Sept. 22, 1970 E. O. RESSLER 3,530,455

DOOR CHIME ALARM SYSTEM

Filed March 2, 1967

4 Sheets-Sheet 1

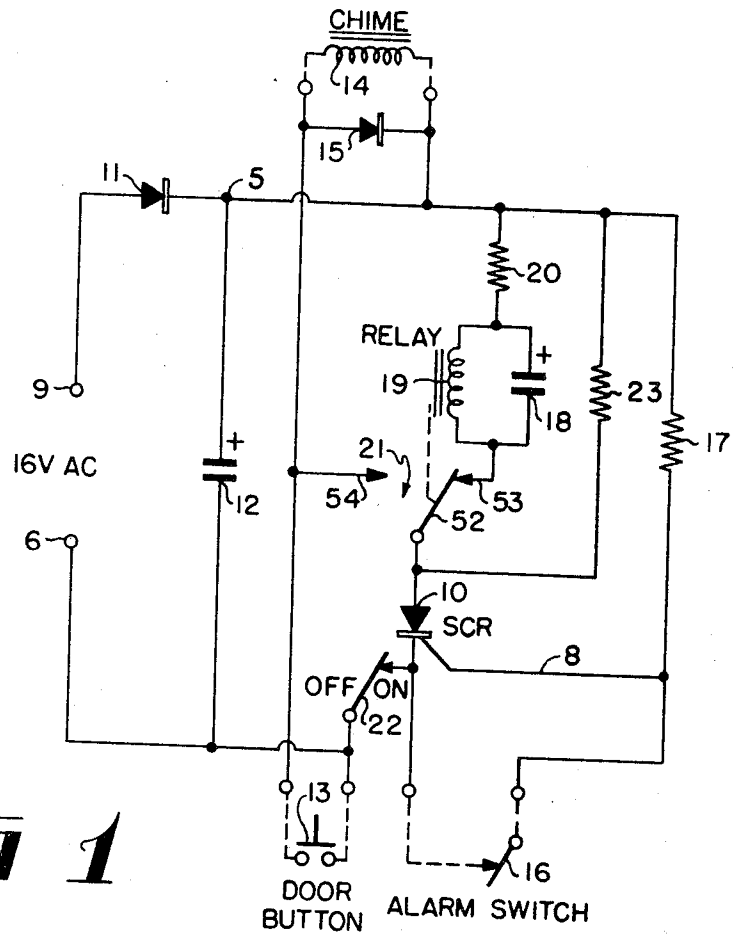

