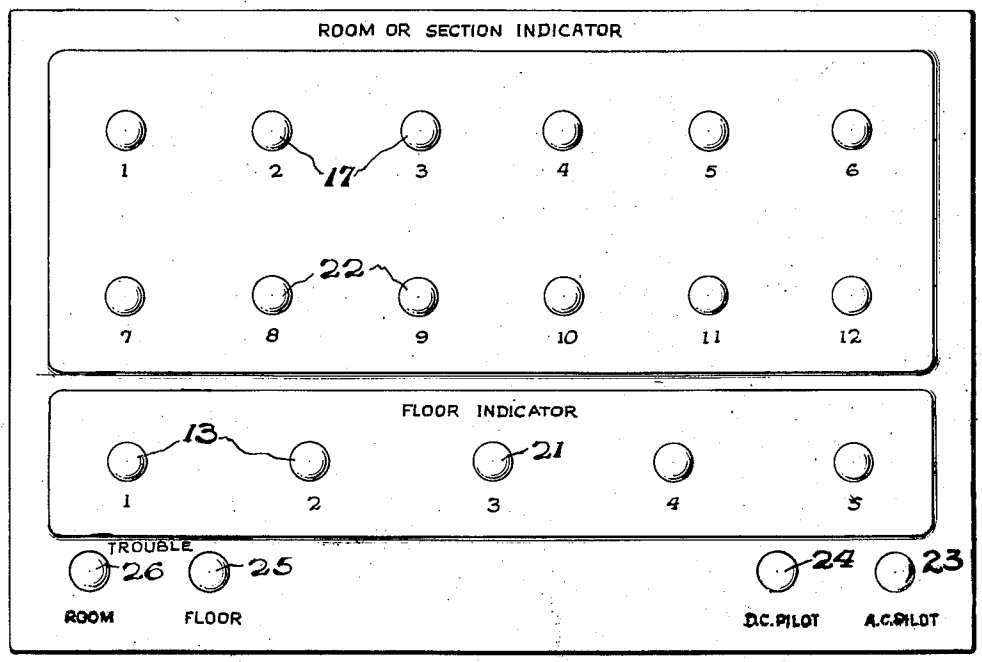
July 29, 1952 S. D. SPURLING 2,605,342

FIRE ALARM SYSTEM

Filed Dec. 10, 1948 4 Sheets-Sheet 1

Fig. 1.



