the equivalent of power supply or power section **44** of FIG. **2.** Also shown in FIG. **3** is the detector or sensor section **104** which is the equivalent of sensor section **50.** Anti-tampering section **106** is the equivalent of anti-tampering section **46.** Finally, alarm or signal section **108** represents the equivalent of alarm or signal section **48.**

Power supply or power section **102** is provided with a **12** volt DC battery **110.** As is obvious, the power section **44** of FIG. **2** could also be used in the circuit of FIG. **3** as could the power section **102** of FIG. **3** be used in the circuit of FIG. **2.**

Anti-tampering section **106** is made up basically of a holding means represented by PNP transistor **112** and a circuit interrupting means represented by N-type base, field-effect transistor **114.** Transistor **112** is preferably a Fairchild 2N3638 component while transistor **114** is preferably a General Electric C106Y component.

Leading from the anti-tampering section **106** to a remotely located detector or sensor unit **104** are three conductors; namely, **116, 118** and **120.** Located within remotely located detector or sensor section **104** is a 1.5 volt DC battery **122** which maintains a positive bias on the base of transistor **112.** Located in line **118** is a switch **124,** which is the motion-sensitive switch previously discussed and designated as switch number **10** in FIG. **2.**

Finally, leading from the anti-tampering section **106** are two leads **130** and **128** to a suitable alarm means **108.** In this specific instance, the alarm means is a warble tone generator which is completely transistorized. The warble tone generator is connected to an external speaker or amplifier and speaker (not shown) through lines **126** and **130.** Obviously, warble tone generator **108** can be a 12 volt DC bell, a siren or the buzzer **72** of FIG. **2.** Warble tone generator **108** contains **3** basic components; namely, NPN transistor **132,** NPN transistor **134** and NPN transistor **136.** All three transistors are preferably Fairchild 2N2926 elements. Transistor **132** plus transistor **134** have a frequency of 700 Hz while transistor **132** plus transistor **136** have a frequency of 500 Hz. The switching rate of warble tone generator **108** is 1.5 Hz.

The circuit of FIG. **3** operates in basically the same manner as that of FIG. **2** except for the substitution of solid state elements. The 1.5 volt bias on the base of transistor **112** prevents any appreciable current from flowing through transistor **112** from the 12 volt power source **110** and, therefore, transistor **114** will be in a non-conducting condition, and the alarm will be inactive. However, if an intruder should actuate the motion-sensitive switch **124** in line **118,** this will short out the 1.5 volt bias and the full 12 volts from battery **110** will pass through transistor **112.** With this voltage passing through transistor **112,** transistor **114** will conduct, thereby, actuating the alarm **108.** Similarly, if lines **120** or **116** between the sensor section **104** and the remainder of the device are cut by an intruder, this will again cut off the 1.5 volt bias from the base of transistor **112** and power will then be supplied to the base of transistor **114** and transistor **114** will again conduct and lock in the conducting condition until it is reset. Once transistor **114** is conducting and is locked, it is necessary to reset the system. This is accomplished by opening normally-closed switch **138** and then closing it again. Also, contained within anti-tampering section **106** is condensor **140.** Condensor **140** acts to delay the operation of the system for a time sufficient to prevent false alarms. The circuit of FIG. **3** can also include any or all of the testing and operating switches of the system of FIG. **2,** for example, line switch **34** and testing switches **42** and **40.**

In accordance with FIG. **4** of the drawings, the system of the present invention may be housed in a single housing for use with a wide variety of devices. For example, it may be used as a protector for such items as brief cases or display cases when one's attention is temporarily diverted. Also, it could be used in exhibition booths to protect valuable items when the attendant must step away for a moment. In accordance with FIG. **4,** the motion-sensitive switch **142** is made up of a ring type contact **144** and a vibrating arm **146** having a weight **148** attached to the end thereof. In this particular instance, the power source can be two 9 volt DC batteries **150.** A loading component **152,** of proper value, is included and a conventional alarm **154.** In this instance, the alarm **154** can be a Mallory Sonalarm or equivalent. For this particular purpose, the system also includes a key-operated line switch or system switch **156.** This switch will, or course, be necessary since the system should not be activated unless a brief case or the like is put in a stationary position. Obviously, the system could not be activated while someone was carrying the brief case, since any motion, as previously discussed, will set off the alarm. Therefore, key-operated switch **156** is an essential component of the system as described in FIG. **4.**

It is thus apparent from the drawings that a simple, inexpensive and highly effective alarm system is provided. The alarm system includes a single power source supplying both the switch and alarm sections and the integrity or anti-tamper section of the alarm system. The switch section includes a very sensitive switch which will set off the alarm on the slightest disturbance of the switch itself. On the other hand, if an intruder should locate the switch and make an effort to deactivate the switch by cutting or pulling out the cord leading from the switch to the alarm section, this in and of itself causes an alarm condition, thus indicating that the line has been tampered with somewhere between the switch and the alarm section.

In light of the above, it is obvious that the system of the present invention provides a simple, inexpensive and sensitive alarm system for alerting the user of the intrusion onto or into property or the disturbance of objects to be protected. The sensor or switch unit can be readily attached to any appropriate piece of equipment or object and thus indicate any movement of the object. For example, the unit is particularly suitable for use on a boat, the motor of a boat, a motorcycle, an open vehicle, such as a jeep or a truck, a car, a camper or trailer, a show vehicle or any item located in a remote, unprotected area. For example, the sensor unit may be attached to the underside of the hood of a vehicle, to the door of a vehicle, to the door or gate of an enclosed area or any other appropriate place where an intruder will obviously move some element or part of the object being protected or a door or gate to the area to be protected. This area can be remotely located as indicated since the electrical line from the sensor or switch unit then passes to another location where the user can observe or hear the alarm. The alarm and anti-tamper section as well as the power section of the device is therefore located where the user wishes. If an intruder in any way disturbs the object or area being protected, the slightest movement of the sensor unit will

cause the alarm to be set off. Similarly, should the intruder discover the line from the switch or sensor unit to the area where the user is located and decide to either break or cut the line, such breaking or cutting of the line will also set off the alarm by virtue of the completion of the second circuit through the buzzer and through the second switch located adjacent the power supply and alarm unit.