Fig 1

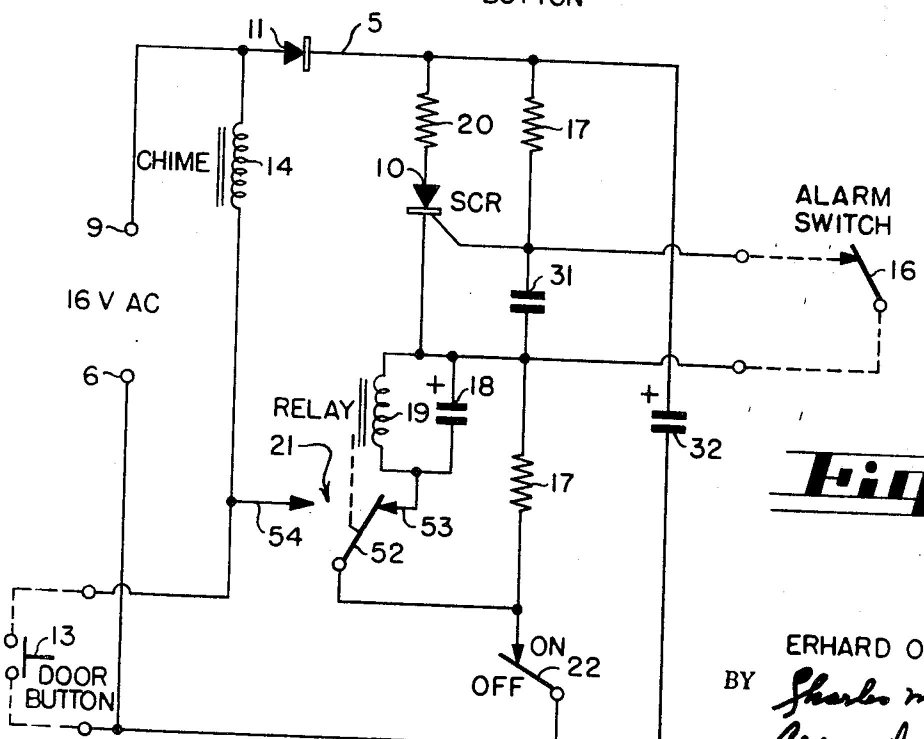

Fig 2

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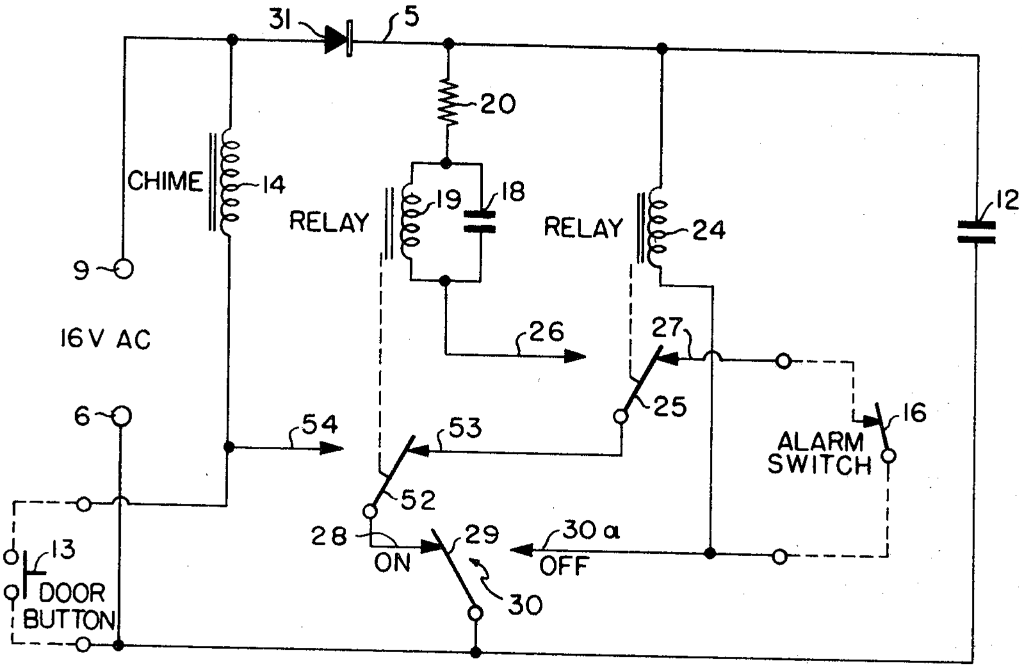