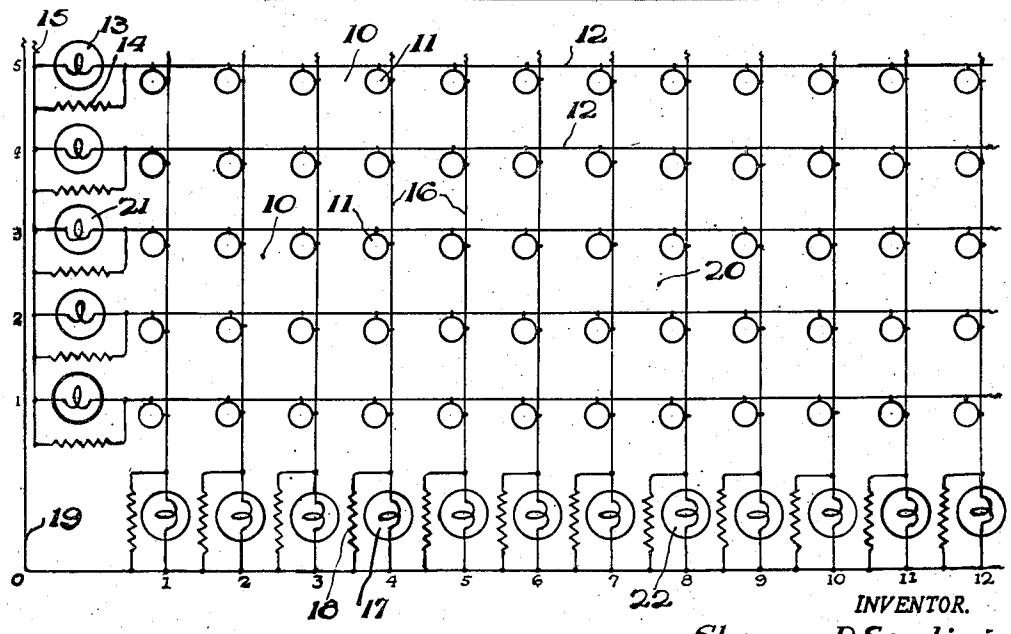


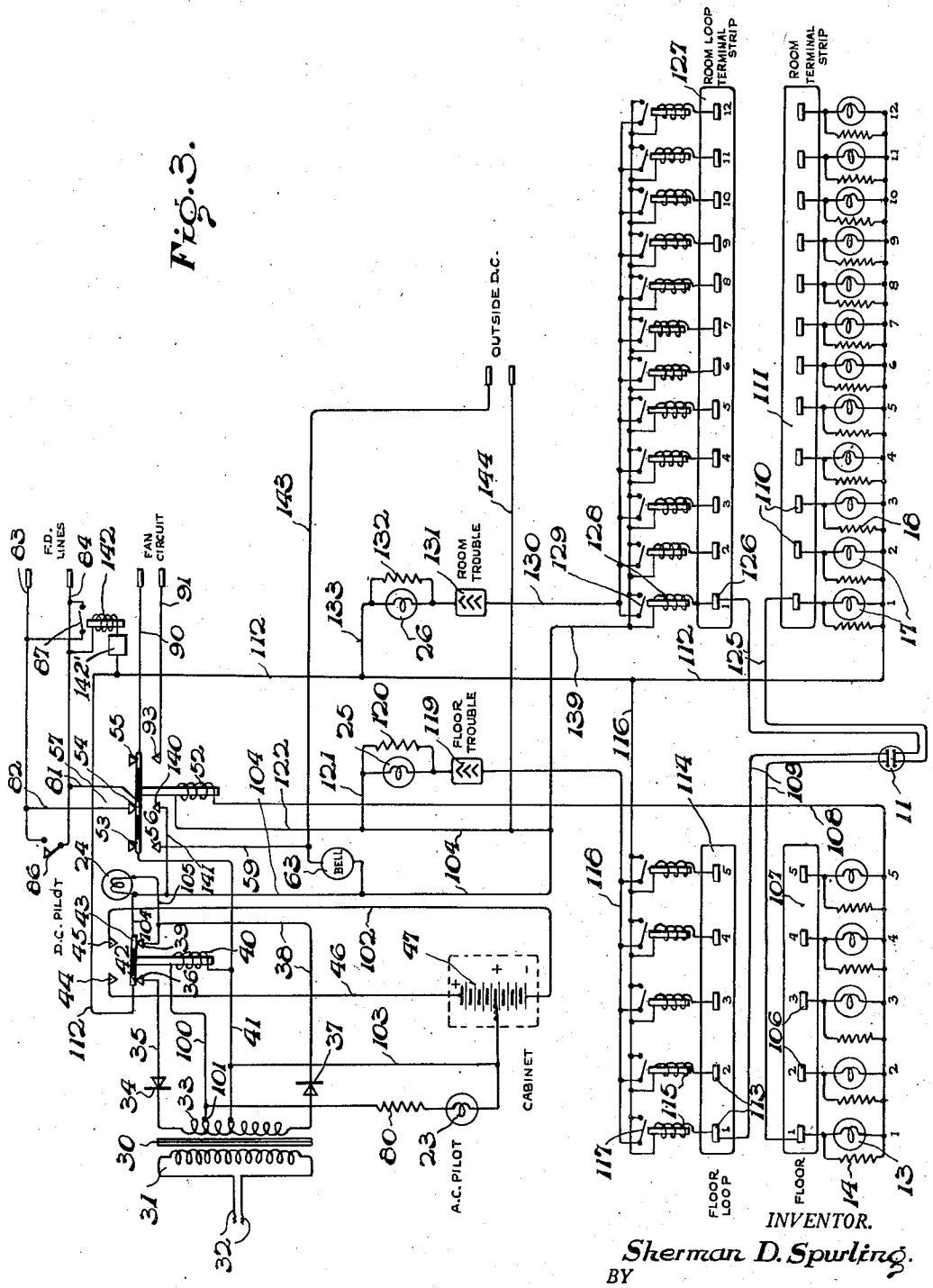
Fig. 2.

