

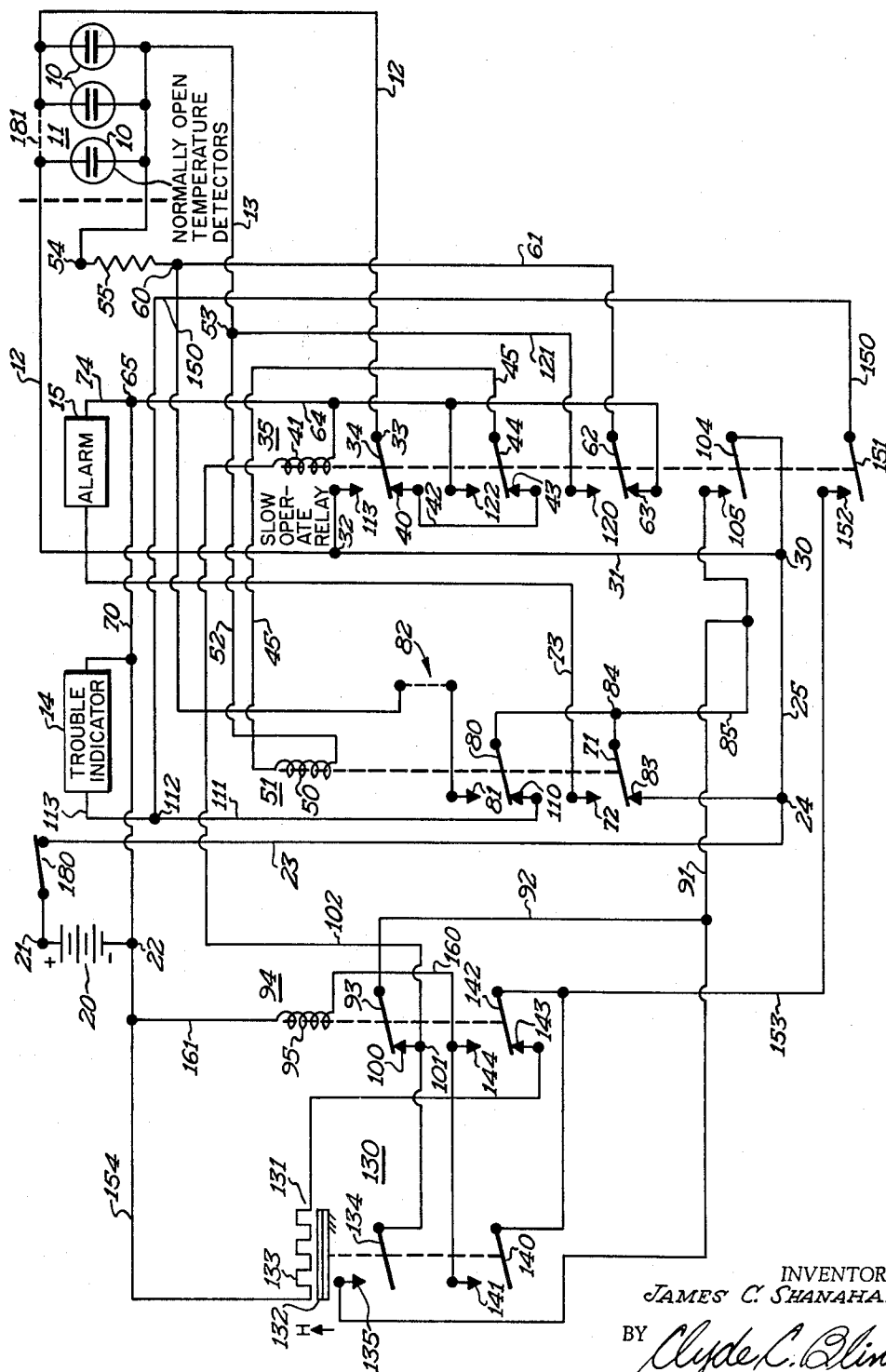
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J. C. SHANAHAN

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SUPERVISED ANNUNCIATOR

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INVENTOR
JAMES C. SHANAHAN
BY *Clyde C. Blinn*
ATTORNEY

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SUPERVISED ANNUNCIATOR

James C. Shanahan, Wayzata, Minn., assignor to
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The present invention is concerned with an improved, supervised, abnormal condition, detection system; in particular, the system is for use as a fire detection system wherein a number of normally open temperature responsive detectors are spaced about a building and connected into a central panel. A closed circuit through the connecting wires is provided so a fault or trouble other than a closed fired detector can be recognized.