Fig 3

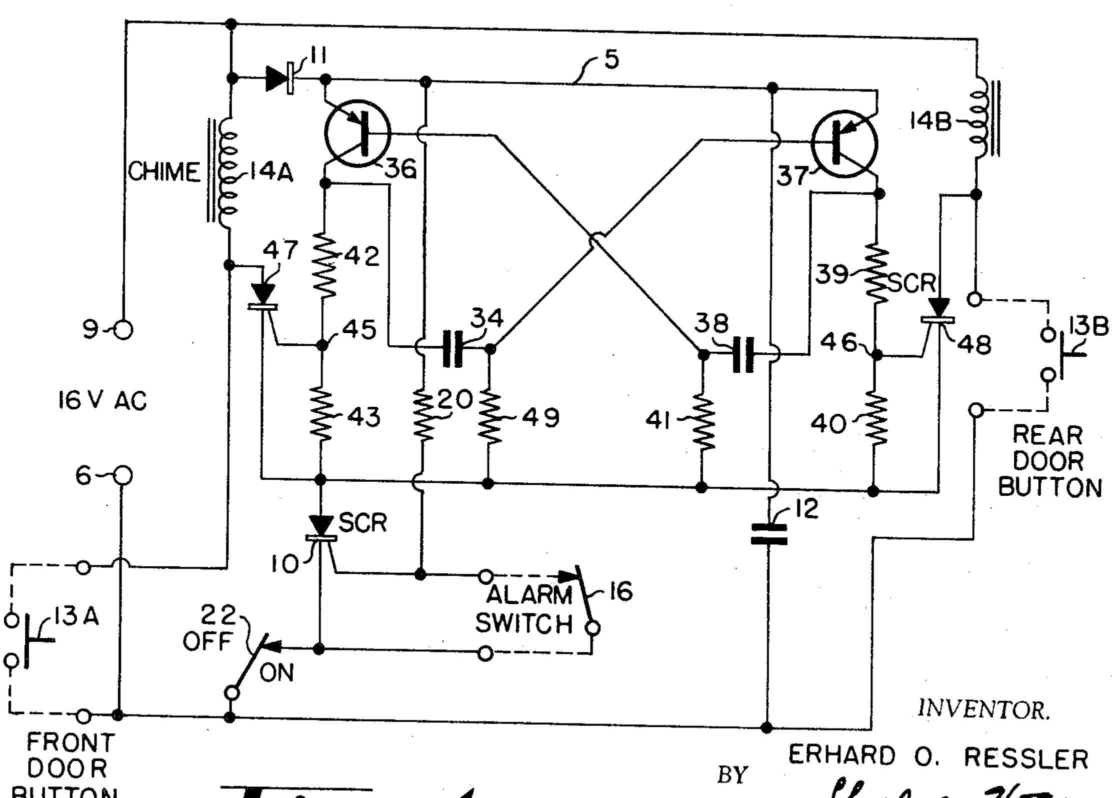

Fig 4

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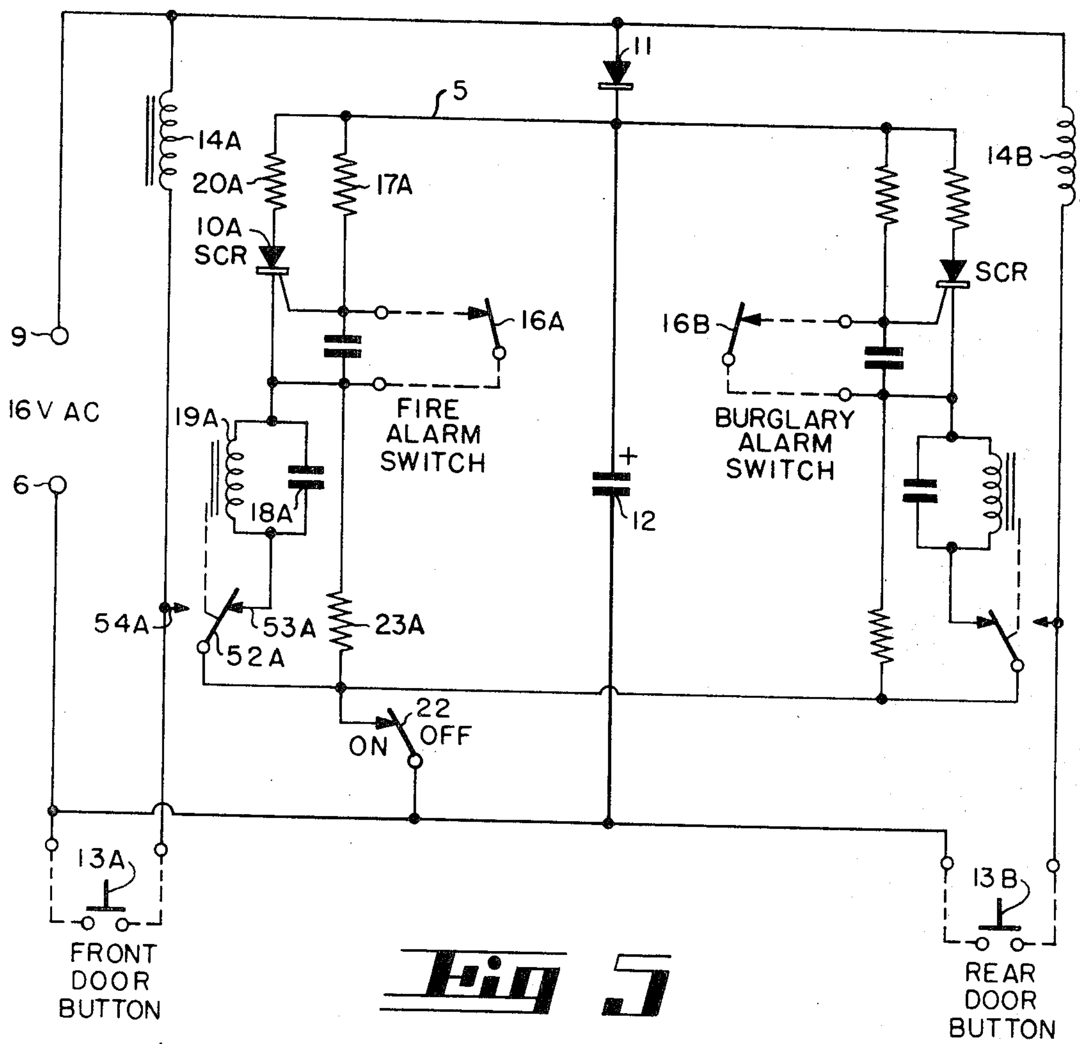