July 29, 1952 S. D. SPURLING 2,605,342

FIRE ALARM SYSTEM

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Fig. 3.



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FIRE ALARM SYSTEM

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Fig. 4.

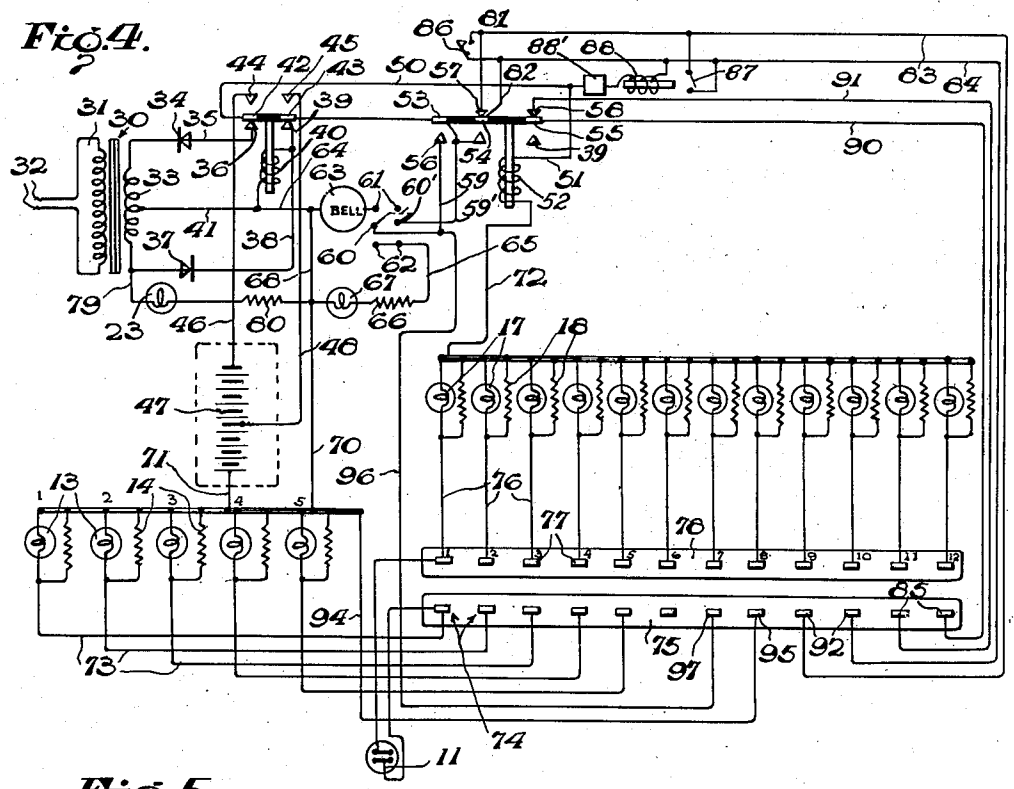
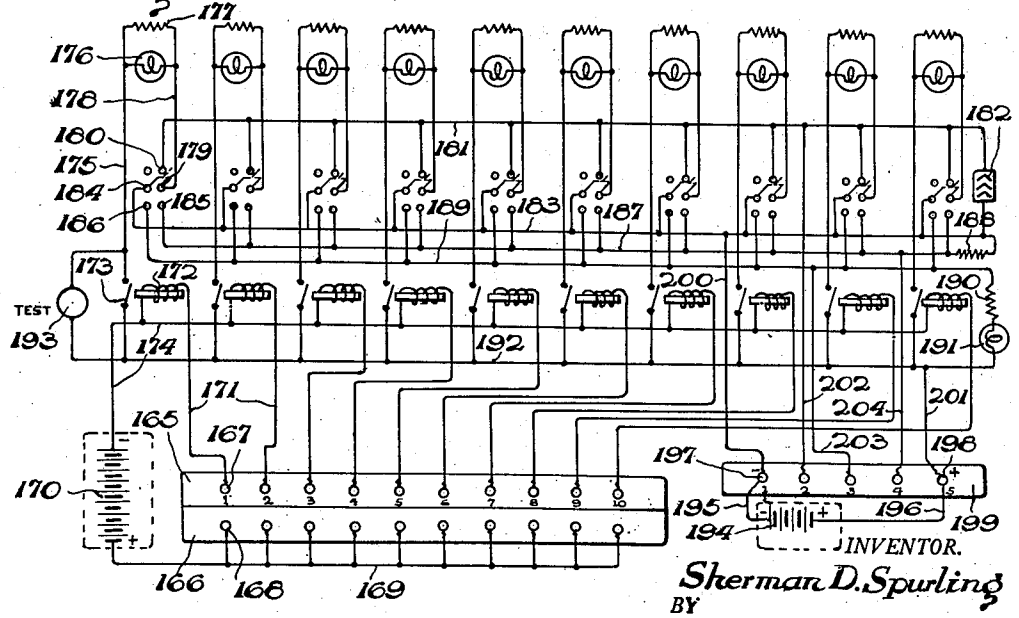


Fig. 5.



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FIRE ALARM SYSTEM

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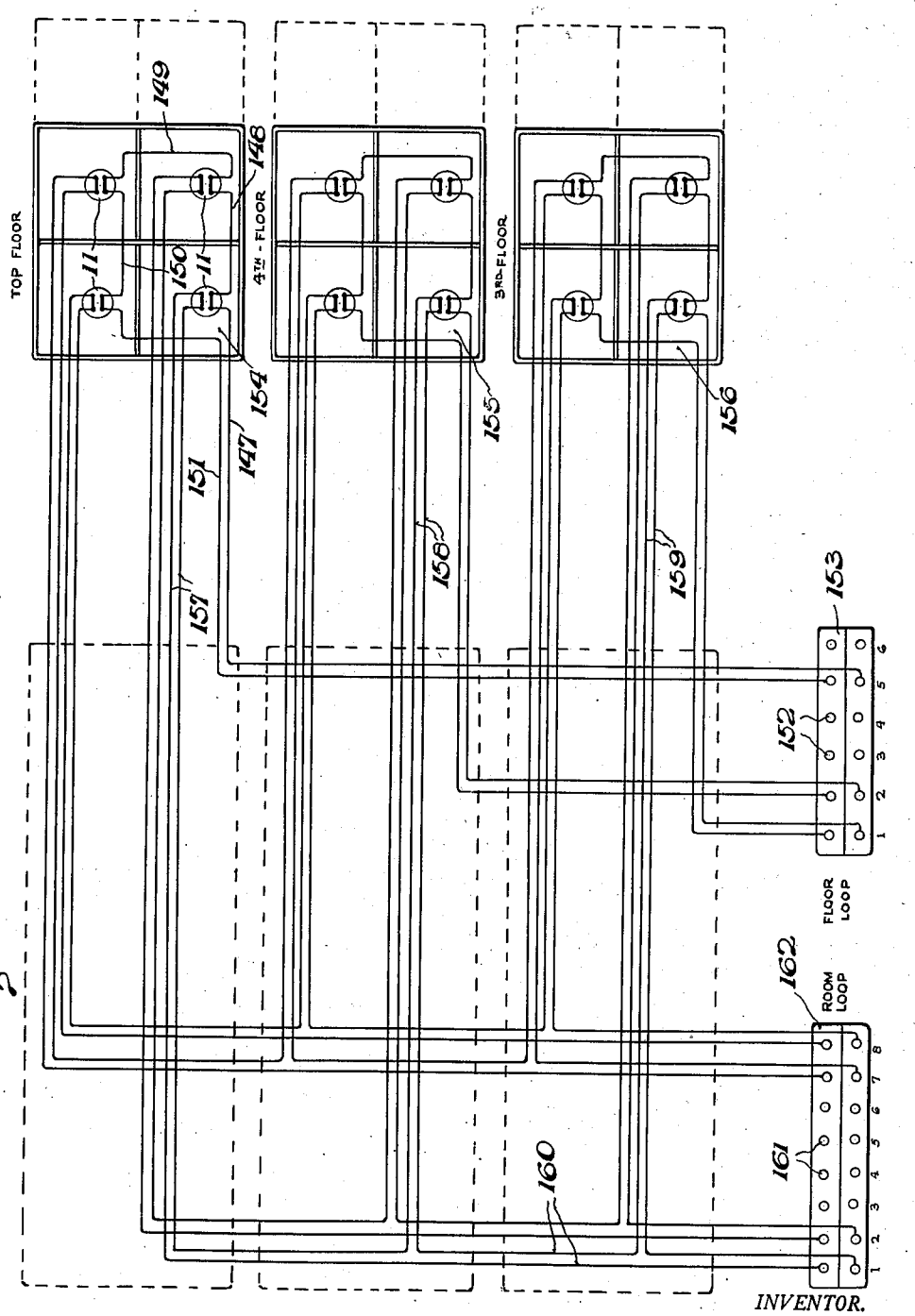