Fire detection systems with constant supervision are broadly old. Such systems generally have two circuits. One circuit is for the fire alarm, and the other circuit is to indicate the existence of a trouble in the system which would prevent the normal detection of a fire. Such systems with the double circuits, one for alarm and one for supervision, are generally required to meet certain fire detection system codes as the infrequent use of a fire detection system makes the system susceptible to being in an inoperative condition when needed.

In the present invention, a system has both an alarm circuit and a supervisory circuit. A closed detector in the alarm circuit provides a certain sequence of operation which energizes an appropriate alarm. During normal times when there is no fire to affect the temperature sensors, a circulating current exists through the lines connecting the various detectors to indicate a trouble free system; however, upon the termination of the circulating current, a trouble indication is provided. Upon the removal of the trouble, the system resets the supervisory circuit back to a normal operating condition, and during the trouble indication period, the alarm circuit is still operative.

An object of the present invention is to provide an improved abnormal condition detection system with a trouble supervisory circuit having automatic reset.

Another object of the present invention is to provide a fire detection system with trouble supervision wherein the detection system remains operative during the period in which a trouble is being indicated and automatic resets following correction of the trouble condition.

These and other objects of the present invention will become apparent upon the study of the single figure which is a schematic drawing of the circuit for the fire alarm system having the trouble supervision.

Referring to the single figure, a detection system is shown with a plurality of conventional, normally open, abnormal condition responsive devices or detectors 10 located in a space such as a building 11. Detectors 10 might be of the type having a spring soldered by a low melting point alloy in a first position so that when a high temperature exists in space 11, the spring is released to close a switch. The detectors are connected in parallel between two loop circuits 12 and 13. The loops may run for a considerable distance throughout space 11 so a plurality of detectors 10 can be connected between the loops and still have the detectors widely spaced throughout the area.

A trouble indicator 14 and an alarm 15 are of a conventional type which might encompass a visual indicator or light on a panel in a control room in addition to some audible alarm adapted to be heard in different areas in and out of the building. A D.C. source of power 20 has a positive terminal 21 and a negative terminal 22.

A supervisory circuit for loops 12 and 13 connecting detectors 10 can be traced as follows: from the positive

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terminal 21 of the source of power, a conductor 23, a terminal 24, a conductor 25, terminal 30, a conductor 31, a terminal 32, loop 12 which is connected to one side of detectors 10, a terminal 33, a movable member 34 of a relay 35 which engages a contact 40 when the energization winding 41 of the relay is de-energized, a conductor 42, a contact 43 engaged by a movable member 44 of relay 35, a conductor 45, a winding 50 of relay 51, a conductor 52, a terminal 53, loop 13, terminal 54, a resistor 55, a terminal 60, a conductor 61, movable member 62 of relay 35, a contact 63, a conductor 64, a terminal 65, and back to the negative terminal 22 of the source of power through a conductor 70. With the mentioned circuit in a trouble free condition, that is no opens or shorts to cut down the normal current flow through the circuit, relay 51 is energized.

With relay 51 energized, movable member 71 of relay 51 is moved against a contact 72 which is connected by a conductor 73 to alarm 15. The other side of the alarm is connected by conductor 74 to terminal 65 and to the negative side of the source of power through a conductor 70. Since movable member 71 is not connected to the positive side of the source of power in the mentioned position, alarm 15 is not energized. Movable member 80 of relay 51 is moved against contact 81 which is connected to terminal 60 through a removable jumper 82 which forms a holding circuit for relay 51 upon the presence of a fire condition when one of detectors 10 closes. The jumper can be removed when a coded fire alarm system is used.

