Dec. 30, 1969 J. C. MIDKIFF 3,487,404

COMBINED FIRE ALARM, BURGLAR ALARM, AND INTERCOMMUNICATION SYSTEM

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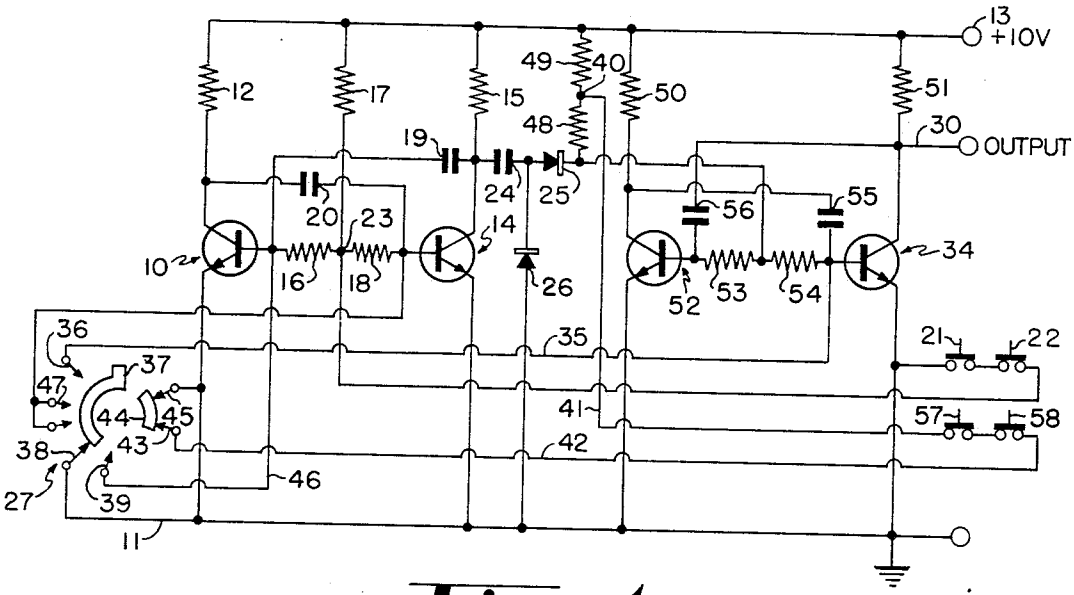

Fig 1

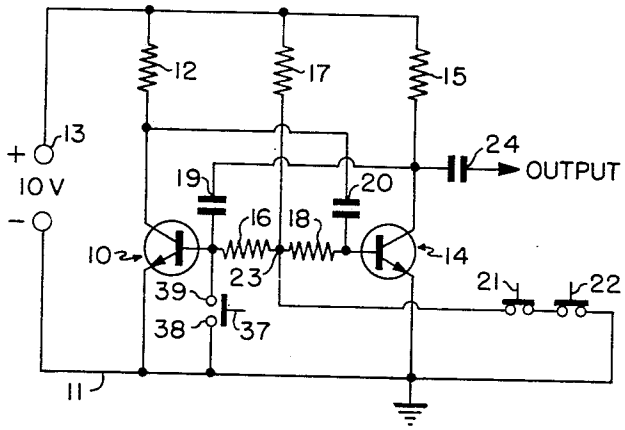

Fig 2

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COMBINED FIRE ALARM, BURGLAR ALARM, AND INTERCOMMUNICATION SYSTEM

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U.S. Cl. 340—416 3 Claims

ABSTRACT OF THE DISCLOSURE

A latching multivibrator provides an audio tone of a given frequency when a fire sensor, associated with that multivibrator, is activated. A second latching multivibrator provides a tone of another frequency when a burglar sensor, associated with the second multivibrator, is activated. The output of the second-mentioned multivibrator is utilized to modulate the output of the first-mentioned multivibrator when a burglary is sensed, the second multivibrator being then utilized to start the first. The inventive combination includes a rotary action control switch which has four positions, a first position for permitting a response either to fire or burglary, a second position for "off" or resetting functions, a third position for permitting a response to fire only, and a fourth position in which the operation of the first-mentioned multivibrator is tested.

BACKGROUND OF THE INVENTION

The present invention provides control circuitry which, when used in conjunction with an intercommunication system having a sound channel, provides means for detecting such undesired hazards as burglary or fire, and adds these additional functions to the normal function of an intercommunication system.

The prior art includes many arrangements for providing an audio tone in response to the sensing of a fire and coupling that audio tone into the loud speakers of an intercommunication system. Such a system is shown, for example in United States patent to Wooten, No. 2,942,245.