Fig. 6.

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2,605,342

UNITED STATES PATENT OFFICE

2,605,342

FIRE ALARM SYSTEM

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Application December 10, 1948, Serial No. 64,548

12 Claims. (Cl. 177—355)

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This invention relates to fire alarm systems, the present application being a continuation-in part of my application Serial No. 737,745, filed March 28, 1947 now abandoned.

It has heretofore been proposed to provide a building containing a plurality of rooms, apartments or other comparable spaces, hereinafter referred to as compartments, such for example as a hotel, with a thermostat or heat responsive switch which, upon the occurrence of a fire in any one of said compartments, will close a suitable circuit leading to a centrally arranged annunciator for indicating the location of the fire. Devices of this character as heretofore proposed become unduly complicated where the number of thermostats is relatively large as, continuing with the example of a hotel, where there are many floors each having a large number of rooms thereon.

It is an object of this invention to provide an improved fire alarm system of the type referred to which is of simplified construction whereby a separate signaling device corresponding to each compartment is unnecessary.

Another object of this invention is to provide an improved firm alarm system as just characterized wherein the annunciator by using separate floor and compartment signaling devices reduces the required number of signaling devices to the sum of the number of floors and the maximum number of rooms on any one floor.

Another object of this invention is to provide an improved fire alarm system which will immediately indicate a break in any line leading from any thermostat to the annunciator.

Another object of this invention is to provide an improved fire alarm system of the type last characterized which will accurately indicate whether the break exists in a line leading to a particular floor or in a line connecting corresponding compartments on the several floors.

Another object of this invention is to provide an improved fire alarm system of the type above characterized which will not only accurately indicate at a central station in which of a plurality of compartments a fire exists but simultaneously and automatically communicate the existence of the fire immediately to an external station, as a fire department station, indicating in which building the fire exists.

Another object of this invention is to provide an improved fire alarm system satisfying any of the foregoing objects which is normally powered by the local electric power lines but upon any break or interruption in the supply of said power

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will be automatically operated to cut in a battery or other emergency source of power for the duration of such interruption.

Another object of this invention is to provide an improved fire alarm system satisfying any of the foregoing objects with which may be associated suitable provisions for giving audible signals to warn occupants of the fire, or to shut off fans, close windows or doors, or operate other means for minimizing the intensity or spread of the fire.

Another object of this invention is to provide an improved fire alarm system satisfying any of the foregoing objects and including an audible signaling device with which may be associated means for interrupting the audible signal but at the same time energizing a visible signaling device to show that the circuit has been actuated but the audible signaling device has been cut out, or with which may be associated provisions for testing the operability of the circuits without sending in an alarm, or with which may be associated means for indicating the operating condition of specified circuits, etc.

Another object of this invention is to provide an improved fire alarm system of the character hereinabove specified wherein the wiring is simplified and subject to ready inspection and repair.

Another object of this invention is to provide an improved fire alarm system as above characterized with a simple and compact annunicator that may be located at any convenient central station and which is provided with readily visible signaling means for not only indicating in which compartment the fire has arisen but also if desired with signaling means for indicating the operability of the involved circuits, the source of power under which the system is working, etc.

Another object of this invention is to provide an improved fire alarm system as above characterized which is easy to install, simple in construction and highly efficient in operation.

Other objects will appear as the description of the invention proceeds.