Under normal operation, the supervisory circuit is closed and the circulating current maintains relay 51 energized. If a trouble developed in the supervisory circuit to de-energize relay 51, an energization circuit for relay 35 is set up. The circuit can be traced as follows: from power terminal 21, conductor 23, terminal 24, a contact 83, movable member 71, a terminal 84, a conductor 85, a conductor 91, a conductor 92, a movable member 93 of a relay 94 having an energization winding 95, a fixed contact 100, a terminal 101, conductor 102, energization winding 41, conductor 64, conductor 70, and back to the negative terminal 22 of the source of power. Relay 35 is a conventional slow operating type which requires a predetermined time of energization of winding 41 before the movable members associated with the relay are moved from the position shown to an upper position against another set of contacts. When relay 35 is operated, a holding circuit is established when a movable member 104 of relay 35 moves against a contact 105 to establish a circuit in parallel with the circuit including movable member 71 and contact 83. The same circuit establishes the energization of the trouble signal 14 through a circuit traced as follows: from power terminal 21, conductor 23, conductor 25, movable member 104, contact 105, conductor 85, movable member 80 of relay 51, a contact 110, a conductor 111, a terminal 112, a conductor 113 to the trouble signal 14 which is connected to the other side of the source of power 22 through conductor 70. The trouble signal 14 is energized to indicate a trouble in the supervisory system.

At the same time that a trouble exists in the supervisory system, the desirability of maintaining the alarm system in operation as much as possible is accomplished upon the energization of relay 35. The positive side of the source of power from terminal 21 is already connected to one end of loop 12. The positive side is connected to the other end of loop 12 upon the operation of relay 35 by a circuit traced as follows: from terminal 21, conductor 23, conductor 25, conductor 31, terminal 32, a contact 113, movable member 34, and terminal 33 of the other end of loop 12. Upon the energization of relay 35, both ends of loop 13 are connected together through a circuit traced as follows: terminal 54, resistor 55, ter-

minal 60, conductor 61, movable member 62 of relay 35, a fixed contact 120, a conductor 121, and back to terminal 53 of the other end of loop 13. Such a connection provides for a circuit to relay 51 through any one of the detectors in the case of a closed detector even though a trouble should exist in the loops 12 and 13. By the connection of energization winding 50 of relay 51 to the negative terminal 22 of the source of power, relay 51 is placed in a position to be energized upon one of detectors 10 closing. The circuit for such a connection is traced as follows: from relay winding 50, conductor 45, movable member 44 of relay 35, contact 122, conductor 64, conductor 70 and back to the negative terminal 22.

With the trouble condition as previously mentioned, a break in the supervisory circuit to cut down the current and de-energize relay 51, relay 35 is energized to indicate the presence of a trouble by signal 14 and relay 51 is again connected across the parallel connected detectors 10 so that upon one of the detectors closing relay 51 can be energized to provide the energization of alarm 15. In order to have automatic reset of the trouble circuit should the trouble condition disappear, a cyclor is provided to periodically open the circuit of relay 35 to allow the system to recycle. Upon recycling, the system will return to the normal position or to the trouble indicating position depending upon whether the trouble is still in existence. During the time of recycling, the importance of maintaining the circuit of relay 35 open only for a short period has not been overlooked as such renders the alarm system inactive. If a fire should develop during the period which the resetting operation is taking place, a fire alarm would not be given. The resetting operation is accomplished by opening the circuit of relay 35 only for a very short period of time.

A conventional recycling apparatus 130 is made up of relay 94 and a time delay relay 131. Relay 131 has a bimetal operator 132 which is heated by a heater 133. Connected to operator 132 are movable member 134 which is associated with contact 135 and movable member 140 which is associated with contact 141. Relay 131 is designed to close the switch of movable member 134 and contact 135 at the beginning of the heating cycle and open the switch at the end of the cooling cycle. The switch of movable member 140 and contact 141 closes at the end of the heating cycle and opens at the beginning of the cooling cycle. Upon the energization of heater 133, member 134 is first to move against contact 135. When bimetal 133 is almost as hot as the design will provide, member 140 moves against contact 141. Upon the de-energization of heater 133, member 140 is first to move away from contact 141, and just before the bimetal 132 is completely cooled to the ambient temperature, movable member 134 moves away from contact 135.