The present invention provides an arrangement which furnishes an alarm in the event of either burglary or fire. In the system of the present invention there is a relatively small number of components. The present invention uses solid state active elements and latching multivibrators, which assure that an alarm, once rendered, will continue to be given until a human operator intervenes and resets the system.

The present invention further includes a rotary switch device operative to provide the functions mentioned in the abstract set forth above.

DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention, together with other and further objects, advantages and capabilities thereof, reference is made to the following description of the accompanying drawings, in which:

FIG. 1 is a circuit schematic of a combined burglar and fire alarm circuit in accordance with the present invention; and

FIG. 2 is a circuit schematic of a representative one of the two latching multivibrators incorporated in the system.

DETAILED DESCRIPTION OF THE INVENTION

The thesis of the invention is that upon actuation, sensors such as **21** and **22** for burglary and **57** and **58** for fire, drive a radio intercommunication system into rapid continuous alarm, with "on-off" tones characteristic of either burglary or fire. Once triggered, the alarm operates indefinitely until to control switch is turned to a reset position.

Detection of burlary is achieved by the use of switch sensors, normally closed, located at doors and windows, such as the elements designated by the reference numerals **21** and **22**. Burglary alarm sensors are per se well known in the art and are normally closed switches which are mechanically or electrically opened by a disturbance caused by a burglary.

Detection of fire is achieved through the use of normally closed thermal switches located at strategic environmental positions throughout the building or home containing the switches. Fire sensors are also per se well known to those in the art and are essentially thermally operated switches which automatically open at an elevated temperature such as 130° F., for example. See **57** and **58**.

The control circuitry in accordance with the present invention is so arranged that the burglary alarm has a distinctly different tone than the fire alarm. By reason of this the home owner can distinguish the type of hazard to which he is alerted and can initiate appropriate protective action.

The invention can operate equally well with any type of intercommunication system having an audio channel and speaker system, such, for example, as an intercommunication system including a built-in radio receiver or one including an audio amplifier of some kind. In either event the output of the system herein disclosed is applied to an audio amplifier for the purpose of providing audible signals.

In accordance wtih the invetnion the audible alarm for the indication of fire consists of a 1000 cycle audio tone while the audible alarm indicating the presence of a burglar consists of that tone, modulated at a lower frequency, that is to say, a wavering audible tone.

The invention utilizes latching multivibrators. Once triggered, an alarm is maintained even though the sensing circuit is restored to normal.

Referring now specifically to FIG. 1 of the drawings, there will be seen a 5 cycle latching multivibrator comprising transistors **10** and **14** and a 1000 cycle latching multivibrator comprising transistors **52** and **34**, together with a rotary switch **27**. The burglar sensors **21** and **22** are connected in series between ground and the junction of resistors **16** and **18**. The fire sensors **57** and **58** are connected in series between point **40** and contact **43** of the switch, which is grounded during normal operation. As shown in FIG. 1, the system will respond to a momentary opening of either of the two sensor circuits in order to provide an audible alarm.

When either of the burglar sensors **21** and **22** is open, the multivibrator comprising transistors **10** and **14** will start and remain on. The output of the multivibrator is coupled through capacitor **24** and diode **25** to a resistor **48**, to produce a pulsating positive voltage across resistor **48** which is applied to the bases of transistors **52** and **34**. This voltage starts the multivibrator comprising the transistors **52** and **34** and modulates its frequency at a 5 cycle rate. If one of the fire sensors **57** or **58** only is activated, the 1000 cycle multivibrator comprising transistors **52** and **34** alone will start and will remain on. This multivibrator cannot start the five cycle multivibrator because of the presence of diodes **25** and **26**. That is, in response to a sensing of fire, the 1000 cycle multivibrator furnishes an "off-on" tone. In response to the sensing of the presence of a burglar, this 1000 cycle tone is modulated at 5 cycles by the 5 cycle multivibrator, so that a wavering tone is produced.

NPN transistor 10 has an emitter connected to ground 11 and a collector in circuit, via resistor 12, with the positive terminal 13 of the power supply. NPN transistor 14 has an emitter connected to ground 11 and a collector connected to terminal 13 via resistance 15. It will be seen that both collectors are biased in the nonconductive direction. The base bias network for transistor 10 comprises resistors 16 and 17 and the base bias network for transistor 14 comprises resistors 18 and 17, resistor 17 being connected between terminal 13 and the junction of resistors 16 and 18. A capacitor 19 is connected between the collector of transistor 14 and the base of transistor 10 and capacitor 20 is connected between the collector of transistor 10 and the base of transistor 14.

