July 21, 1953 F. B. ALLEN 2,646,556

SUPERVISED ALARM SYSTEM

Filed June 17, 1950

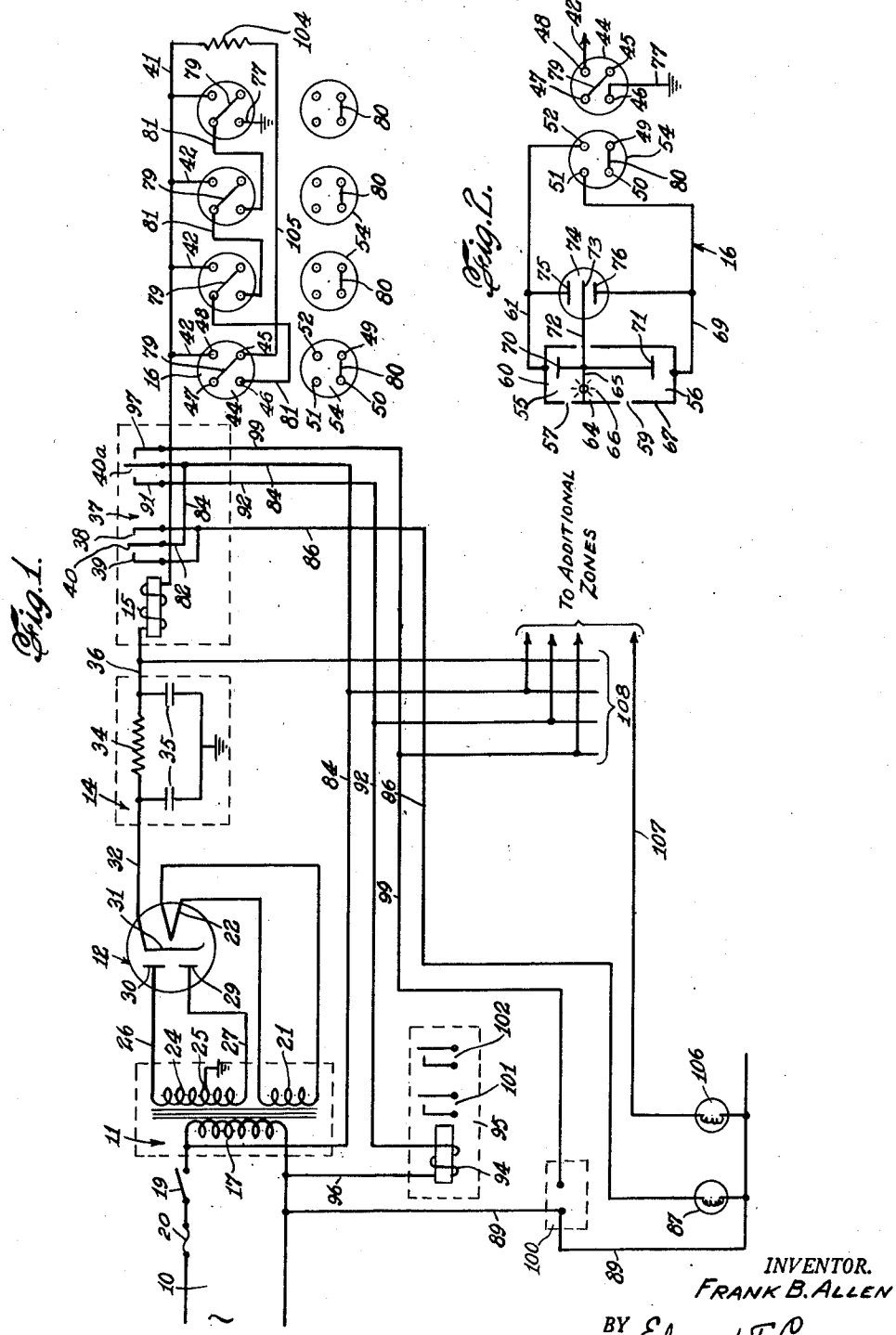



Fig. 1.

Fig. 2.

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Patented July 21, 1953

2,646,556

# UNITED STATES PATENT OFFICE

2,646,556

## SUPERVISED ALARM SYSTEM

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Application June 17, 1950, Serial No. 168,706

4 Claims. (Cl. 340—213)

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This invention relates to supervised alarm systems and more particularly to a system for use with a detector such as the ionization type wherein there is no current flow through the detector until a predetermined condition has occurred.

A system of the type to be described may be used for fire or smoke detection and may utilize an ionization detector. In the ionization detector a reference chamber and a test chamber have spaced electrodes upon which a predetermined potential difference is maintained, the air in both of the chambers being ionized by the presence of a radioactive material, the apparatus being constructed so that upon the entry into the test chamber of a fluid such as smoke the balanced condition is affected and an electronic relay is actuated to provide an alarm.

In the event the detector is used to indicate fire or smoke, it is important that supervisory means be continuously operable to ascertain any failure in the system such as a broken wire or the removal of a detecting unit. As a detector of this sort draws practically no current until an unbalance has occurred resulting from the disturbance of the ionization condition in the test chamber, there is no current flow and thus it is difficult to supervise the condition of the circuit.

The present invention aims to provide a supervised alarm circuit for use with a detector normally drawing practically no current.

Another object of the invention is to provide a supervised alarm circuit having means to indicate the failure of the source of electrical energy.

It is also an object of the invention to provide means to indicate a short circuit occurring in the detector circuit.

Another object of the invention is to provide means to indicate the removal of a detector unit from its mounting base.

A still further object of the invention is to provide a supervised alarm system which is simple and economical in manufacture and efficient in operation.

A circuit in accordance with the invention is advantageous as it permits the use of an adaptor and testing means for the adjustment of the detector in the position in which it is to be used.

Other objects and advantages of the invention will be apparent from the following description and from the accompanying drawing which shows, by way of example, an embodiment of the invention.

In the drawings:

Figure 1 is a diagrammatical representation of a supervised alarm system constructed in accordance with the invention.

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Figure 2 is a diagrammatical representation of an individual detector circuit used in the system shown in Figure 1.

Referring to the drawings, there is shown a supervised alarm system in accordance with the invention connected to a source of alternating current supply 10 through a transformer 11. The alternating current supplied by the transformer 11 is converted to direct current by the rectifier 12 and filtered in the circuit 14 after which it is passed through a relay coil 15 connected in series with a plurality of detector units 16 and thence to ground. As shown in the drawing, the detector units 16 are connected together for use in a single zone and a plurality of parallel connections may be made to other detectors likewise connected in one or more other zones.

The transformer 11 is preferably of the regulator type producing a constant output voltage irrespective of minor variations in its input voltage. A primary winding 17 of the transformer 11 is connected through a switch 19 and a fuse 20 to the source of alternating current supply 10. A secondary heater winding 21 is connected to a heater filament 22 of the full-wave rectifier tube 12. A secondary load winding 24 of the transformer 11 has its midpoint 25 grounded and its outside leads 26 and 27 connected to anodes 29 and 30 of the full-wave rectifier 12. A cathode 31 of the full-wave rectifier tube 12 is connected in series by a wire 32 to the filter 14 including an inductance 34 across the ends of which are connected a pair of grounding condensers 35. The output of the filter 14 is connected by a wire 36 in series with the coil 15 of a supervisory and alarm relay 37 having a pair of double-throw contacts 40 and 40*a*. The outgoing lead of the relay coil 15 is connected by a wire 41 from which the detector units 16 are connected in parallel by wires 42. The detector units 16 are supported by mounting brackets 44 each made with jacks 45, 46, 47 and 48 to coact respectively with plugs 49, 50, 51 and 52 positioned in bases 54 of the units.

In Figure 1, four of the detector units 16 are shown connected in parallel with each other to provide multiple protection for a single zone. For simplicity of illustration, the mounting brackets 44 are shown with the detector units 16 removed. In Figure 2 there is shown a single detector unit 16 supported on its mounting bracket 44. The detector unit 16 includes a control ionization chamber 55 and a test ionization chamber

56, chamber 55 being vented to the atmosphere through a small aperture 57 in its wall for equalization of the control chamber pressure and the atmosphere pressure, while chamber 56 has a comparatively large opening 59 for the easy movement of air to be tested through the chamber. The control ionization chamber 55 has its outer wall 60 forming an electrode connected by a wire 61 to terminal 52 of the base 54. An intermediate insulated portion 64 carries a partition 65 having thereon a small portion of radioactive material 66 which provides for the ionization of the air in the control chamber 55 and in the test chamber 56. The test chamber 56 has its outer wall forming an electrode 67 connected by a wire 69 to terminal 51 of its base. Within the chambers 55 and 56 are positioned electrodes 70 and 71 both spaced from the walls of their respective chambers and insulated therefrom and connected by a wire 72 to the control electrode 73 of a cold cathode tube 74. Plate 75 of the cold cathode tube 74 is connected to the wire 61 and a second plate 76 is connected to the wire 69 thereby connecting the cold cathode tube in parallel across the two chambers 55 and 56. The ionization chambers and the cold cathode tube are mounted in a suitable casing on the base 54 to provide a detector assembly easily removable or replaceable, if desired.