In addition to the previously mentioned switch of relay 94, a movable member 142 engages a contact 143 when relay 94 is de-energized and a contact 144 when relay 94 is energized. Upon the energization of relay 35, an energization circuit for heater 133 is provided as follows: from terminal 21, conductor 23, contact 83, movable member 71, movable member 80, contact 110, conductor 111, terminal 112, a conductor 150, a movable member 151 of relay 35, a contact 152, a conductor 153, movable member 142, contact 143, heater 133, a conductor 154 back to terminal 22 of the source of power. As soon as heater 133 is energized, movable member 134 will move against contact 135 to provide a holding circuit for relay 35 which is used upon the energization of relay 94. At the time movable member 134 engages contact 135 nothing else operates in the circuit. As bimetal 132 continues to heat up, movable member 140 will engage contact 141 to energize relay 94 through the same circuit which was previously mentioned in connection with heater 133 except that conductor 153 is connected to movable member 140 which engages contact 141 which is connected by a conductor 160 to winding

95. The other side of winding 95 is connected to terminal 22 of the source of power to a conductor 161. Upon the energization of relay 94, a holding circuit for relay 94 is provided in parallel with the previously mentioned energization circuit. The holding circuit can be traced as follows: from conductor 153, movable member 142, contact 144, conductor 160, energization winding 95. When relay 94 is energized to open the previously mentioned circuit including movable member 142 and contact 143, heater 133 is de-energized and the switch of movable member 140 and contact 141 opens. Movable member 93 and contact 100 also open a circuit to coil of relay 35 which is in parallel with a closed circuit including movable member 134 and contact 135. Since a holding circuit was established for relay 95, the relay is maintained energized. As bimetal 132 cools down to almost the ambient temperature, the switch of movable member 134 and contact 135 opens to de-energize relay 35.

With relay 35 de-energized, the first mentioned supervisory circuit including the two loops 12 and 13 is connected to relay 51. If the supervisory circuit is restored to normal operation and a current flows through the circuit, relay 51 is energized to establish normal operation of the circuit. If the trouble still exists and relay 51 is not energized, the slow operating relay 35 will be energized as previously mentioned to return the system to the trouble state to energize trouble indicator 14. At the same time, heater 133 will again be energized and the automatic reset operation circuit 130 will again function to provide the cyclic de-energization of relay 35 to constantly attempt to restore the system back to normal operation.

By means of the resetting circuit 130, relay 35 is only de-energized for a short period so that the alarm system which is maintained during the trouble indication continues to function. Obviously, if some sort of cycling resetting means was used which maintained relay de-energized for a long period of time, the alarm system would be inoperative at that time. Upon the occurrence of fire during the resetting operation, the alarm system would not be able to give the appropriate alarm.

By means of a circuit including movable member 80 and contact 81 of relay 51, a holding circuit for relay 51 is established and by the previously mentioned circuit including movable member 80 and contact 110, the recycling circuit is rendered inactive. Under a fire alarm condition, any trouble existing in the circuit does not provide a trouble indication at 14. The holding circuit for the relay 51 can be traced as follows: from the terminal 21 of the source of power conductor 23, conductor 25, movable member 104, and contact 105, conductor 85, movable member 80, contact 81, jumper 82, conductor 150, conductor 61, movable member 62, contact 43, conductor 121, conductor 52, energization winding 50, conductor 45, movable member 44 and contact 122, conductor 64 and back to the terminal 22 of the source of power.

Under certain conditions, detectors 10 are replaced by coded signal devices. Such signal devices are quite conventional and comprise a spring driven switching device which are manually started to operate the switch in an on-off manner in accordance with some predetermined code. Such a device is shown in the expired McFell Patent 1,233,679. The code is usually selected by the given area in which the coded device is to be used so that when a manual lever is pulled down to start the signal device, the code can give an audible signal indicative of the area in which the device is located. If the detectors 10 are substituted by coded devices, a fire alarm signal would not be able to pulse the relay 51 to ring the alarm 15 in accordance with the coded signal. Jumper 82 is removed to break the previously mentioned holding circuit so that upon a coded signal being received, relay 51 can be energized in accordance with the coded signal.

By means of the resetting circuit 130, the system can be reset to normal operation after a coded signal has

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been received and the circuit between loops 12 and 13 is again open. The resetting operation is accomplished by the mentioned operation of relay 94 to open the circuit of relay 35 to allow the previously mentioned circuit operation to take place.