In the ready state of this circuit transistors 10 and 14 are cut off and capacitors 19 and 20 are charged to the full power supply voltage of plus 10 volts. The junction of resistors 16, 17 and 18 is held at ground potential by reason of the sensing switches 21 and 22, which are connected in series between point 23 and grounded conductor 11.

When any one of the burglary sensing switches 21, 22 is open, then a positive potential is available at point 23 and the bases of both transistors are positively biased relative to ground so that the circuit of transistors 10, 14 then operates as a conventional multivibrator producing a square wave output at the collector of transistor 14 which is applied across resistor 48 via coupling capacitor 24.

Even when the opened sensing switch 21 or 22, as the case may be, is closed, grounding point 23, the multivibrator will continue to operate, in what is called a latching state. That is, the multivibrator comprising 10 and 14. Let it be assumed that transistor 10 has just changed from a conducting to a cut-off state, whereupon capacitor 20 begins to charge through the emitter to base circuit of transistor 14 and resistor 12. Transistor 14 will be saturated until capacitor 20 is almost completely charged and capacitor 19 will discharge through resistors 16 and 18 and produce a reverse bias to cut off transistor 10 as transistor 14 is saturated. After capacitor 20 is charged transistor 14 will no longer be saturated and capacitor 19 will now begin to charge through the emitter to base circuit of transistor 10 and resistor 15. Transistor 10 will now be saturated and transistor 14 will be cut off by reason of the discharge of capacitor 20 through resistors 16 and 18. After capacitor 19 has completely charged, transistor 10 will cut off and this cycle will continue until the reset switch 27, which is closed to connect the base of transistor 10 to ground 11, is actually closed, connecting 39 and 38.

The 1000 cycle multivibrator comprises the following circuit elements, each element referred to in the following table being generally similar to that opposite it in the five cycle multivibrator column, as tabulated below.

5 cycle multivibrator:	1000 cycle multivibrator
17	48, 49
12	50
15	51
10	52
16	53
18	54
14	34
20	55
19	56

NPN transistor 52 has an emitter connected to ground 11 and a collector in circuit, via resistor 50, with the positive terminal 13 of the power supply. NPN transistor 34 has an emitter connected to ground 11, and a collector connected to terminal 13 via resistance 51. It will be seen that both collectors are biased inthe nonconductive direction. The base bias network for transistor 52 comprises resistors 53 and 48, 49 and the base bias network for transistor 34 comprises resistors 54 and 48, 49, resistors 48, 49 being connected between terminal 13 and the junction of resistors 53 and 54. A capacitor 56 is connected between the collector of transistor 34 and the base of transistor 52 and capacitor 55 is connected between the collector of transistor 52 and the base of transistor 34.

In the ready state of this circuit transistors 52 and 34 are cut off and capacitors 56 and 55 are charged to the full power supply voltage of plus 10 volts. The junction of resistors 48 and 49 is held at ground potential by reason of the sensing switches 57 and 58, which are connected in series between point 40 and conductor 42, grounded via 43, 44, 45 and 11.

When any one of the fire sensing switches 57 or 58 is open, then a positive potential is available at point 40 and the bases of both transistors 52 and 34 are positively biased relative to ground so that the circuit then operates as a conventional multivibrator producing a square wave output at the collector of transistor 34 which is applied to an audio amplifier (not shown).

Even when the opened sensing switch 57 or 58, as the case may be, is closed, grounding point 40, the multivibrator including transistor 52 and 34 will continue to operate, in what is called a latching state. Let it be assumed that transistor 52 has just changed from a conducting to a cut-off state, whereupon capacitor 55 begins to charge through the emitter to base circuit of transistor 34 and resistor 50. Transistor 34 will be saturated until capacitor 55 is almost completely charged and capacitor 56 will discharge through resistors 53 and 54 and produce a reverse bias to cut off transistor 52 as long as transistor 34 is saturated. After capacitor 55 is charged transistor 34 will no longer be saturated and capacitor 56 will now begin to charge through the emitter to base circuit of transistor 52 and resistor 51. Transistor 52 will now be saturated and transistor 34 will be cut off by reason of the discharge of capacitor 55 through resistors 53 and 54. After capacitor 56 has completely charged, transistor 52 will cut off and this cycle will continue until the switch contacts 36, 37, 38 which are closed to connect the base of transistor 34 to ground 11, are actually closed.

In the switch position shown in FIG. 1 the fire sensor switch circuit is closed between junction point 40 and ground by conductor 41, conductor 42 and contacts 43, 44 and 45. This position is the normal operating position in which circuitry responds either to the sensing of a fire or the sensing of an unlawful entry by a burglar.