Fig 5

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DOOR CHIME ALARM SYSTEM

Filed March 2, 1967 4 Sheets-Sheet 4

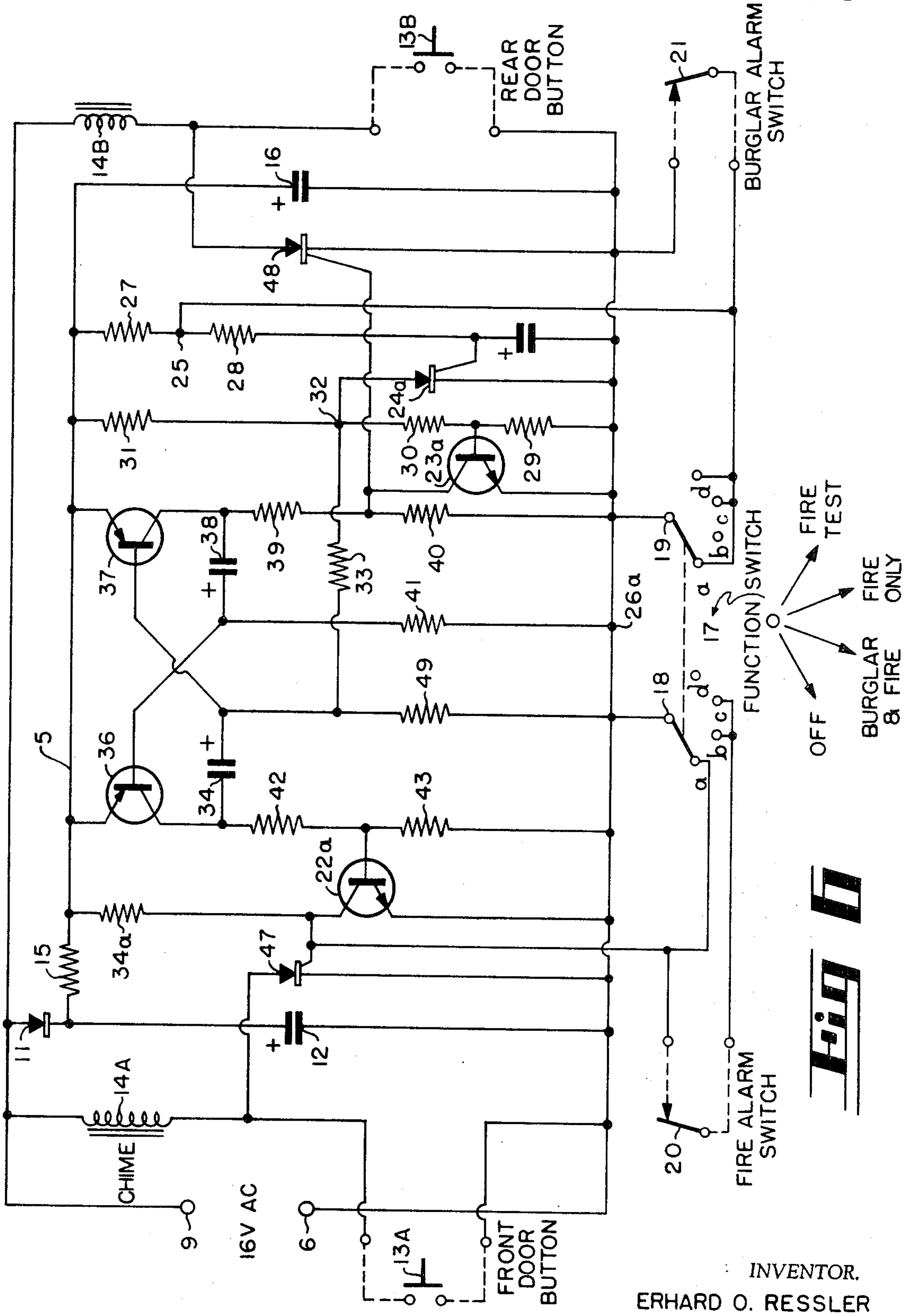

Fig. 6

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DOOR CHIME ALARM SYSTEM

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ABSTRACT OF THE DISCLOSURE

The invention is a system, readily adapted to conventional bell or door chime circuits, which embodies appropriate sensors and electronic control circuitry actuated by a circuit make or break or by an environmental thermal condition to trigger one or more alarm signals so that they will operate continuously until the circuit is reset. The system thereby provides for an alarm to signal any one of a plurality of conditions to which an occupant of a dwelling can respond.

FIELD OF THE INVENTION

The invention relates to alarm systems and is particularly concerned with alarms which are actuated by the occurrence of one or more of a plurality of different changes in the environmental conditions in which the system is established.

A principal object of the invention is to provide a system which will function as a burglar alarm, or a fire alarm, or both, and which is readily adapted for incorporation into and easily installed for use with a conventional door bell or door chime system. Although the invention contemplates a system operative to actuate an audible alarm, it can be adapted to actuate other types of alarm signals such as visual, sensual or olfactory.

Another object is to provide an alarm system which, by the use of electronic components and functions, is simple of manufacture, reliable in operation, economical in its power requirements, and capable of long life without the need for repair or replacement of parts.

DESCRIPTION OF DRAWINGS

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode which has been contemplated of applying that principle. The novel features that are characteristic of the invention itself, however, both as to its organization and method of operation, together with additional objects and advantages thereof, will best be understood from the following description of specific embodiments when read in conjunction with the accompanying drawings, in which:

FIG. 1 is a schematic circuit of a D.C. operated silicon-controlled-rectifier triggered, single tone chime alarm system.

FIG. 2 is a circuit of an A.C. (alternating current) and D.C. (direct current) operated, silicon-controlled-rectifier triggered, single tone system.

FIG. 3 is an alternative circuit in which all functions are performed by a A.C. through relays.

FIG. 4 is illustrative of a system operative through solid state components, without mechanical relays and including a multitone alarm.

FIG. 5 is illustrative of an alarm designed in a dual tone configuration and operable from a plurality of locations.

FIG. 6 is a modification somewhat similar to FIG. 4 with one chime tone and rate of alarm for burglar alarm but a different tone and note for fire alarm.

DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

A typical circuit designed for direct current operation of chime and alarm circuits, triggered by a silicon controlled rectifier (SCR **10**) or gating device is shown in FIG. 1. Alternating current from a standard step-down (110 volt–16 volt) chime transformer (not shown) is available at terminals **6, 9** and is rectified by series diode **11** and filtered by a shunt capacitor **12**. A chime (not shown) is activated by a solenoid or chime activating element **14**. Parenthetically this solenoid is shunted by a diode **15** in order to prevent inductive transients from triggering the silicon controlled rectifier **10**.

The silicon controlled rectifier **10** has an anode, a cathode and a cathode gate. An on-biasing circuit for the silicon controlled rectifier comprises the high potential terminal **5** of the power supply circuit, resistor **17**, a single-pole, single-throw alarm switch **16**, a single-pole, single-throw switch **22**, and the remaining terminal of the power supply. The silicon controlled rectifier is normally held in a nonconductive state by reason of the closure of alarm switch **16** or the closure of a plurality of similar switches **16**, which "shorts" the circuit comprising the cathode and cathode gate of SCR **10**.

The cathode of SCR **10** is in series with switch **22** and its anode is in series with moving contact **52** and fixed contact **53** of a set of relay contacts **21** including contact **54**, with a parallel combination of a relay coil **19** and capacitor **18**, and with a series resistor **20** and high potential power supply terminal **5**. The elements **18, 19** and **21** constitute a cycling switch device. When one of the alarm switches **16** is open, that breaks the short circuit between the cathode and the cathode gate of SCR **10** and the on-biasing circuit exercises control, rendering the SCR conductive.

A charging circuit for capacitor **18** is traced from high potential power supply line **5**, resistor **20**, capacitor **18**, contacts **53** and **52**, the silicon controlled rectifier **10**, switch **22**, and the low potential terminal of the power supply. Capacitor **18** accordingly charges and when the voltage reaches the proper amount relay coil **19** is energized, breaking the charging circuit for the capacitor by moving contact **52** over to contact **54**. At this portion of the cycle a circuit is made from **5** through **14** and **54, 52**, the silicon controlled rectifier and switch **22**, so that the chime is actuated. Capacitor **18** discharges through coil **19** and when the voltage across capacitor **18** is sufficiently low the relay is returned to its normal state, connecting contacts **52** and **53** so as to recharge the capacitor. This cycling action repeats itself inudefinitely until on-off switch **22** is opened by an attendant who responds to the alarm. The proper choice of relay coil **19** resistance, charging capacitor **18** and resistor **20**, determines the rate of cycling and therefore the rate at which the alarm will be actuated. Resistor **23** parallels the circuit including elements **18, 19, 52** and **53** and holds the SCR **10** in conduction during cycling intervals. Resistors **23** is in circuit between terminal **5** and the anode of SCR **10**.

One side of the chime coil **14** is connected to one terminal of the power supply and the other side is in circuit with the other terminal, via door button **13**, when the latter is closed. This permits conventional operation of the door chime.

The circuit of FIG. 2 is designed for A.C. operation of the chime circuit in that the chime solenoid **14** is placed in circuit with the input terminals **9, 6** when the door button **13** is closed. Those elements in series with rectifier **11** are D.C. operated. Elements in the FIG. 2 embodiment, like those of the FIG. 1 embodiment, bear the same reference numerals so that further description thereof is unnecessary except to note that capacitor 31 functions to protect the SCR 10 from transient disturbances.

The door chime is operated on 16 volts A.C. using door button 13 as in a conventional chime installation. Diode 11 and filter capacitor 12 supply D.C. for operation of the alarm circuits. When alarm switch 16 (or one of several like switches connected in series) is opened, gate current passes through resistance 17 and resistance 23 and triggers the SCR 10 into conduction. The cycling process now begins through the action of resistance 20, capacitor 18, and the relay 19. Current flows through elements 20, 10, 18–19, 53, 52 and 22 to charge capacitor 18. When it is charged it opens contacts 52, 53 and capacitor 18 discharges, reclosing contacts 52 and 53. Switch 22 is a control switch to deactivate the circuit. The chime in this circuit is operated on alternating current which not only simplifies alarm connection to existing door chime installations but renders it adaptable for ready installation in places where appropriate wiring to power and connections to operating controls can be accommodated.

The FIG. 3 embodiment resembles FIG. 2 in the sense that the chime is A.C. operated and the other elements are D.C. operated, but it departs primarily in that a relay, having a coil 24 and a moving contact 25 and fixed contacts 26 and 27, is used in lieu of the SCR 10. This is an all-relay-operated alarm circuit with the chime operating on alternating current. As in the previous circuits, diode 11 and capacitor 12 supply D.C. to the alarm circuits. Switch 30 is of the make before break type.

Relay coil 24 is normally energized through alarm switch 16, its own holding contacts 27 and 25, contacts 53 and 52, controlled by relay coil 19, and contacts 28 and 29 of single-pole double-throw switch 30. Opening the alarm switch 16 breaks this circuit, deenergizing relay coil 24, whereupon moving contact 25 is thrown to contact 26, causing capacitor 18 to charge. When the voltage across capacitor 18 reaches the appropriate amount relay coil 19 encircuits contacts 52 and 54, causing coil 14 to sound the chime and the system goes through the same cycle as the FIGS. 1 and 2 circuits. Operating switch 30, bringing contact 29 into contact with contact 32, interrupts the cycling operation.

Referring next to the FIG. 5 version, it provides two distinct tones, and accordingly it has one chime including a coil 14A and another chime including a coil 14B. A fire alarm switch 16A is in the subsystem for the chime coil 14A and a burglar alarm switch 16B is in the subsystem for the chime coil 14B. FIG. 5 is essentially a double version of FIG. 2, except for the elements 11, 12 and 22.

It will be seen by inspection that the elements 10A, 20A, 23A, 16A, 18A, 19A, 52A, 53A, 54A and 17A of FIG. 5 perform the same functions with respect to operation of a distinct chime in the event of fire alarm as do the similarly numbered elements (sans letter suffix) in FIG. 2. Likewise, the similar elements to the right of the diode 11 and capacitor 12 in FIG. 5 function in a similar manner to furnish a chime tone and to actuate chime coil 14B in response to a burglar alarm. The over-all operation of the FIG. 5 embodiment is such that when the fire alarm switch 16A is actuated by reason of the sensing of a fire, then chime coil 14A is actuated. When the burglar alarm switch 16B is actuated by detection of the presence of a burglar, then chime coil 14B is energized. In the FIG. 5 circuit a rear door button 13B may be encircuited with coil 14B and a front door button 14A may be encircuited with chime coil 14A so that distinctive chime tones are also rendered in response to pressing of buttons at the front and rear doors, except that the chimes respond only once to the pressing of each button, whereas the alarm signals are continuous or repetitive.

The FIG. 4 version has some points of similarity to the FIGS. 2 and 3 versions in that the front door button 13A causes the chime coil 14A to be A.C. energized. The FIG. 4 version provides two tones, of which one is caused to be produced by chime coil 14A and the other is caused to be produced by the chime coil 14B. The SCR 10, the biasing resistor 17, the filter capacitor 12, the rectifier 11, and the on-off switch 22 and the alarm switch correspond to the similarly numbered elements in the FIGS. 1 and 2 systems.

The FIG. 4 system is all solid state, and it uses no mechanical relays.

The cycling device in the FIG. 4 system is a multivibrator circuit comprising a pair of PNP type transistors 36 and 37 having their emitters connected together and to the high potential terminal of the D.C. power source. The collector circuit of transistor 37 is coupled to the base of transistor 36 via capacitor 38, the collector load comprising resistors 39 and 40. Transistor 36 has a base resistor 41. Similarly, the collector load of transistor 36 comprises resistors 42 and 43 and that collector load circuit is coupled to the base of transistor 37 by a capacitor 34. Transistor 37 has base resistor 49.

The anode-cathode circuit of the silicon controlled rectifier 10 is disposed between the low potential terminal of the power supply and the multivibrator in such manner that when switch 16 is opened, removing the short from the cathode gate circuit of the SCR 10, then power is supplied to the multivibrator which alternately generates square waves at its output terminals 45 and 46, in a conventional fashion, thereby triggering silicon controlled rectifiers 47 and 48 alternately into conductivity, thereby alternately energizing chime coils 14A and 14B.

The front door button 13A in FIG. 4 is in circuit between the power supply source and chime coil 14A and the rear door button 13B is in circuit between the power supply source and chime coil 14B.

The principle of operation in FIG. 6 differs from that of FIG. 4 in that the multivibrator of FIG. 6 is operative continuously and permanently. As before, the multivibrator is comprised of transistors 36 and 37, capacitors 34 and 38, resistors 39, 40, 41, 42, 43, 49. As previously described, chime coil 14A is activated by SCR 47 or the front door button 13A, while chime coil 14B is activated by SCR 48 or the rear door button 13B. Power is supplied as before from a 16 volt transformer secondary winding (not shown), rectifier 11, filter capacitor 12, dropping resistor 15, filter capacitor 16. The continuously operating multivibrator produces a square wave signal across resistors 43 and 40. A function switch 17 having two poles 18 and 19 and four positions is provided to select the appropriate operating function. A fire alarm switch 20 (or series of switches) and a burglar alarm switch 21 (or series of switches) are encircuited to provide different tone and rate of alarm upon alarm switch operation.

It will now be shown how transistor 22*a* in conjunction with fire alarm switch 20 activates SCR 47 and chime 14A at one rate of alarm, while transistor 23*a* and SCR 24*a* in conjunction with burglar alarm switch 21 activates SCR 48 and chime 14B at a different rate of alarm.

First, consider switch 17 in its "off" position as when in FIG. 6, with moving contacts 18 and 19 in the *a* position. Switch contacts 18 and 19 are connected to the common ground potential 26*a*. When switch 17 is in the *a* position the collector of transistor 22*a* and the gate terminal of SCR 47 are grounded. This prevents the square wave across resistor 43 from triggering SCR 47. Point 25 between resistors 27 and 28 is also grounded and thereby prevents SCR 24*a* from conducting. With SCR 24*a* nonconductive, point 32 is free to rise to a potential determined by the values of resistors 31, 30, 29. Base current into transistor 23*a* causes its collector to saturate. The low saturation voltage of transistor 23*a* holds the gate terminal of SCR 48 from being triggered into conduction by the square wave across resistor 40.