The invention is capable of being embodied in a variety of ways, as will be apparent to those skilled in the art from the ensuing explanation, and therefore it is to be expressly understood that the drawings are for purposes of illustration only, and are not to be construed as definitions of the limits of the invention, reference being had to the appended claims for that purpose.

Referring in detail to the accompanying drawings wherein like parts are designated by the same reference characters in the several figures,

Fig. 1 is a diagrammatic face view of an annunciator embodying the present invention;

Fig. 2 is a purely diagrammatic view for the purpose of illustrating the thermostatically operated switches in the several compartments together with electrical connections to signaling means for respectively designating the floor and room on the floor at which the fire exists;

Fig. 3 is an electrical diagram of a fire alarm system embodying the present invention and including provisions for indicating a break in any of the circuits leading to the respective compartments;

Fig. 4 is an electrical diagram of a simplified fire alarm system for indicating the compartment at which the fire exists without provisions for indicating a break in any of the lines;

Fig. 5 is an electrical diagram illustrating the signal system which may be installed at any suitable external station, as for example a fire department station; and

Fig. 6 is an electrical diagram for illustrating the wiring connections from each of the several compartments of a building provided with the fire alarm system of the present invention.

In conformity with the present invention each compartment of a building, of whatever number of floors and of whatever number of compartments on the several floors, is provided with at least one thermostat for the purpose of actuating switch means to close a pair of electrical circuits in the event of a fire. For simplicity the invention has been illustrated as using only one thermostat in each compartment, but as will be apparent to those skilled in the art more than one thermostat can be used in each compartment if the size thereof is such as to warrant it. Any suitable thermostat may be employed, but by preference the thermostat used is a dual action thermostat which will function to close the electrical circuits if the rate of temperature rise exceeds a predetermined rate or if the temperature exceeds a predetermined minimum, so that the thermostat will respond to a rapidly rising temperature, such as would exist if a fire occurs in the neighborhood of the thermostat even though the average temperature of the compartment may be low, or to an elevated temperature above that which is normal for the compartment. Thermostats of this character are available on the market and disclosed, for example, in the patents to Van Houten, Nos. 2,267,484 and 2,267,541 of December 23, 1941, and Griffith, No. 2,413,140 of December 24, 1946.

Referring first to Fig. 2, the invention has been shown diagrammatically as applied to a building of five stories having twelve compartments on each story, although as will be apparent to those skilled in the art the invention may be applied to buildings having any number of stories and any number of compartments on each story. As illustrated diagrammatically in this figure, each compartment **10** is provided with a combined thermostat and thermostatically operated switch **11**. A suitable lead **12** connects one contact point of all of the thermostatically operated switches on each floor in series with one another and with a signaling device **13** individual to that floor, preferably in the form of a lamp, around which is shunted a suitable resistor **14** such that, in the event the lamp burns out, the circuit for that floor leading to the line **15** is still effective to operate as herein described. Similarly, a suitable lead **16** connects one contact point of all of the thermostatically operated switches for the compartments of like number on the several floors in series with one another and with a signaling device individual to that room number, also preferably in the form of a lamp **17**, around which is shunted a suitable resistor **18** such that, in the event the lamp burns out, the circuit to the line **19** is still effective to operate as herein described. Therefore, if a fire occurs in any compartment, as compartment No. 8 on the third floor designated **20** in Fig. 2, the thermostatically operated switch **11** in that compartment will simultaneously complete the circuit through lamp **21** indicating the third floor and lamp **22** indicating compartment No. 8. Thus, in the illustration selected, the simultaneous lighting of the two lamps **21** and **22** will at once indicate that the fire exists in compartment **38**.

According to the present invention the series of lamps **13** designating the floors and the series of lamps **17** designating the compartment numbers are assembled in an annunciator which may be disposed at any desired central location, as in the office of a hotel, or in the lobby of an office building, or a position visible or readily accessible from the exterior of the building so that the location of the fire may be at once observed by firemen upon reaching the building, etc. Such an annunciator is diagrammatically indicated in Fig. 1 wherein the floor lamps, respectively numbered **1** to **5**, are shown at **13** and the compartment lamps, respectively numbered **1** to **12** and illustrated as in two tiers, are designated **17**. Therefore, in the case of a fire in compartment **38** as above referred to, floor lamp **3** designated **21** and compartment lamp **8** designated **22** will light simultaneously, so that at a mere glance at the face of the panel the fire may be located.