Operation

As the circuit of the drawing is shown, the system is de-energized. Upon closing switch 130 to connect terminal 21 of the source of power to conductor 23, relay 51 is energized through the mentioned supervisory circuit. Since relay 35 is slow to operate approximately 50 milliseconds, the energization circuit of relay 35 through the normally closed switch formed by movable member 71 and contact 83 is broken before the relay has a chance to operate. As long as no trouble exists in the circuit and all of the detectors 10 are open, relay 51 will remain energized and the alarm and trouble indicators will be de-energized. Various types of trouble can exist in a fire detection system of this type to cause the energization of the trouble signal 14. For explanation purposes, an open circuit in loop 12 at the position 181 will be assumed. The open circuit results in the de-energization of relay 51. If the open circuit remains for a short period, relay 35 is energized through the circuit including the switch formed by movable member 71 and contact 83 and the switch formed by movable member 93 and contact 100. The de-energization of relay 51 results in the establishment of a circuit to energize the trouble signal 14. While the trouble signal is in operation, relay 51 is reconnected to loops 12 and 13 so that upon one of the detectors 10 closing, relay 51 can be energized to initiate the energization of alarm 15.

After the trouble indicated is given, relay 35 connects the opposite ends of loops 12 and 13 so the break in the loop 12 at the point 181 will not affect the operation of the fire alarm system should a detector on either side of the break close. If such was not the case, and the break took place in the forward end of the loop, all of the detectors farther out would be cut off from the alarm system rendering the fire alarm system only partially effective. With the break of the type described, none of these detectors 10 are cut out of the circuit should a fire exist to close a detector.

Assuming that relay 51 is de-energized and relay 35 is energized, the trouble indicator 14 would be energized to show that a trouble existed on the line. If the trouble at point 181 happened to be an installer removing a wire from a terminal, a replacement of the wire on the terminal would not allow relay 51 to be re-energized except for the resetting operation of circuit 130. Assuming that the trouble at point 181 was removed and a closed circuit existed in loop 12, the resetting circuit 130 would go through a normal operation to open the switch of movable member 134 and contact 135 to deenergize relay 35. At that time, relay 51 would again be re-energized and the system would remain in a normal energized state. Of course, if the trouble had not been removed, relay 51 would not have been able to be re-energized and relay 35 would again be energized to condition the circuit for receipt of an alarm. The recycling operation of circuit 130 continues until the trouble is removed.

For a normal alarm signal which takes place upon one of detectors 10 providing a closed circuit between loops 12 and 13, relay 51 is shunted to be de-energized and relay 35 is energized. A subsequent circuit then allows relay 51 to be re-energized and both relays 35 and 51 are energized to establish a circuit to energize the alarm 15. With both relays 51 and 35 energized, the resetting circuit 130 is not placed in operation as the switch formed by movable member 80 and contact 110 is open.

If the normally open detectors 10 are substituted for a coded device which would provide a closed circuit in accordance with some predetermined signal, jumper 82 would be removed so relay 51 is energized in accordance

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with the code received. Since the relay 51 would operate in accordance with the code, even though a circuit is provided to heater 133 of the resetting mechanism, the circuit is not established long enough to heat up bimetal 132. After the coded signal was received from the coding mechanism, relay 51 is de-energized and the normal resetting operation which exists upon the presence of only a trouble in the circuit occurs.

While the present invention has been described in one particular manner, the intention is to limit the scope of the invention only by the appended claims in which I claim:

1. In a fire alarm system, a first and a second series electrical circuit, a plurality of normally open temperature responsive switch means adapted to close upon reaching a predetermined temperature, circuit means connecting said switch means in parallel between said first and said second series circuits, first relay means having an energization winding and a plurality of switches, slow operating relay means having an energization winding and a plurality of switches, a source of power, series circuit means forming a normal circuit including said first and second series circuits, and two normally closed switches of said slow operating relay means for connecting said energization winding of said first relay means to said source to energize said first relay means when no break exists in said first and second circuits, time delay relay means having an energization winding and a normally closed delay switch operated in response to the energization thereof, second circuit means including a first normally closed switch of said first relay means and said normally closed delay switch of said time delay relay means for connecting said slow operating relay means to said source of power, means connecting a first normally open switch of said slow operating relay means in parallel with said first normally closed switch of said first relay means to provide a holding circuit to maintain energization of said slow operating relay means, and circuit means including a second normally open switch of said slow operating relay means and a second normally closed switch of said first relay means connecting said energization winding of the time delay relay means to said source whereby said slow operating relay means is de-energized upon the opening of said normally closed delay switch after a selected time period so that upon a subsequent removal of a break in said first and second circuits said first delay means will again be energized.

2. In a fire alarm system, a first and a second electrical circuit, a plurality of normally open temperature detector means adapted to provide a closed circuit upon reaching a predetermined high temperature, circuit means connecting said detector means in parallel between said first and said second circuits, first relay means having an energization winding and a plurality of switches, slow operating relay means having an energization winding and a plurality of switches, a source of power, circuit means connecting said first and second circuits, two normally closed switches of said slow operating relay means and said energization winding of said first relay means in a series circuit to said source to energize said first relay means, said series circuit being supervised since a trouble will reduce a current to deenergize said first relay means, time delay relay means having an energization winding to initiate operation of a normally closed delay switch which opens after a predetermined period of energization of said last mentioned winding, second circuit means connecting a normally closed switch of said first relay means, said normally closed delay switch and said energization winding of said slow operating relay means in a second series circuit to said source of power, means connecting a first normally open switch of said slow operating relay means in parallel with said normally closed switch of said first relay means to provide a holding circuit to maintain energization of said slow operating relay means after said trouble exists, third circuit means including a sec-

ond normally open switch of said slow operating relay means and a second normally closed switch of said first relay means connecting said energization winding of the time delay relay means to said source, trouble indication means, said indication means being energized when said third circuit means is complete, alarm indication means, further circuit means including said first normally open switch of said slow operating relay means and a normally open switch of said first relay means for connecting said alarm means to said source, and means for connecting one of said first mentioned electrical circuits and said first relay means to said source to form a series circuit including said detector means whereby upon the energization of said first relay means by a closed detector during said trouble said alarm indication means is energized.

3. In an alarm system, first and second circuit loops, first relay means having a first energization winding and a plurality of switches operated thereby, slow operating second relay means having a second energization winding and a plurality of switches operated thereby, a source of power, a plurality of normally open detector switches, said detector switches being closed upon the presence of a high temperature and being connected in parallel between said first and said second loops, first circuit means connecting two switches of said second relay means and said first energization winding in a series circuit between adjacent ends of said loops, circuit means connecting opposite ends of said loops to said source whereby during normal operation said first relay means is energized, third circuit means including a normally closed switch of said first relay means for connecting said second energization winding to said source whereby upon an open first circuit resulting in a termination of current flow in said loops said second relay is energized, a holding circuit for said second relay means to maintain said second relay means energized when said normally closed switch of said first relay is subsequently open, trouble alarm means, means for energizing said trouble alarm means when said first relay means is de-energized and said second relay means is energized, alarm means, circuit means associated with said first and second relays when energized to energize said alarm means, and cycling means energizable upon the presence of said trouble for periodically breaking said holding circuit for a short period so that whereby upon the subsequent presence of said current flow in said first circuit means said second relay means remains deenergized to indicate the removal of the trouble, however, if said current flow in said first circuit remains terminated said trouble alarm means remains energized.

4. In a detection system, at least one normally open device providing a closed circuit upon the presence of a predetermined condition, a source of power, a first and a second loop circuit, means connecting one end of each of said loops to an opposite side of said source, means connecting said device between said loops, a first relay means having a first energization winding, second relay means having a holding circuit, first circuit means associated with said second relay means for connecting said first energization winding between said loops to establish a supervisory circuit whereby said first relay means is energized if no trouble exists in said circuit to affect the supply of a predetermined current to said energization winding, means associated with said first relay when not energized for connecting said second relay means to said source to indicate the presence of trouble in the system, means associated with said second relay means for connecting said source to said loops at the opposite ends from said first mentioned power connection when said predetermined current does not exist whereby said first relay means can be energized upon a closed circuit of said device even though said open circuit trouble is present, and cycling means operable during said trouble for periodically de-energizing said second relay means to establish said super-

visory circuit to check said circuit so that if said trouble is gone said second relay will remain deenergized.

5. In a fire detection system, at least two loop circuits, a source of power, circuit means connecting one end of each of said loops to said source, high temperature responsive switch means providing a closed circuit upon the presence of a predetermined temperature indicative of fire, means connecting said switch means between said loops, first relay means, second relay means, first means actuated by said second relay means for normally connecting said first relay means between the other ends of each of said loops whereby a normal trouble free first circuit including said loops maintains said first relay means energized, a second circuit including circuit means actuated by said first relay means for connecting said second relay means to said source of power, said second relay means having a holding circuit which is established after said second relay is actuated, circuit means including means controlled by said second relay means when energized for connecting said source of power between one of said other ends and said first relay means whereby upon said responsive switch means providing a closed circuit energization of said first relay means can be established to actuate an alarm, cycling means including a time delay relay means and a third relay means for periodically opening said second circuit for a short period as long as said first relay is de-energized and said second relay is energized to allow said first circuit to be established if no open condition remains in said first circuit, said time delay relay comprising a bimetal operated switch means having a heater for heating a bimetal actuator and a normally open first switch which opens and closes at a low temperature of said bimetal and a normally open second switch which opens and closes at a high temperature of said bimetal, circuit means including normally open switch means actuated by said second relay means and said second switch for connecting said third relay means to said source, normally closed switch means actuated by said third relay means and said first switch connected in parallel forming a part of said second circuit, and circuit means including said normally open switch means actuated by said second relay means and switch means actuated by said third relay means for energizing said heater upon the occurrence of an open condition in said first circuit and said third relay switch means de-energizing said heater and closing a holding circuit for an energization circuit of said third relay means after said second switch closes.

6. In a detection system, at least one normally open device providing a closed circuit upon the presence of a selected condition, a source of power, a first and a second loop circuit, means connecting each of said loops to an opposite side of said source, means connecting said device between said loops, a first relay means having a first energization winding, second relay means having a holding circuit, said second relay means being slower to operate than said first relay means, first circuit means associated with said second relay means for connecting said first energization winding between said loops to establish a supervisory circuit whereby said first relay means is energized if no open circuit trouble exists in said circuit to affect the supply of a predetermined current to said energization winding, means associated with said first relay when not energized for connecting said second relay means to said source to indicate the presence of trouble in the system, means associated with said second relay means for connecting said source to said loops at the opposite ends from said first mentioned power connection when said predetermined current does not exist whereby said first relay means can be energized upon a closed circuit of said device even though said open circuit trouble is present, a slow operating cycling means energizable by said first and second relays during said trouble condition for periodically de-energizing said second relay means to establish said supervisory circuit to

check said circuit so that if said trouble is gone said second relay will remain de-energized, and means associated with said first relay means to prevent operation of said cycling means when said first relay means is energized so that until said device is open a predetermined period after closing said second relay means is held energized.

7. In a detection system, at least two loop circuits, a source of power, circuit means connecting one end of each of said loops to said source, condition responsive switch means providing a closed circuit upon the presence of a predetermined condition, means connecting said switch means between said loops, first relay means, second relay means, first circuit means actuated by said second relay means for normally connecting said first relay means between the other ends of each of said loops whereby a closed circuit including said loops maintains said first relay means energized, a normally closed switch actuated by said first relay means, third relay means and a first normally closed switch operated thereby, second circuit means including said normally closed switch of said first relay means and said normally closed switch of said third relay means for connecting said second relay means to said source of power however upon said second relay means being energized a holding circuit is established in parallel with said first relay switch, circuit means including means actuated by said second relay means for connecting said source of power between one of said other ends of said first relay means whereby upon said responsive switch means providing a closed circuit energization of said first relay means can be established to actuate an alarm even though said loop has an open condition, a time delay relay means for initiating the opening of said

second circuit means to allow said first circuit means to be established if no open condition remains in said first circuit, said time delay relay comprising a heater, a bimetal and bimetal operated switch means having a first delay switch which opens and closes at a lower temperature of said bimetal and a second delay switch which opens and closes at a high temperature of said bimetal, circuit means connecting said first delay switch in parallel with said first normally closed switch of said third relay means; circuit means including said normally closed switch of said first relay means, a normally open switch of said second relay means, and a second normally closed switch of said third relay means connecting said heater to said source; said third relay means being connected in parallel with said heater and said second normally closed switch of said third relay means by a circuit including said second delay switch; and a normally open switch of said third relay means connected by circuit means in parallel with said second delay switch to form a holding circuit for said third relay means whereby the total time said second circuit is open is maintained at a minimum to maintain the system responsive to closed detector device even though an open circuit exists in said first circuit.

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NEIL C. READ, *Primary Examiner.*