Now consider switch 17 in the *b* position which constitutes "Burglar and Fire" alert position. By tracing the circuit from moving contact 18 via fixed contact *b* and fire alarm switch 20, it can be seen that the gate terminal of SCR 47 is connected to ground potential 26*a* until fire alarm switch **20** is opened by temperature rise. The square wave across resistor **43** can now activate SCR **47** via transistor **22***a* and its collector resistor **34***a*. Chime **14***a* is in turn activated through SCR **47** at a rate determined by the multivibrator and its circuit components. It will be recalled that point **32** was free to rise to a potential determined by resistors **31**, **30**, and **29** due to the effect of SCR **24***a* being in its nonconductive state. Resistor **33** is connected between point **32** and the base of transistor **37** and so provides a base potential determined by the value of resistor **33** and potential point **32**.

The multivibrator frequency thus established is different from that which would result from a conductive state of SCR **24***a*. The conductive state of SCR **24***a* is produced by an opening of burglar alarm switch **21** which allows point **25** to rise to a potential determined by resistors **27** and **28**. SCR **24***a* is now triggered into conduction. Potential point **32** moves toward the common potential **26***a* causing transistor **23***a* to cease conduction by stopping base current flow via resistor **30**. With transistor **23***a* in the nonconductive state the gate terminal of SCR **48** is allowed to follow the square wave across resistor **40**. SCR **48** is now activated at a rate determined by the multivibrator frequency and so activates chime **14B**. The multivibrator frequency is determined to some extent by the potential at point **32** as described earlier. This potential at point **32** depends upon the state of SCR **24***a* which in turn depends upon the state of burglar alarm switch **21**.

In the circuit embodiment of FIG. 6 the alarm rate during burglar alarm is about twice that of the alarm rate during fire alarm. Thus there are two distinct differences between fire and burglar alarm, the difference in chime tone frequency and the difference in rate of chime actuation.

The remaining two positions of switch **17** serve the convenience of the user of the equipment. In position *c* moving contact **19** shorts out burglar alarm switch **21** to allow opening of protected doors and windows without setting off the alarm. Position *d* allows testing of fire alarm condition without activating temperature sensitive switch **20**.

The specific circuit embodiment of FIG. 6 is a two tone, two rate alarm device. It is so designed that a single tone, two rate alarm device may be derived from it by omitting chime **14***a*, SCR **47**, transistor **22***a* and resistor **34***a* and effecting a slightly different connection of the emitter circuit of transistor **23***a*. This particular feature facilitates economical production of two tone and single tone alarm devices by using an optimum number of common components and circuit connections.

It will also be understood that the signal-actuating condition, whether initiated by a burglar or a fire, or a flood condition, is to be established by known means such as make or break switches installed at windows or doors, thermally actuated switches or float valves located at appropriate places and levels inside or outside of the builting in which the invention is utilized.

The word "chime" as used herein is intended to cover obvious equivalents such as door bells or like signaling devices.

I claim:

1. A combined door chime and alarm system comprising a source of power,

a door switch,

means for connecting said door switch and chime in series across said source,

an alarm switch,

a silicon controlled rectifier gating device having an anode and a cathode and a gate element,

said alarm switch being connected between said cathode and gate element so as normally to disable said silicon controlled rectifier,

an on-biasing circuit for said silicon controlled rectifier comprising, in series combination, a first resistor connected to said gate and a normally closed "on-off" switch connected to said cathode, said series combination being coupled across said source, where by in response to opening of the alarm switch said silicon controlled rectifier is enabled,

a relay device having a coil and first and second fixed contacts and a moving contact, said contacts being arranged selectively to encircuit the anode of said silicon controlled rectifier either with said chime or with said coil,

the first fixed contact being connected to the chime and the second fixed contact being connected to the coil and the moving contact being in circuit with the anode of the rectifier,

the moving contact normally touching said second fixed contact,

a time-constant circuit for energizing said coil and comprising a second resistor and a capacitor, said resistor and said coil and said rectifier being connected in series with said on-off switch and said source, the capacitor being connected across said coil, whereby when the alarm switch opens the silicon controlled rectifier becomes conductive and the capacitor is charged and activates the coil to move said moving contact over to the first fixed contact to activate the chime and to permit the capacitor to discharge through the coil whereby the coil becomes deactivated, and

a third resistor connected between said anode and said source for completing an energizing circuit through said rectifier and keeping the rectifier conductive when the moving contact is not in contact with the second contact.

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