In the event a single detector unit 16 is to be used in a zone, its terminal 47 is grounded, while if a plurality of units are to be used in a zone, a ground wire 77 is connected to the terminal 46 of the last detector providing a series ground connection through all of the detector units in one zone. The mounting brackets have their terminals 45 and 47 connected by jumpers 79 while the detector bases 54 have their terminals 49 and 50 connected by jumpers 80. A series connection between each detector is provided by connecting terminal 46 of the first detector unit by a wire 81 with terminal 47 of the next unit and making like connections between each of the detector units 16. By this means a series connection is made through each detector unit 16 to ground so that the removal of one of the detector units will indicate an open circuit and produce a trouble signal.

The movable contact 40 of the supervisory and alarm relay 37 is used to complete a circuit to provide an indication of a zone in which fire or other conditions is present. Movable contact 40 is connected by a wire 84 to one side of the supply transformer coil 17 while fixed contact 39 is connected by a wire 86 to a zone indicator 87 having its other terminal connected by wire 89 to the other side of the coil 17 of the supply transformer. The other fixed contact 38 is connected in parallel with the fixed contact 39.

The double-throw contact 40*a* is connected to one side of the source of supply through the wire 84. Fixed contact 91 is connected through a wire 92 to one side of the coil 94 of an alarm relay 95, the other side of the coil 94 is connected to the other side of the source of supply by a wire 96. Fixed contact 97 of the double-throw contacts 40*a* is connected by a wire 99 to one side of a trouble buzzer 100. The other side of the trouble buzzer is connected by the wire 89 to one side of the coil 17 of the power supply. The alarm relay 95 has additional contacts 101 and 102 which may be connected in a circuit with alarm gongs to a central station, or to initiate the discharge of a fire extinguishing system.

The supervisory and alarm relay 37 preferably has a wound armature so that its contacts may be positioned depending upon the current flow through the relay coil 15. Under conditions of no current or under a predetermined minimum current flow, the armature moves to connect contact 40*a* with 97 to give a trouble alarm, and contacts 40 and 38 are connected to give a zone indication. For a greater current flow through the relay coil 15, the armature changes the position of the movable contacts to a floating position between the fixed contacts. Under conditions of a still greater current, the armature causes the movable contacts to move upwardly to connect contacts 39 and 40 for the zone indicator 87 and to connect contacts 40 and 91 to the fire alarm relay 95. In order to produce sufficient current flow to maintain the movable contacts floating during normal operation of the system, a resistor 104 is connected between the wire 41 and the terminal 45 of the detector mounting base by a wire 105. A circuit is then provided drawing a predetermined minimum current through the relay coil 15 so as to hold the contacts away from the trouble position.

In operating a system in accordance with the invention, it is connected to a source of alternating supply 10 thereby energizing the transformer 11 and high voltage is applied to the plates of the rectifying tube 12. The output of the rectifying tube 12 passes through the filter 14, through the coil 15 of the supervisory relay 37, through the resistor 104, the jumper connection 79 of the mounting block, through the jumper connection 80 of the detector base, and through wires 81, and to ground through connection 77.

In the event any of the detectors 16 are removed from their mounting bracket 44, the circuit for the resistor 104 is opened thereby causing the supervisory relay to cause the trouble alarm to be given. Likewise, if an open circuit occurs in the wiring to the detector unit 16, the current through the relay coil 15 drops to zero causing the trouble alarm to be sounded and causing a zone indication. A failure of the alternating current supply likewise causes the relay to drop to the trouble position.

In the event a condition is present, such as fire, causing an unbalance of the ionization chambers 55 and 56, the cold cathode tube 74 is triggered to break down and cause an increased current flow through the relay coil 15 thereby producing a fire alarm and zone indication. Further, in the event a short circuit occurs in the detector or zone wiring an alarm signal is given.

In order to adjust or set the detector 16 for any predetermined condition, an adaptor jack (not shown) may be interposed between the detector base 54 and the mounting bracket 44 thereby providing for connections to adjust the detector while it is positioned in the space wherein it is to be used.

If conditions warrant the installation of one or more additional zones, connections thereto may be made in parallel to wires 84, 92, 99 and 86 as indicated at 108, and an additional zone indicator 106 may be connected by a wire 107.

From the foregoing description it may be seen that a supervised alarm system has been provided for use with a detector normally drawing practically no current. Supervision is given of the failure of the power supply, the presence of a short circuit, the presence of fire and an indication of the removal of one of the detector units.

While the invention has been illustrated and described with reference to a specific embodiment

thereof, it will be understood that other embodiments may be resorted to without departing from the invention. Therefore, the form of the invention set out above should be considered as illustrative and not as limiting the scope of the following claims.

I claim:

1. An electrically actuated alarm system comprising an alarm signal to indicate a predetermined condition, a trouble signal to indicate malfunctioning of the system, single relay means to close a circuit to the trouble signal for a current flow below a minimum amount and to open the trouble circuit for a current flow above the minimum amount and to close a circuit to the alarm signal for a current flow of the same polarity above a predetermined amount, a resistor in series with the relay means to provide a current flow above the minimum amount to open the trouble signal circuit, a detector connected in parallel with the resistor and responsive to a predetermined condition to provide a current flow above the predetermined amount to close the alarm circuit, a mounting bracket for the detector carrying a pair of contacts connected in series, a base for the detector, and a second pair of contacts connected in series and carried by the base, whereby when the detector is in position on the mounting block the two pairs of contacts are in series.

2. An electrically actuated alarm system comprising an alarm signal to indicate an ionization condition, a trouble signal to indicate malfunctioning of the system, a relay switch having a set of double-throw contacts, one set of contacts connected to the alarm signal and the other set connected to the trouble signal, a single relay coil to actuate the relay switch, the relay switch constructed and arranged to close the trouble contacts for a current flow through the relay coil below a minimum amount and to open the trouble contacts for a current flow of the same polarity above the minimum amount and to close the alarm contacts for a current flow above a predetermined amount, a resistor in series with the relay coil to provide a current flow above the minimum amount to open the trouble signal circuit, a detector connected in parallel with the resistor responsive to an ionization condition to pass current to provide a current flow above the predetermined amount to close the alarm circuit, a mounting bracket for the detector, a pair of contacts on the mounting bracket in series with the relay coil, a base for the detector, and a pair of series-connected contacts on the base, the base series contacts adapted to coact with the bracket contacts to complete the relay circuit to the resistor and the detector whereby a trouble signal is given if the detector is removed from its bracket.



3. An electrically actuated alarm system comprising alarm signal means to indicate a predetermined condition, a trouble signal to indicate malfunctioning of the system, a circuit adapted to be connected to a source of electric current, a resistor connected across the circuit to draw a predetermined current therethrough, a detector responsive to the predetermined condition to provide additional current through the circuit of the same polarity as the current through the resistor, first switch means, a set of double-throw contacts for the first switch means, one set of contacts connected to the alarm signal and the other set connected to the trouble signal, second switch means, a set of double-throw contacts for the second switch means, a zone indicator, both of said second sets of double contacts connected to the zone indicator, and single relay means responsive to the current in the circuit to close the trouble switch for a current flow below a predetermined minimum amount and to close the alarm switch upon the flow of a predetermined additional amount of current and to close one set of the zone indicator switch contacts with the alarm contacts and the other set of zone contacts with the trouble contacts so that the location of the condition or trouble is given.

4. An electrically actuated alarm system comprising alarm signal means to indicate a predetermined condition, trouble signal means to indicate malfunctioning of the system, electric circuit connection means, relay means to operate the signals, a resistor connected in the circuit in series with the relay to draw a predetermined current therethrough for normally preventing actuation of the trouble signal means, a detector responsive to the predetermined condition to provide additional current through the relay of the same polarity as the current through the resistor for the actuation of the alarm signal, a mounting bracket for the detector, a pair of contacts carried by the mounting bracket and connected in series with the resistor, a base for the detector, and a pair of contacts connected in series and carried by the base, the base contacts cooperating with the bracket contacts to complete the circuit through the resistor, whereby upon the removal of the detector and its base the trouble signal is actuated.

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**References Cited** in the file of this patent

UNITED STATES PATENTS

| Number | Name | Date |
|---|---|---|
| 1,229,939 | Goldstein | June 12, 1917 |
| 1,909,212 | Muehter | May 16, 1933 |
| 2,000,074 | Grant, Jr. | May 7, 1935 |
| 2,473,940 | Clark | June 21, 1949 |