In the first position counterclockwise to that shown the base of transistor 34 is grounded via conductor 35, contact 36, contact 37 and contact 38, and the base of transistor 10 is grounded via contact 39, contact 37 and contact 38. This is the off or reset position of switch 27.

In the "fire only" (two steps counterclockwise) position of the switch 27 the base of transistor 10 is grounded via conductor 46 and contacts 39 and 38 and the base of transistor 14 is grounded via contacts 47, 37 and 38. This is the "fire only" position.

In the fire test position (three steps counterclockwise) the fire sensor circuit will open because conductor 42 cannot be grounded.

The series diode 25, in series between capacitor 24 and resistor 48, is poled to pass positive voltages to resistor 48 and the shunt diode 26 is poled not to short out such voltages. However, these diodes prevent signal outputs from the 1000 multivibrator from starting the 5 cycle multivibrator.

It will be understood that the output terminal marked 30 in FIG. 1 and the grounded line 11 constitute signal output terminals that provide the audio tones hereinabove described. These outputs are applied to the input of any conventional sound channel system that includes an audio amplifier. The postulate of this discussion is that the audio amplifier (not shown) is suitably ready for operation or capable of being triggered into operation by the presence of the audio signals produced by the FIG. 1 circuit. Audio amplifying systems and radio communication systems are

per se well known to those skilled in the art and therefore are not described herein.

I claim:

1. A system for furnishing to an existing sound communications channel characteristic signals indicative of the presence of either a burglary hazard or a fire hazard comprising in combination:

signal generating means in the form of a first latching multivibrator for producing a characteristic signal capable of being modulated,

modulating means in the form of a second latching multivibrator for producing a modulating signal,

first sensing means responsive to one of said hazards for initiating operation of the signal generating means to produce said characteristic signal in unmodulated form, and

second sensing means responsive to the other hazard for initiating operation of the modulating means, the modulating means being coupled to the signal generating means so that the modulating means starts the signal generating means and modulates the signal which it produces, said signal generating means being adapted to be coupled to said communications channel,

means for so biasing each of said multivibrators that it continues operation until disabled, and

switching means for disabling said multivibrators.

2. A system for furnishing to an existing sound communications channel characteristic signals indicative of the presence of either a burglary hazard or a fire hazard comprising in combination:

a source of current having positive and negative signals,

signal generating means for producing a characteristic signal capable of being modulated,

modulating means for producing a modulating signal,

each of the modulating means and the signal generating means comprising a first transistor having an emitter and collector and base, load resistors for the collectors, capacitors intercoupling the base of each transistor with the collector of the other, and a T-shaped resistance network providing a junction and having its ends connected to said positive terminal and said bases,

fire sensing means responsive to a fire hazard for initiating operation of the signal generating means to produce said characteristic signal in unmodulated form, and

burglary sensing means responsive to the burglary hazard for initiating operation of the modulating means, the modulating means being coupled to the signal generating means so that the modulating means starts the signal generating means and modulates the signal which it produces, said signal generating means being adapted to be coupled to said communications channel, and

means for encircuiting the burglary sensing means with the modulating means comprising a series connection of the burglary sensing means between said junction and ground,

the fire sensing means being adapted to be connected between ground and a potential point between the positive terminal and the junction of the T-shaped resistance network associated with the signal generating means.

3. The combination in accordance with claim 2 and a switch having four positions and contacts adapted to make circuits as follows:

in the first position, to connect the fire sensing means between ground and said point,

in the four position, to disconnect the fire sensors transistor associated with the modulating means and the second transistor associated with the signal generating means,

in the third position, to ground the bases of both transistors of the modulating means, and

in the fourth position, to disconnect the first sensors from ground.

References Cited

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JOHN W. CALDWELL, Primary Examiner

PERRY PALAN, Assistant Examiner

U.S. Cl. X.R.

331—47; 332—16; 340—220, 276, 384, 420

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,487,404 December 30, 1969

James C. Midkiff

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 4, "to", first occurrence, should read -- a --; line 34, "invetnion" should read -- invention --. Column 3, line 40, "long as" should be inserted at the beginning of the line; line 71, "inthe" should read -- in the --. Column 6, Claim 3 should appear as shown below:

3. The combination in accordance with Claim 2 and a switch having four positions and contacts adapted to make circuits as follows:

in the first position, to connect the fire sensing means between ground and said point,

in the second position, to ground the bases of the first transistor associated with the modulating means and the second transistor associated with the signal generating means,

in the third position, to ground the bases of both transistors of the modulating means, and

in the fourth position, to disconnect the fire sensors from ground.

Signed and sealed this 9th day of June 1970.

(SEAL)

Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents