March 28, 1950 A. F. SPERRY 2,501,793

ELECTRIC ALARM SYSTEM

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Fig. 1

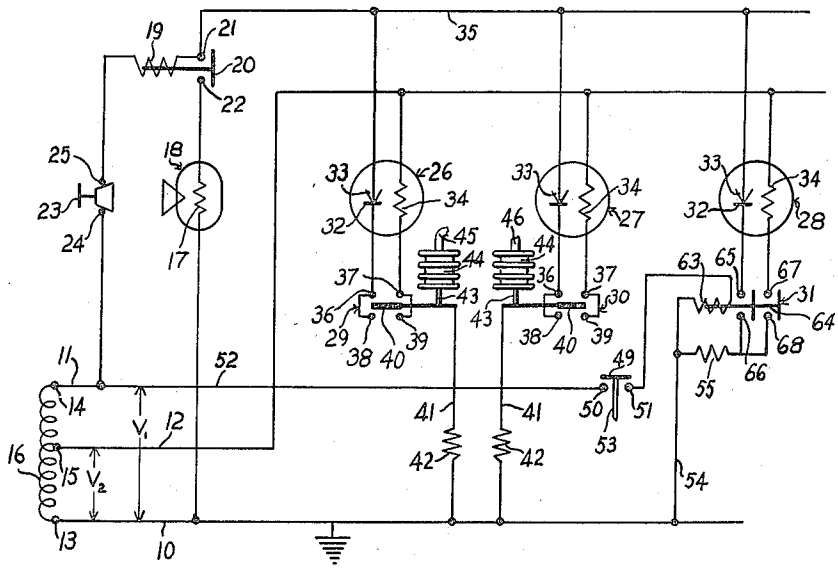


Fig. 3

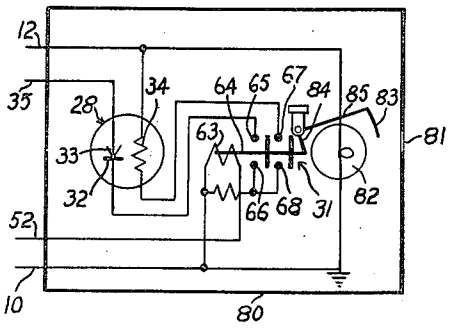
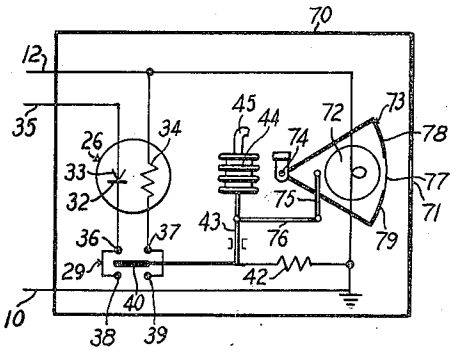


Fig. 2



INVENTOR.
ALBERT F. SPERRY

BY Armin Herz

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ELECTRIC ALARM SYSTEM

Albert F. Sperry, Chicago, Ill.

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13 Claims. (Cl. 177—311)

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This invention relates to an alarm system for the supervision of a plurality of apparatuses.

A general object of this invention is to provide an electric alarm system which is of simple construction, reliable in operation and self-resetting.

More particularly it is an object of this invention to provide an alarm system wherein a single alarm device can be actuated by any one of several signal circuits each coordinated to one of the apparatuses to be supervised by the alarm system and the particular signal circuit which put the common alarm device into operation due to the occurrence of an abnormal condition in the coordinated apparatus is then rendered inactive for the duration of the abnormal condition in the apparatus, but is automatically reset for a next operation of the common alarm device when the condition in the apparatus has returned to normal.

It is a further object of the invention to provide an automatically resetting alarm system of the kind just described wherein the circuit containing the common alarm device can be manually broken by means of a single switch, e. g. a push-button switch, regardless of which signal circuit has put the alarm into operation.

Another object of the invention is to provide an alarm system wherein a plurality of signal circuits, each comprising a normally closed switch, work in parallel upon a common alarm device and, when one of these signal circuits has actuated the alarm device, the switch in that signal circuit opens after some time lag without interfering with the energized alarm device which has to be cut out by hand and is thereafter ready again for becoming actuated by any one of the signal circuits to the exclusion of that particular signal circuit which caused the operation of the alarm device before.

It is a further object of the invention to provide in an electric alarm system for the supervision of a plurality of apparatuses a normally open alarm circuit controlled by a relay upon which several signal circuits operate in parallel, each of these signal circuits containing switch means which, in consequence of the occurrence of a faulty condition in the coordinated apparatus, first close and then, after a time lag, inactivate the signal circuit.

Another object of the invention is to provide in combination with contact devices having a movable means for keeping each signal circuit inactive as long as the condition in the coordinated apparatus is normal and activating it upon the occurrence of an abnormality of said condition, a

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permanently illuminated lamp and shutter means which are movable by the movable means of the coordinated contact device to indicate visually which particular signal circuit or circuits is or have been actuating the audible alarm.

A further object is to provide in an electric alarm system of the type referred to, wherein a movable part of the contact device of at least one of the signal circuits is put into action by either one of two abnormal conditions, such as pressure above a prescribed value and underpressure below the same or a different prescribed value, optical signal means which comprise a movable element moving in unison with said movable part of the contact device so as to indicate visually not only which particular signal circuit or circuits is or have been actuating the audible alarm, but also what kind of abnormal condition provoked the operation of the alarm.

A still further object of the invention is to provide in an electric alarm system having a normally open alarm circuit controlled by a relay upon which several signal circuits operate in parallel, a control circuit for each signal circuit which is independent of said relay and which, after the signal circuit has been activated due to the occurrence of an abnormal condition in the coordinated apparatus, renders this signal circuit inoperative on the relay and keeps it so inoperative until the condition in the apparatus is back to normal.

In one particular embodiment of the invention the switch means in each signal circuit comprise a thermal switch operable by a heater element which forms part of a control circuit that becomes energized upon the occurrence of a faulty condition in the coordinated apparatus and stays so energized during the time the faulty condition persists, no matter what the position of the thermal switch and/or the condition of the common alarm circuit is.

Where control circuits of the kind just referred to are to be used, it is a further object of the invention to provide means which will keep the heater element from overheating, but will permit it to operate at full strength upon the thermal switch during the period the heater element is operative to open said switch.

Other objects of the invention will appear as the description proceeds, reference being had to the accompanying drawing in which:

Fig. 1 is a wiring diagram showing by way of example one form of an alarm system embodying the present invention; and

Figs. 2 and 3, respectively, show schematically

a two-way pressure responsive alarm actuating unit and a single-action alarm actuating unit, each of these units comprising also optical indicating means.

Referring first to Fig. 1, the reference numerals 10, 11 and 12 denote three supply mains connected respectively to the end terminals 13, 14 and an intermediate point 15 of a suitable electric current source, such as the secondary winding 16 of a transformer. The supply main 10 is grounded and forms the return lead for the main 11 as well as for the main 12, the voltage V_2 across the mains 10, 12 being lower than the voltage V_1 across the mains 10, 11.

An alarm circuit is provided between the mains 10 and 11, this alarm circuit comprising an operating coil 17 of an alarm device 18 of any suitable kind, preferably, as shown, an acoustic device, further a relatively high-resistance main relay 19 with armature 20 adapted to close two normally open contacts 21, 22, and a manually operable cut-out switch 23, such as a push-button switch, permitting the temporary opening of two normally closed contacts 24, 25.

Cooperating with the normally open alarm circuit just described are several signal circuits, each being coordinated to one of several apparatuses so that the common alarm device 18 will be operated upon the occurrence of irregularities in the operation or condition of any one of these apparatuses. In Fig. 1 there are shown three such signal circuits, but any other number of apparatuses may be served by the common alarm circuit. Each signal circuit contains a switch device, generally denoted as 26, 27 and 28, respectively, adapted to open with a certain time delay, and a contact device, generally denoted as 29, 30, and 31, each cooperating with one of the switch devices 26, 27 and 28. The time delay with which the switch devices 26, 27 and 28 are intended to operate may be realized in one of various ways, well known in the art of making time delay switches or relays, and in the example shown thermal switches are used, each comprising a contact pair 32, 33 which is operable by a heater coil 34. Each contact 32 is connected to a contact of the coordinated contact device 29, 30 or 31 as will be presently described, whereas the contacts 33 are connected in parallel to a lead 35 which in turn is connected to a suitable point of the common alarm circuit, such as to the contact 21. The heater coils 34 are each connected at one end to a contact of the coordinated contact device and at the other end to the low voltage supply main 12.

The contact device 29 for the switch device 26 comprises a double pole switch 40 which may move between two end positions, in the one end position closing a pair of contacts 36, 37 and in the other end position closing another pair of contacts 38, 39. Contact 36 is connected to contact 38 and contact 37 to contact 39 and the switch 40 is connected by a lead 41 through a resistor 42 to the grounded supply main 10. The double pole switch 40 is movable from one of its two end positions to the other and to any intermediate position by means of an element 43 which operates in response to changes of some selected condition existing in the coordinated apparatus, such as pressure, temperature, liquid level, etc. In the example shown the element 43 participates in the movements of a pressure responsive bellows 44 which is connected with the coordinated apparatus by means of a pipe 45.

The contact device 30 cooperating with the switch device 27 is shown as being of the same type as the contact device 29 and for that reason the same reference numerals are used for both contact devices 29 and 30. However, the pipe leading from the bellows 44 to the apparatus to which the contact device 30 is coordinated is given a different number, 46, to indicate that this pipe leads to another apparatus than the pipe 45.

The contact device 31 is in the form of a relay 63 controlling by its armature 64 two pairs of contacts 65, 66 and 67, 68. The armature 64 closes both contact pairs 65, 66 and 67, 68 when the relay coil 63 is energized and opens both contact pairs when the relay becomes de-energized. A switch 49 adapted to connect two contacts 50, 51 in a lead 52 connecting one end of the relay coil 63 with either the main 11 or the main 12, in the example shown with the main 11, is operable by a member 53 which is actuatable for closing the contacts 50, 51 when a selected condition in the apparatus with which the member 53 is in operative connection becomes abnormal. The other end of the coil 63 is connected to the supply main 10 by means of a lead 54. Connected between this lead 54 and the interconnected contacts 66 and 68 is a resistor 55. The contacts 65 and 67 are respectively connected to the contact 32 and to one end of the heater coil 34 of the switch device 28.

The operation of the signal system thus far described is as follows:

As long as the conditions to be supervised in the various apparatuses are normal, the switches 40 or 64 in the contact devices 29, 30, 31, etc., are all in their inactive position shown in Fig. 1. Assuming now that a faulty condition occurs in the apparatus connected by the pipe 45 to the bellows 44 and that this faulty condition consists in an overpressure, then the bellows 44 will expand, moving by means of the element 43 the double pole switch 40 into contact with the contacts 38 and 39. Thereby a signal circuit is established which can be traced from the grounded supply line 10 over the resistor 42, the lead 41, switch 40, contact 38, contact 36, the closed thermal switch 32, 33, lead 35, point 21, the main relay coil 19, and the closed contacts 24, 25 to the supply line 11. At the same time a circuit through the heater coil 34 is established which extends from line 10 through the resistor 42, the lead 41, the switch 40, the contacts 39 and 37, and the heater coil 34 to the low voltage supply line 12. The energized main relay coil 19 attracts its armature 20 so as to connect the contacts 21, 22, inserting thereby the coil 17 of the acoustic alarm device 18 into the circuit. The alarm circuit thus established remains closed and keeps the signal sounding as long as it is not manually opened by means of the push-button switch 23. Opening of the thermal switch 32, 33 under the heating action of the heater coil 34 will not open the alarm circuit.

As the armature 20 of the main relay 19 connects the contacts 21 and 22 and thereby establishes the alarm circuit, the resistor 42 is automatically cut out and remains ineffective as long as the thermal switch 32, 33 remains closed. During that period a circuit through the heater coil 34 by-passing the resistor 42 is established which can be traced from the main 10 through the low resistance signal coil 17, the contacts 22, 21 closed by the armature 20, the closed thermal switch 33, 32, contact 38, switch 40, contacts 39 and 37 and through the heater coil 34 to the low voltage main 12. Thus, while the heater coil 34 is energized via

the resistor 42 for that short interval between the closing of the contacts 38 and 39 or 36 and 37 by the double pole switch 40, and the closing of the contacts 21 and 22 by the armature 20 of the relay 19, the resistor 42 is inoperative for the period the heater coil operates to open the thermal switch 32, 33, that is to say, when a strong heating effect is actually desirable. When the heating effect of the heater coil on the thermal switch reaches the point where the thermal switch opens and thereby breaks the just described heating circuit by-passing the resistor 42, that heating circuit including the resistor 42 is re-established which existed before the relay armature 20 connected the contacts 21 and 22. Now the heater coil operates at a reduced temperature due to the resistor 32 being in series with the heater coil. From the moment on, therefore, when the thermal switch 32, 33 opens, the heater coil operates at a temperature which, while being sufficient to keep the thermal switch open, is low enough not to overheat the heater coil even during a period of hours or days. This reduced operating temperature of the heater coil also permits the latter to cool down quickly to the temperature at which the thermal switch closes when, due to the fact that the condition in the coordinated apparatus has been restored to normal, the double pole switch 40 returns to its neutral position shown in Fig. 1.

As has been mentioned before, the alarm circuit through the coil 17 remains closed after the thermal switch 32, 33 of the switch device 26 has been opened by the action of its heater coil 34. To silence the alarm device 18 the push-button switch 23 is pressed down manually. This breaks the circuit containing the relay coil 19 which is thus de-energized and releases the armature 20 to open the contacts 21, 22 in the alarm circuit through the alarm device coil 17. Upon release of the push-button switch 23 the main relay 19 is ready again for actuation by any of the signal circuits of the device with the exception of the signal circuit belonging to the contact device 29 which, as long as the irregularity of condition persists in the coordinated apparatus, remain interrupted at the open thermal switch 32, 33. Any other of the contact devices 30, 31, etc., however, upon receiving from its coordinated apparatus the impulse caused by a faulty condition in that apparatus which will cause its movable member 40 or 64 to move from its neutral position shown in the drawing into a contact-closing position, will cause energization of the main relay 19 and the alarm circuit in the same manner as has been described in connection with the switch device 26.

The actuation and operation of the alarm circuit is basically the same whether the switch devices are put into operation by a contact device of the kind shown at 29 or 30 or of the kind shown at 31. It is to be noted, however, that the double pole switch arrangement of the contact devices 29 and 30 is operative both at a given maximum as well as at a given minimum value of the condition to be controlled, whereas the armature 64 of the contact device 31 operates with one "off"- and one "on"-position only. In the example shown the double pole switch 40 cooperates with a bellows (which may be replaced by some other fluid pressure responsive device) so as to close the one contact pair 38, 39 when a certain overpressure is reached and the other contact pair 36, 37 when a certain underpressure occurs, whereas it occupies an inactive position as long as the pressure is within the allowed range. In contrast thereto the armature 64 of the contact device 31 always closes or opens all the four contacts 65 to 68 simultaneously, closing them when the condition to be supervised in the coordinated apparatus passes a predetermined value in one given direction. Assuming, for instance, that the condition to be supervised is the liquid level, the arrangement may be such that the member 53 moves the switch 49 to close the contacts 50, 51 in the line 52 when the liquid level in the apparatus falls below a given minimum level but keeps the contacts 50, 51 open without regard to any height of the liquid level above that prescribed minimum level. Or, the member 53 may be connected to the interior of the coordinated apparatus in such a manner as to close the switch 49 when the liquid level rises above a certain prescribed maximum height, whereas the switch 49 is kept open as long as the liquid level remains below that height. When in either case the member 53 moves the switch 49 into its closing position the relay coil 63 is energized and pulls its armature 64 into the position in which it connects the contact 65 with the contact 66 and the contact 67 with the contact 68. When the condition in the coordinated apparatus has become again such as to allow the member 53 to return to the position in which it keeps the switch 49 open the coil 63 becomes de-energized, and the heater coil 34 of the switch device 28 is cut out, permitting the thermal switch 32, 33 of this device to reset itself for a next actuation of the main relay 19 should another irregularity of the supervised condition occur in the same apparatus.

With each contact device 29, 30, 31, etc., means are combined for indicating visually which particular signal circuit is or has been actuating the audible alarm signal 18. These visual means include a lamp and a light intercepting member which is movable between said lamp and a window or sight opening provided in the wall of a panel board or box. Fig. 2 shows diagrammatically an optical indicating device operatively connected with a contact device of the kind shown in Fig. 1 at 29 (or 30). The contact device 29 together with the switch device 26, the bellows 44 and the resistor 42 are housed in a signal box 70 having a sight opening or window 71. Behind that sight opening 71 a lamp 72 is located which is connected between the grounded supply line 10 and one of the supply lines 11 or 12, here the low voltage line 12, so as to be permanently illuminated. A transparent segment 73 is pivoted on an axis 74 and may be swung about that pivot by means of a lever 75 which, through a link 76, is connected with the member 43 and moves in unison therewith. The central portion 77 of the transparent segment 73 may be white, whereas the two end portions 78 and 79 of the segment may be colored in two different colors, such as red and green, respectively. As long as the condition in the coordinated apparatus is normal, which means that the double pole switch 40 is in its neutral position, also the segment 73 is in its neutral position shown in which the white portion 77 is between the lamp 72 and the sight opening 71 of the box 70. If the pressure in the apparatus rises the bellows 44 expands and by means of the member 43 moves not only the switch 40 into contact with the lower contact pairs 38, 39, but also turns, through the intermediary of the leverage 76, 75, the segment 73 in the clockwise direction, bringing thereby the red colored portion of the segment between the lamp

72 and the window 71. This window appears now in red color, indicating that, in the apparatus to which this particular box 70 is coordinated, an overpressure exists. Assuming that in all other apparatuses the supervised conditions are regular, the windows of all other signal boxes will be illuminated white, whereas the sight opening 71 belonging to the box 70 just described will stand out by its red color, thereby indicating in a conspicuous manner which apparatus has operated the alarm. When the attendant opens the push-button 23 to stop the alarm signal this will not influence the position of the segment 73 which remains in its overpressure indicating position regardless of the condition of the alarm circuit and regardless as to whether the thermal switch 32, 33 is still closed or is in its open position. The segment will remain in this position until the condition in the coordinated apparatus is returned to normal, whereupon the segment 73 resumes its neutral position together with the double pole switch 40.

In case underpressure occurs in the coordinated apparatus causing the switch 40 to close the upper contact pair 36, 37, the segment 73 is moved in anti-clockwise direction bringing the green portion 78 between the sight opening 71 and the lamp 72 so that this sight opening appears in green color.

If at any time sounding of the alarm is caused by one apparatus while the condition in another apparatus, which has actuated the alarm at some earlier time, is not back yet to normal, then both the windows 71 belonging to the two apparatuses will appear illuminated other than white. By the particular color in which each window 71 appears, the attendant can not only tell which apparatuses are out of order but also of what kind the irregularity is in each apparatus.

If the push-button switch 23 is located at some convenient central point and the windows 71 are arranged side by side, e. g. near the top of the signal panel, the attendant, when he is called by the acoustic alarm device 18 to operate that button, is brought in front of the illuminated windows 71 and can hardly avoid noticing which signal is operating. But even if he does not look at the visual signal at that time, the visual indication will persist as long as the contact device has not been reset by the return of a normal condition in the coordinated apparatus.

Fig. 3 shows a lamp and shutter arrangement as may be used in cooperation with the contact device 31 of Fig. 1. Here the shutter 83 is operated by the armature 64 of the relay 63, moving by means of a lever system 84, 85 or the like the shutter between a sight opening 81 of a box 80 and the lamp 82 when the armature 64 is pulled into contact closing position, and keeping the shutter outside of the range of the sight opening 81 when the armature 64 is in its neutral position. If the shutter 83 is transparent and colored in some color, e. g. yellow, then the sight opening 81 will appear white as long as the armature 64 is in its neutral position and will turn yellow when the armature 64 has been attracted by the coil 63 and has thereby moved the shutter 83 in the position in which it intercepts selectively the light rays passing from the lamp 82 through the sight opening 81. The shutter 83 will not be brought back into the elevated position shown in Fig. 3 until the condition in the coordinated apparatus has been remedied, regardless of opening of the thermal switch 32, 33 by the heater coil 34 or operation of the push-button 23 by the attendant. Since the shutter 83 has only an "on" and an "off" position, it may, instead of being transparent and colored in some other color than white, be opaque so as to cut off completely the passage of light from the lamp 82 through the window 81 when in one of its two positions, in the example shown in Fig. 3 in its "on" position corresponding to the existence of an irregular condition in the associated apparatus. This irregularity would then be optically indicated by a blacked-out spot on the otherwise on all windows illuminated panel board.

While I have shown in the drawing one particular embodiment of my invention, I desire it to be understood that various changes and modifications outside of those already mentioned in this specification may be made in the details of the alarm system without departing from the spirit of the invention or from the scope of the appended claims.

What I claim is:

1. In an electric alarm system for the supervision of a plurality of apparatuses, a normally open alarm circuit common to said plurality of apparatuses, a relay for controlling said alarm circuit, each of said apparatuses having coordinated thereto a signal circuit for actuating said relay, switch means in each signal circuit adapted to be operated in consequence of the occurrence of a faulty condition in the coordinated apparatus so as to first close said signal circuit for energization of said relay and then to render said signal circuit inoperative upon said relay and hold it so inoperative for as long a time as the faulty condition perists in the coordinated apparatus, and means cooperating with each of said signal circuits for automatically resetting said switch means to the initial position upon the condition in the coordinated apparatus being restored to normal.

2. In an electric alarm system for the supervision of a plurality of apparatuses, a normally open alarm circuit common to said plurality of apparatuses, a relay for controlling said alarm circuit, each of said apparatuses having coordinated thereto a signal circuit for actuating said relay, a normally closed thermal switch in each signal circuit, a heater for each thermal switch forming part of a circuit adapted to become energized upon the occurrence of a faulty cond tion in the coordinated apparatus and stay so energized during the persistence of such faulty condition, said thermal switch being adapted to open upon said heater reaching a predetermined temperature and to stay open until said heater has become de-energized in consequence of the condition in the coordinated apparatus having returned to normal.

3. In an electric alarm system for the supervision of a plurality of apparatuses, a normally open alarm circuit common to said plurality of apparatuses, a relay for controlling said alarm circuit, each of said apparatuses having coordinated thereto a signal circuit for actuating said relay, a control circuit independent of said relay, a resistor common to said signal circuit and said control circuit, a normally closed thermal switch in said signal circuit, a heater element in operative position with regard to said thermal switch forming part of said control circuit, and means adapted to keep said signal circuit as well as said control circuit inactive as long as the condition in the coordinated apparatus is normal and to activate both said circuits upon the occurrence of an abnormality of said condition, the heater

element in said control circuit, upon the latter being so activated, opening its coordinated thermal switch and keeping it open until the condition in the apparatus is restored to normal, and a by-pass path around said resistor for shorting out said resistor during the period said heater element is operative to open said thermal switch.

4. In an electric alarm system for the supervision of a plurality of apparatuses, a normally open alarm circuit common to said plurality of apparatuses, a relay for controlling said alarm circuit, each of said apparatuses having coordinated thereto a signal circuit for actuating said relay and a control circuit independent of said relay, a normally closed thermal switch in each signal circuit, a heater element in each control circuit in operative position with regard to its coordinated thermal switch, means for keeping said signal circuit as well as said control circuit inactive as long as the condition in the coordinated apparatus is normal and to activate both said circuits upon the occurrence of an abnormality of said condition, the heater element in said control circuit, upon the latter being so activated, opening its coordinated thermal switch and keeping it open until the condition in the apparatus is restored to normal.

5. In an electric alarm system for the supervision of a plurality of apparatuses, a normally open alarm circuit common to said plurality of apparatuses, a relay for controlling said alarm circuit, each of said apparatuses having coordinated thereto a signal circuit for actuating said relay, a control circuit independent of said relay, a resistor common to said signal circuit and said control circuit, a normally closed thermal switch in said signal circuit, a heater element in operative position with regard to said thermal switch forming part of said control circuit, and means for keeping said signal circuit as well as said control circuit inactive as long as the condition in the coordinated apparatus is normal and to activate both said circuits upon the occurrence of an abnormality of said condition, the heater element in said control circuit, upon the latter being so activated, opening its coordinated thermal switch and keeping it open until the condition in the apparatus is restored to normal, and a by-pass path around said resistor for shorting out said resistor during the period said heater element is operative to open said thermal switch.

6. In an electric alarm system for the supervision of a plurality of apparatuses, a normally open alarm circuit common to said plurality of apparatuses, a relay for controlling said alarm circuit, each of said apparatuses having coordinated thereto a signal circuit for actuating said relay, a control circuit independent of said relay, and a contact device adapted to keep said signal circuit as well as said control circuit inactive as long as the condition in the coordinated apparatus is normal and to activate both said circuits upon the occurrence of an abnormality of said condition, said control circuit, upon being so activated, rendering, with a time lag, the signal circuit inoperative upon said relay and keeping it so inoperative until the condition in the apparatus is restored to normal whereby said contact device is caused to break said control circuit so as to release said signal circuit for return to its initial condition, and a holding contact for holding said relay energized after the signal circuit which actuated said relay has been rendered inoperative by its coordinated control circuit.

7. In an electric alarm system for the supervision of a plurality of apparatuses, a normally open alarm circuit common to said plurality of apparatuses, a relay for controlling said alarm circuit, each of said apparatuses having coordinated thereto a signal circuit for actuating said relay, a control circuit independent of said relay and a contact device adapted to keep said signal circuit as well as said control circuit inactive as long as the condition in the coordinated apparatus is normal and to activate both said circuits upon the occurrence of an abnormality of said condition, said control circuit, upon being so activated, rendering the signal circuit inoperative upon said relay and keeping it so inoperative until the condition in the apparatus is restored to normal whereby said contact device is caused to break said control circuit so as to release said signal circuit for return to its initial condition, and a manually operable switch in said alarm circuit in series with said relay for de-energizing said relay so as to open said alarm circuit and thereby to place said relay and alarm circuit into readiness for a subsequent operation upon the activation of a signal circuit other than any signal circuit which was rendered inoperative on account of the existence of an abnormal condition in the apparatus coordinated to that last named signal circuit.

8. In an electric alarm system for the supervision of a plurality of apparatuses, a normally open alarm circuit common to said plurality of apparatuses, a relay for controlling said alarm circuit, each of said apparatuses having coordinated thereto a signal circuit for actuating said relay, a control circuit independent of said relay and a contact device adapted to keep said signal circuit as well as said control circuit inactive as long as the condition in the coordinated apparatus is normal and to activate both said circuits upon the occurrence of an abnormality of said condition, said control circuit upon being so activated rendering, with a time lag, the signal circuit inoperative upon said relay and keeping it so inoperative until the condition in the apparatus is restored to normal whereby said contact device is caused to break said control circuit so as to release said signal circuit for return to its initial condition, a holding contact for holding said relay energized after the signal circuit which actuated said relay has been rendered inoperative by its coordinated control circuit, and a manually operable switch in said alarm circuit in series with said relay for deenergizing said relay so as to open said alarm circuit as well as said holding contact and thereby to place said relay, said alarm circuit and said holding contact into readiness for a subsequent operation upon the activation of a signal circuit other than any signal circuit which was rendered inoperative on account of the existence of an abnormal condition in the apparatus coordinated to that particular signal circuit.

9. In an electric alarm system for the supervision of a plurality of apparatuses, a normally open alarm circuit common to said plurality of apparatuses, a relay for controlling said alarm circuit, each of said apparatuses having coordinated thereto a signal circuit for actuating said relay, a control circuit independent of said relay, a normally closed thermal switch in said signal circuit, a heater coil in operative position with regard to said thermal switch forming part of said control circuit, and a contact device adapted to keep said signal circuit as well as said control circuit inactive as long as the condition in the

coordinated apparatus is normal and to activate both said circuits upon the occurrence of an abnormality of said condition, the heater coil in said control circuit, upon the latter being so activated, opening with a time lag its coordinated thermal switch and keeping it open until the condition in the apparatus is restored to normal whereby said contact device is caused to break said control circuit so as to release said signal circuit for return to its initial condition, and a manually operable switch in said alarm circuit in series with said relay for de-energizing said relay so as to open said alarm circuit and thereby to place said relay and alarm circuit into readiness for a subsequent operation upon the activation of a signal circuit other than any signal circuit which was rendered inoperative on account of the existence of an abnormal condition in the apparatus coordinated to that particular signal circuit.

