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3,495,231

ALARM SYSTEM

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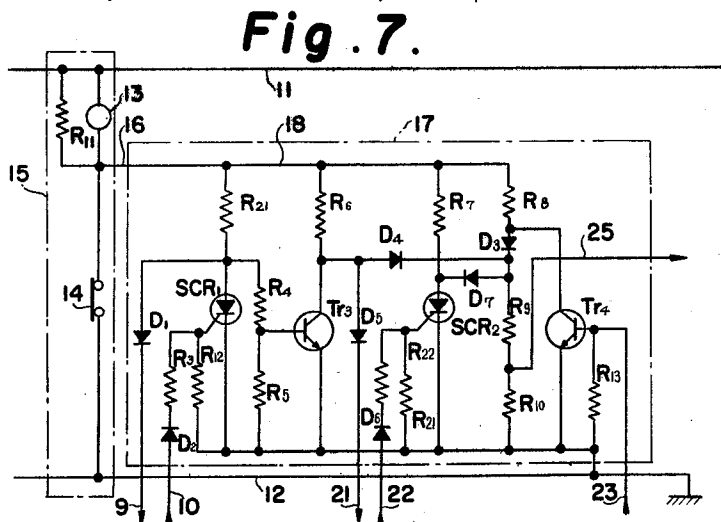
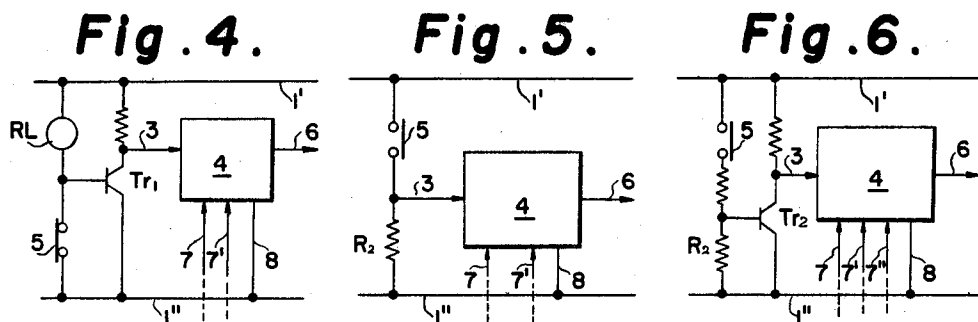
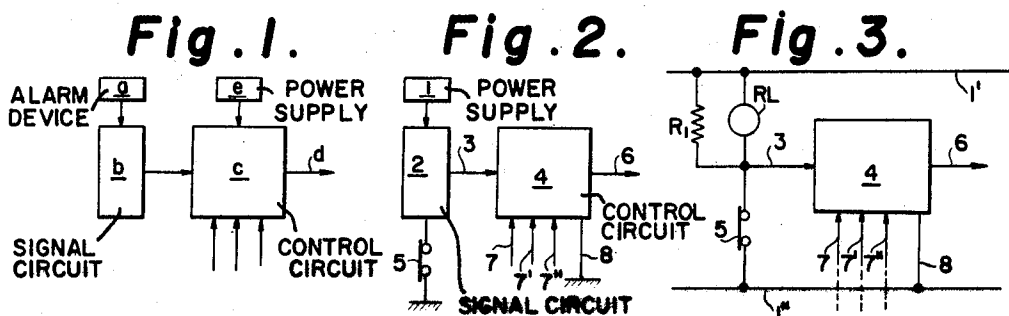
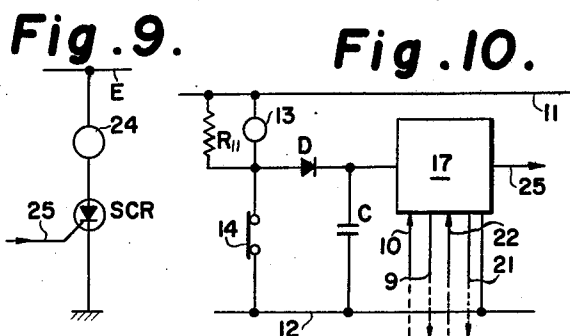
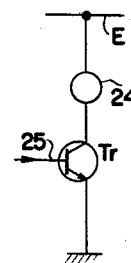


Fig. 8.



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1

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ALARM SYSTEM

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1 Claim

ABSTRACT OF THE DISCLOSURE

A signal device including a parallel connected electric lamp and resistor and an abnormal condition responsive normally closed electric contact. The contact and lamp are connected in series across a supply source. At the junction of the contact and the lamp is connected a control circuit which is normally short circuited by the contact but upon the occurrence of the abnormal condition will be energized from said source of supply. The control circuit acts on a second lamp which will flicker in response to an alarm condition. Means are provided to provide an alarm stopping signal, and to stop the lamp flicker.

This invention relates to an alarm or supervisory device which operates an alarm device such as an electric bell or buzzer or lamp in response to the occurrence of an abnormal condition. Usually such an alarm system comprises a signalling device which operates to transmit a signal to a control circuit to energize an alarm device of the type mentioned above. In order to insure quick response the signalling device as well as the control circuit should be maintained normally energized. This results in substantial waste of electric power and hence shortens the working life of electric components utilized in the system.

Accordingly, it is the principal object of this invention to reduce such a waste of electric power and elongate the working life of electric elements.

An object of this invention is to provide a novel alarm device which can provide an alarm signal and can also flicker an abnormal condition indicating lamp.

According to this invention the signalling device is constructed and arranged such that it effectively deenergizes or short circuits the control circuit but operates to energize it only when the signalling device is operated in response to the occurrence of an abnormal condition.

In one preferred embodiment of this invention, the signal device includes a parallel connected electric lamp and a resistor and an abnormal condition responsive normally closed electric contact or switch, said contact and lamp being connected in series a source of supply, and the common junction between the contact and the lamp is connected to the control circuit. Thus, the control circuit is normally short circuited by the contact but upon occurrence of the abnormal condition will be energized from said source of supply by the opening of said contact.

In another example of this invention the control circuit comprises means to supply an alarm signal when said control signal is energized, means to stop said alarm signal, an abnormal condition indicating lamp, means to cause said lamp to flicker when said control circuit is energized, means to supply an alarm signal stopping sig-

2

nal to cease said supply of alarm signal, means to supply an alarm confirming signal when said supply of alarm signal is ceased and at the same time to supply a steady voltage to said abnormal condition indicating lamp to stop the flicker, and means responsive to an operation stopping signal supplied from outside to said control circuit to deenergize said indicating lamp.

While the specification concludes with a claim particularly pointing out and distinctly claiming the subject matter of this invention, it is believed that the invention will be better understood from the following description taken in connection with the accompanying drawings in which:

FIG. 1 is a block diagram illustrating one example of a prior art alarm device;

FIG. 2 shows a block diagram to explain the principle of this invention;

FIGS. 3, 4, 5 and 6 show block diagrams of various embodiments of this invention;

FIG. 7 shows the detail of the control circuit embodying this invention;

FIGS. 8 and 9 show two examples of abnormal condition indicating lamp circuits which are to be energized by the outputs from the control circuit shown in FIG. 7; and

FIG. 10 shows a block diagram of a modification of the embodiment shown in FIG. 7.

As diagrammatically represented by FIG. 1, in a prior art alarm or supervisory device a signalling circuit *b* is normally energized from a source of supply *a* to transmit alarm signals to a control circuit *c* upon occurrence of an abnormal condition. The control circuit *c* is normally energized from a source of supply *e* so that the control circuit *c* can operate to supply an output signal *d* to an alarming device such as an electric lamp or a buzzer, not shown, whenever it receives an alarm signal from the signalling circuit *b*. In this manner, since the control circuit *c* is normally maintained in the energized state with the result that the control circuit *c* not only consumes large quantity of electric power but also shortens the useful life of the circuit element thereof. In addition, there is a fear that the control circuit *c* malfunctions owing to external disturbances or noises other than the abnormal or alarm signals.

It is the principal object of this invention to eliminate such disadvantages of the prior art alarming device and according to one embodiment of this invention which is diagrammatically shown in FIG. 2, while a signal circuit *2* is normally connected to a source of supply *1* to provide an output to a control circuit *4*, the responsive device such as a transistor contained in the control circuit *4* is not normally connected to a source of supply as in the prior art device. According to this invention, an electric contact or switch *5* disposed to be actuated in response to the occurrence of abnormal conditions is provided so as to normally by-pass the output conductor *3* leading to the control circuit *4*. More particularly, in the absence of an abnormal condition the contact *5* is held closed to short circuit the control circuit *4*, thus preventing it from being energized. However, upon occurrence of an abnormal condition the contact *5* is opened to energize the control circuit *4* via the output conductor *3* whereby a signal lamp or a buzzer, not shown, will be energized by an output conductor *6*. Signal lines *7*, *7'* and *7''* are also connected to the control circuit *4* to energize

3

or deenergize the alarming or signal lamp and the like by other abnormal conditions.