It is obvious that certain variations of the system can be made without altering the basic concepts involved. For example, a conventional holding or latching relay can be inserted in the alarm circuit so that a single contact between contacts **20** and **24** of switch **10** will cause the relay to close and latch and thus continuously sound the buzzer or alarm. Thus, once contact is made, the sounding of the buzzer or alarm will not depend upon whether contact is made a second or third time by the contacts of switch **10.** Similarly, the AC power supply can be substituted by a suitable DC power supply. However, it should be clearly recognized at this point that a single buzzer or alarm and a single source of power are operative for both the anti-intrusion or switch section of the system as well as the anti-tamper section of the system. Thus, a single alarm and a single power source operate and create an alarm condition whether the switch section is operating normally or whether the switch section has been disconnected by one tampering with the line leading from the switch section to the alarm and control section of the alarm system.

We claim:

1. An anti-intrusion alarm system, consisting of; a power and anti-tampering unit, including a source of power, alarm means and a normally-closed switch means including holding means for holding said normally-closed switch means open when said holding means is energized; a remotely located detector unit including a motion-sensitive switch means; and cable means connecting said power and anti-tampering unit to said detector unit, including a first conductor leading from one contact of said motion-sensitive switch to a series combination of said alarm means and a first terminal of said power source in said power and anti-tampering unit, a second conductor leading from a second terminal of said power source to a second contact of said motion-sensitive switch, to complete a first circuit through said power source and said alarm means when said motion-sensitive switch is closed, and a third conductor leading from said second contact of said motion-sensitive switch to a series combination of said holding means and said first terminal of said power source, to complete a second circuit to energize said holding means and hold said normally-closed switch open when said first conductor and said third conductor are intact and to deenergize said holding means and permit said normally-closed switch to close when said first or said third conductor are cut; and a third circuit within said power and anti-intrusion unit including said power source, said alarm means and the contacts of said normally-closed switch, whereby said alarm means is energized when said holding means is deenergized and said normally-closed switch is closed.

2. A system in accordance with claim **1** wherein the normally-closed switch means is the contacts of a normally-closed relay and the holding means is the coil of said relay.

3. A system in accordance with claim **1** wherein the source of power is an AC source of power.

4. A system in accordance with claim **3** wherein the source of power includes a step-down transformer adapted to reduce the voltage of the AC source of power.

5. A system in accordance with claim **1** wherein the alarm means is a multi-vibrator.

6. A system in accordance with claim **1** wherein the motion-sensitive switch means includes a vertically-disposed hollow ring forming the second contact of said switch and a resilient, spring-type arm forming the first contact of said switch, passing through the opening in the hollow ring contact and having a weight mounted on its free end.

7. A system in accordance with claim **6** wherein the resilience of the arm and the magnitude of the weight are adjusted such that slight vertical movement of the switch means will cause the arm contact to vibrate against the edges of the ring contact and turning of the switch on either side or on its top will cause said arm contact to contact one side or the top, respectively, of said ring contact.

8. A system in accordance with claim **1** wherein the first alarm circuit additionally includes a test switch adapted to close a circuit bypassing the switch means.

9. A system in accordance with claim **1** wherein the second alarm circuit includes a test switch for interrupting the power to the holding means.

10. An anti-intrusion alarm system, consisting of; a power and anti-tampering unit, including a source of power, alarm means and a normally-conducting, solid-state switching means including holding means for rendering said normally-conducting switching means non-conducting when said holding means is energized; a remotely located detector unit including a motion-sensitive switch means; and cable means connecting said power and anti-tampering unit to said detector unit, including a first conductor leading from one contact of said motion-sensitive switch means to a series combination of said alarm means and a first terminal of said power source in said power and anti-tampering unit, a second conductor leading from a second terminal of said power source to a second contact of said motion-sensitive switch means, to render a first circuit through said power source and said alarm means conducting when said motion-sensitive switch means is closed, and a third conductor leading from said second contact of said motion-sensitive switch means to a series combination of said holding means and said first terminal of said power source, to complete a second circuit to energize said holding means and render said normally-conducting switching means non-conducting when said first conductor and said third conductor are intact and to deenergize said holding means and permit said normally-conducting switching means to conduct when said first and said third conductor are cut, and a third circuit within said power and anti-intrusion unit including said power source, said alarm means and the terminals of said normally-conducting switching means, whereby said alarm means is energized when said holding means is deenergized and said normally-conducting switching means is conducting.

11. A system in accordance with claim **10** wherein the alarm means is a warble tone generator.

12. A system in accordance with claim **10** wherein the normally-conducting switching means is an N-type base, field-effect transistor.

13. A system in accordance with claim **10** wherein the holding means is a PNP transistor normally having

a positive bias applied to its base.

14. A system in accordance with claim **13** wherein the motion-sensitive switch means is mounted in the circuit in a position such that closing said switch means shorts out the bias on the base of the PNP transistor.

15. A system in accordance with claim **13** wherein the cutting of any line leading to the source of the bias on the base of the PNP transistor interrupts the application of said bias to said transistor.

* * * * *