10. In an electric alarm system for the supervision of a plurality of apparatuses, a normally open alarm circuit common to said plurality of apparatuses, a relay for controlling said alarm circuit, each of said apparatuses having coordinated thereto a signal circuit for actuating said relay, a control circuit independent of said relay, a resistor common to said signal circuit and said control circuit, a normally closed thermal switch in said signal circuit, a heater coil in operative position with regard to said thermal switch forming part of said control circuit, and contact means adapted to keep said signal circuit as well as said control circuit inactive as long as the condition in the coordinated apparatus is normal and to activate both said circuits upon the occurrence of an abnormality of said condition, the heater coil in said control circuit, upon the latter being so activated, opening with a time lag its coordinated thermal switch and keeping it open until the condition in the apparatus is restored to normal, a holding contact for holding said relay energized after the signal circuit which previously actuated said relay has been rendered inoperative by its coordinated control circuit, and a by-pass path around said resistor containing said holding contact for shorting out said resistor during the period said holding contact and said thermal switch are closed and thereby said heater coil is operative to open said thermal switch.

11. In an electric alarm system for the supervision of a plurality of apparatuses, a normally open alarm circuit common to said plurality of apparatuses, a relay for controlling said alarm circuit, each of said apparatuses having coordinated thereto a signal circuit for actuating said relay, a control circuit independent of said relay, a normally closed thermal switch in said signal circuit, a heater coil in operative position with regard to said thermal switch forming part of said control circuit, and a contact means adapted to keep said signal circuit as well as said control circuit inactive as long as the condition in the coordinated apparatus is normal and to activate both said circuits upon the occurrence of an abnormality of said condition, the heater coil in said control circuit, upon the latter being so activated, opening with a time lag its coordinated thermal switch and keeping it open until the condition in the apparatus is restored to normal whereby said contact device is caused to break said control circuit so as to release said signal circuit for return to its initial condition, a holding contact for holding said relay energized after the signal circuit which actuated said relay has been rendered inoperative by its coordinated control circuit, and a manually operable switch in said alarm circuit in series with said relay for de-energizing said relay so as to open said alarm circuit as well as said holding circuit and thereby to place said relay, said alarm circuit and said holding circuit into readiness for a subsequent operation upon the activation of a signal circuit other than any signal circuit which was rendered inoperative on account of the existence of an abnormal condition in the apparatus coordinated to that particular signal circuit.

12. In an electric alarm system for the supervision of a plurality of apparatuses, a normally open alarm circuit common to said plurality of apparatuses, a relay for controlling said alarm circuit, each of said apparatuses having coordinated thereto a signal circuit for actuating said relay, a control circuit independent of said relay and a contact device having means movable in response to changes of a selected condition in the apparatus so as to activate said signal circuit as well as said control circuit upon the occurrence of an abnormality of said condition and to interrupt said control circuit when the condition in the apparatus is restored to normal, said control circuit including means for rendering its coordinated signal circuit, independently of said contact device, inoperative on said relay for the duration of said abnormality, and shutter means operatively connected with said movable means of said contact device to move in response to the movements of said movable means.

13. In an electric alarm system for the supervision of a plurality of apparatuses, a normally open alarm circuit common to said plurality of apparatuses, a relay for controlling said alarm circuit, each of said apparatuses having coordinated thereto a signal circuit for actuating said relay, a control circuit independent of said relay and a contact device having means movable from a neutral position in either of two directions in response to changes of a selected condition in the apparatus so as to activate said signal circuit as well as said control circuit upon the occurrence of an irregularity in said condition in either direction as compared with the condition prescribed as regular and to interrupt said control circuit when the condition in the apparatus is restored to regular, said control circuit including means for rendering its coordinated signal circuit, independently of said contact device, inoperative on said relay for the duration of said abnormality, and shutter means operatively connected with said movable means of said contact device to move in unison with and in the same sense as said movable means.

ALBERT F. SPERRY.

REFERENCES CITED

The following references are of record in the file of this patent:

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