FIG. 3 shows the embodiment of FIG. 2 in more detail wherein a lamp RL for indicating the normal condition which is connected in parallel with a resistor R_1 is connected in series with said abnormal condition responsive contact 5 across supply conductors 1' and 1''. The purpose of the resistor R_1 connected in parallel with the lamp RL is to assure continuous supply of electric power even when the filament of the lamp RL becomes broken. The junction between the lamp RL and the contact 5 is connected to one input terminal of the control circuit 4 via the output conductor 3.

In the arrangement shown in FIG. 3, the contact 5 is maintained closed under normal condition so that no operating voltage will be supplied to the control circuit 4 over the output conductor 3. However, when the contact is opened in response to an abnormal condition, the control circuit 4 will be connected across supply conductors 1' and 1'' via parallel connected lamp RL and the resistor R_1 , the output conductor 3 and a return conductor 8. The current flowing through the lamp RL at this time is much smaller than that flows when the contact 5 is closed, so that the intensity of light emanated from the lamp RL becomes so small as to be visible or will be reduced to a value that can be clearly distinguished from the intensity under normal condition.

In the modification shown in FIG. 4 a transistor Tr_1 is included in the output conductor 3 to amplify the signal for operating the control circuit 4.

In further modifications shown in FIGS. 5 and 6 a normal open type contact 5 is connected in series with a current limiting resistor R_2 across supply line 1' and 1'', the output conductor 3 leading to the control circuit 4 being connected to the junction between the contact 5 and the resistor R_2 . FIG. 6 is identical to FIG. 5 except that it has a transistor Tr_2 in the output conductor 3.

Thus, with the arrangements shown in FIGS. 5 and 6 the control circuit 4 will be energized only when the contact 5 is closed in response to the occurrence of fault, thus preventing undesirable consumption of power in the absence of fault.

As can be clearly noted from various embodiments described above, since in accordance with this invention an abnormal condition responsive contact 5 or switch is provided for the signalling circuit 2 so as to energize a control circuit 4 by the operation of said contact in response to the occurrence of a fault, the control circuit will not be misoperated by any noise coming from outside during the normal state. However, upon occurrence of an abnormal condition the contact will be brought to a position to supply power to the control circuit 4. Further as the control circuit 4 is maintained in the deenergized state under normal condition, its power consumption is small and the life of its component elements can be prolonged.

FIG. 7 shows a circuit diagram of one example of an alarm circuit utilizing the principle of this invention. In this case, a running or normal condition indicating lamp 13 and a contact 14 which is connected in series with the lamp 13 and is arranged to be opened upon occurrence of an abnormal condition are connected across source conductors 11 and 12, the latter conductor being grounded. In parallel with the running condition indicating lamp 13 is connected a resistor R_{11} , thus completing a signal circuit 15. A signal output circuit or conductor 16 is connected between the junction of the lamp 13 and the normal close contact 14, said output conductor 16 being connected to an input conductor 18 of a control circuit 17. A resistor R_2 and a first silicon controlled rectifier element SCR_1 are connected in series between the input conductor 18 and a grounded conductor 12 and a junction between these elements is connected to a conductor 9 for energizing an electric bell or other similar alarming device via a diode D_1 . The gate electrode of the silicon controlled rectifier element SCR_1 which is

4

grounded through a resistor R_{12} is connected to a conductor to receive a bell stopping signal through a resistor R_3 and a diode D_2 . The junction between the resistor R_{21} and the anode electrode of the silicon controlled rectifier element SCR_1 is grounded through serially connected resistor R_4 and R_5 so that the base electrode of a first transistor Tr_3 may be energized from the junction of these resistors. This transistor Tr_3 is connected between conductors 18 and 12 in series with a resistor R_6 . Also parallel branches each consisting of a resistor 7 and a second silicon controlled rectifier element SCR_2 ; a resistor R_8 , a diode D_3 and resistors R_9 and R_{10} , respectively are connected between the conductors 18 and 12. The junction between the resistor R_6 and the transistor Tr_3 is connected to the junction between the diode D_3 and the resistor R_9 via diode D_4 and is also connected to transmit an alarm confirming signal to a conductor 21 through a diode D_5 . The gate electrode of the second silicon controlled rectifier element SCR_2 which is grounded through a resistor R_{21} is connected to a conductor 22 to receive an operation stopping signal through a diode D_6 and a resistor R_{22} . Also as shown in FIG. 7, the anode electrode of the silicon controlled rectifier element SCR_2 is connected to the upper end of the resistor R_9 via a diode D_7 , and a second transistor Tr_4 is connected between the junction between the resistor R_8 and the diode D_3 and the grounded conductor 2, the base electrode of this transistor Tr_4 which is grounded through a resistor R_{13} being arranged to receive flicker signals from a conductor 23 via a resistor R_{13} . A conductor 25 leading to an abnormal condition indicating lamp 24, to be described later in connection with FIG. 8, is connected to the junction between resistors R_9 and R_{10} .

In operation, so long as the condition is normal, the contact 14 will be maintained closed to short circuit the output conductor 16. Accordingly, since the control circuit 17 is not energized by any input, it would not be operated by any external noise or signal. Upon occurrence of a fault, the contact 14 will be opened, whereby an electric bell or buzzer, not shown, will be energized by a current flowing through a circuit which can be traced from the conductor 11, parallel connected lamp 13 and the resistor R_{11} , the resistor R_2 , the diode D_1 and the conductor 9. At the same time, while a current flows through the branch including the resistor R_8 , the diode D_3 , and resistors R_9 and R_{10} since the transistor Tr_4 is repeatedly turned on and off under the control of a flicker signal R_{13} supplied from the conductor 23, at the instant when the transistor Tr_4 is on the serially connected elements D_3 , R_9 and R_{10} which are connected in parallel with the transistor Tr_4 will be short circuited thus effectively reducing to zero the voltage appearing on the output conductor 25. Whereas when the transistor Tr_4 is turned off, current flows through the branch circuit including the resistor R_8 , the diode D_3 , and resistors R_9 and R_{10} to generate intermittently an output from the conductor 25 with the result that the abnormal condition indicating lamp 24 shown in FIGS. 8 and 9 are caused to flicker. In FIG. 8 a transistor Tr is used while in FIG. 9 a silicon controlled rectifier SCR is used to control the lamp 24 in response to the signal from the conductor 25. It is of course to be understood that, at this time the base electrode of the transistor Tr_3 is energized by a voltage supplied through resistors R_{21} and R_4 so that the transistor is in the conductive state.

Then, if it is assumed that the conductor 10 is supplied with a bell ceasing signal which is transmitted by operating a bell ceasing switch, not shown, any may be in the form of a push button switch and the like then the signal will be supplied as the input signal to the gate electrode of the silicon controlled rectifier element SCR_1 via the diode D_2 and the resistor R_3 to render conductive the silicon controlled rectifier element whereby a current will flow through it via the resistor R_{21} . In this manner the bell operating signal will be stopped and the resistors R_4 and R_5 are short circuited by the silicon controlled rectifier

5

6

element SCR₁ to turn off the transistor Tr₃. Whereupon the current through the resistor R₆ will be transmitted through the resistor R₆ will be transmitted through the diode D₅ and the conductor 21 as an alarm confirming signal while the same time a portion of the current flowing through the resistor R₆ will flow through the diode D₄, and resistors R₉ and R₁₀ thus supplying a constant voltage to the output conductor 25 irrespective to whether the transistor Tr₄ is on or off. Thus, the flicker of the abnormal condition indicating lamp 24 is terminated to restore it to its normal energized condition. The purpose of the diode D₃ is to prevent the current through the diode D₄ from flowing through the transistor Tr₄. Further, the alarm confirming signal is transmitted for the purpose of confirming the alarming signal to provide a signal for a sequence interlock circuit (not shown) in order to prevent the control circuit 17 from stopping its operation even when a stop switch to be described later is misoperated prior to the actuation of the bell stop switch.

Where the machine to be supervised is not in the operating state, it is also necessary to maintain the control circuit 17 in the inoperative condition. To this end, it is necessary to impress an operation stopping signal to the gate electrode of the silicon controlled rectifier element SCR₂ from the conductor 21 via the diode D₆ and the resistor R₂₂ by manipulating an operation stopping switch, not shown in the drawing. The silicon controlled rectifier element SCR₂ will then be turned on to complete a circuit extending from the conductor 18, through the resistor R₆, the diodes D₄ and D₇, the silicon controlled rectifier element SCR₂ to the conductor 12 to by-pass the constant current which has been flowing via the resistor R₆, the diode D₄ and the resistor R₉ to the output conductor 25. The current supplied through the resistor R₈ will also not appear on the output conductor 25 because it is by-passed through the transistor Tr₄ and the grounded conductor 12 when the transistor is on whereas through a circuit including the resistor R₈, the diodes D₃ and D₇, the silicon controlled rectifier element SCR₂ and the conductor 12 when the rectifier element is on. As a consequence, the abnormal condition indicating lamp 14 will be extinguished. By the well known characteristics of silicon controlled rectifier elements, once these elements SCR₁ and SCR₂ have been made conductive by the closure of the bell stopping switch and the operation switch they will continue to maintain their on condition even after these switches are opened and will be turned off only by interrupting the input to the control circuit 17.

Returning again to FIGS. 8 and 9, in the arrangement shown in FIG. 8 the abnormal condition indicating lamp 24 and a transistor Tr are connected in series across a source of supply E and the ground with the base electrode of the transistor connected to the output conductor 25. In the alternative arrangement shown in FIG. 9 a silicon controlled rectifier element SCR is substituted for the transistor Tr. Where a transistor is used, the source E may be either a flat direct current or a rectified current which becomes zero at a predetermined period but where a silicon controlled rectifier element is utilized, owing to its inherent characteristics of continuously maintaining its conductive state once it has rendered conductive, it would be impossible to either flicker or extinguish the indicating lamp 24 so long as it is energized by a DC voltage. Therefore, it is necessary to use a rectified current (not filtered) so as to cause the controlled rectifier element to turn off at each zero voltage point of the rectified current. Further when a rectified, but not filtered, voltage is impressed across source conductors 11 and 12, it is necessary to use a filter circuit comprising a diode D and a condenser C before the control circuit 17, as shown in FIG. 10 to smooth out the current supplied to the control circuit. This is because that the current supplied to the control circuit 17 should not have any zero point in order to utilize the memory action of silicon controlled rectifier elements utilized in the control circuit 17.

Thus, in accordance with this invention, a signalling circuit 15 energized from supply conductors 11 and 12 is connected to a control circuit 17, and a normally closed contact 14 in the signalling circuit 15 is opened in response to an abnormal condition to supply power from said supply conductors to the control circuit 17. When energized, the control circuit 17 operates to send out current to a conductor 9 for driving an electric bell and the like. The input to the control circuit 17 is also converted into an interrupted current by intermittently turning on and off the second transistor Tr₄ in response to a flicker signal thus causing the abnormal condition indicating lamp 24 to flicker. A bell stopping signal supplied the control circuit 17 is applied to the gate electrode of a first silicon controlled rectifier element SCR₁ to turn it conductive to by-pass or interrupt the bell driving signal outgoing from the conductor 9. Upon turning on of the silicon controlled rectifier element, the first transistor Tr₃ is rendered non-conductive whereby the input from the source conductors 11 and 12 is transmitted as an alarm confirming signal over a conductor 21. Also non-conduction of the transistor Tr₃ assures to supply a constant voltage to the output conductor irrespective to whether the transistor 22 is supplied to the gate electrode of a second silicon controlled rectifier element SCR₂ in the control circuit 17 to turn on this rectifier element whereby said constant voltage supplied to the output conductor 25 is reduced to zero.

While the invention has been shown and described in connection with some preferred embodiments thereof, it should be understood that the invention is not limited thereto but many other modifications may be made without departing from the true spirit and scope of the invention.

What is claimed is:

1. An alarm device, comprising in combination:

(a) a power supply with second and first line means (11, 12);

(b) a signal circuit serving as the device input including a lamp means in series with a first junction which in turn is in series with a short circuit contact (14), said lamp means (13), junction and short circuit contact (14) being disposed across said second and first line means (12, 11), said short circuit contact (14) being normally closed to prevent the flow of electricity to other components but opening in response to abnormal conditions, a first resistor (R₁₁) in parallel with said lamp means, a signal conductor line (18) connected to said junction;

(c) first and second transistors with bias resistors (Tr₃, Tr₄) in parallel between said signal conductor line (18) and said first line means (12), a resistor bias line (R₉, R₁₀) including a junction point in parallel with said first and second transistors, and an output line (25) connected to said junction point, said first and second transistors and said bias resistors supplying an intermittent output across said resistor bias line (R₉, R₁₀) and said output line (25);

(d) first and second silicon controlled rectifiers (SCR₁, SCR₂) including control electrodes therefor, in parallel with said first and second transistors;

(e) first bias resistor means (R₄, R₅) coupled to said first transistor (Tr₃) and second bias resistor means (R₁₃) coupled to said second transistor (Tr₄), said first and second silicon controlled rectifiers respectively providing a short circuit bypassing said first and second bias resistor means when the respective control electrode electrodes are energized;

(f) first and second control electrode input lines (10, 22) coupled to said first and second control electrodes for controlling the bypassing of said first and second transistors; and,

(g) an output switching element (Tr, SCR) connected to said output line 25 responsive to the intermittent output thereof and a lamp (24) coupled to said

switching element, said intermittent output causing said switching element to switch said lamp on and off.

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5

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