As hereinafter explained, the system may also be provided with signal lights to indicate whether the system is operating on the local electric power system or on an emergency system as a battery, and the face of the panel accordingly be provided with lights **23** and **24** to show how the system is being powered. As also explained hereinafter, the system may include a signaling device which becomes effective in the event that the connections on any floor are broken or the connections between corresponding compartments on the several floors are broken, and the face of the panel may therefore be provided with lamps **25** and **26** to show whether the trouble exists in a floor circuit or in a circuit between corresponding compartments on the several floors, respectively.

Referring next to Fig. 4, a suitable wiring diagram is illustrated for an installation wherein the occurrence of a fire in any compartment is indicated at a central station, as an annunciator as shown in Fig. 1, and an appropriate signal is sent to an outside station, as a fire department station, as hereinafter explained, this system including no provision for indicating automatically when any of the circuits is broken and therefore sometimes referred to as an unsupervised system. As shown, a transformer **30** of any suitable size and construction has its primary **31** connected by leads **32** to any suitable source of power, as the local electric power lines supplying for example 110 volts A. C. One end of the secondary **33** of said transformer is connected through any suitable rectifier **34** and lead **35** with a contact point **36** and the opposite end is connected through any suitable rectifier **37** and lead **38** with a contact point **39**. Lead **38** has connect-

ed thereto one end of a relay coil 40, the opposite end of said coil 40 being connected by lead 41 to the secondary 33, say at the midpoint thereof. Associated with the contact points 36 and 39 are the contact points 42 and 43, respectively, operable by the armature of the relay coil 40, which armature is suitably biased as by a spring to withdraw contact points 42 and 43 from the contact points 36 and 39, respectively, and engage them with opposed contact points 44 and 45 hereinafter referred to. However, when current is received at the primary 31 the relay coil 40 is energized and its armature with contact points 42 and 43 held in position to engage the same with the contact points 36 and 39, respectively. Opposing contact points 36 and 39 and in a position to be engaged by the contact points 42 and 43 when relay coil 40 is de-energized are a pair of contact points 44 and 45. Contact point 44 is connected by lead 46 to one end of a battery 47 of any suitable size and construction, say sixteen volts if the transformer 30 is constructed to provide sixteen volts on the secondary, while contact point 45 is connected by lead 48 to an intermediate point of said battery 47, say the midpoint thereof. Thereby, when the coil 40 is de-energized contact points 42 and 43 are moved automatically into engagement with the contact points 44 and 45 and apply to the lines next to be described the same voltage from the battery 47 as exists when coil 40 is energized to hold contact points 42 and 43 in engagement with contact points 36 and 39.

Contact point 42 is connected by leads 50 and 51 with one end of a second relay coil 52. Associated with said relay coil 52 is an armature carrying three contact points 53, 54 and 55 with which are associated contact points 56, 57 and 58, respectively. Said armature is biased, as by a spring, so that when coil 52 is de-energized contact points 54 and 55 are engaged with contact points 57 and 58, respectively, while contact point 53 is separated from contact point 56. Contact points 56 and 53 are connected by leads 59 and 59' respectively to the poles 60 and 60' of a double pole, double throw switch which may be moved to close contact point 61 at one extremity of its throw or contact point 62 at the opposite extremity of its throw. One of the contact points 61 is left blank, but the other contact 61 which is associated with the pole 60 is connected by a suitable lead to a bell or other audible signal device 63 which in turn is connected by lead 64 to lead 41. Both of the contact points 62 are connected through lead 65 and a suitable resistor 66 to a visible signal device as a lamp 67 which in turn is connected by lead 68 to lead 64.

The several floor lights 13 with their associated shunt resistors 14 are connected in series by suitable leads 70 and 71 to the leads 64, 41 in circuit with secondary 33 and to the terminal of the battery 47, respectively. Similarly, the several room lights 17 with their associated shunt resistors 18 are connected in series by a suitable lead 72 to the relay coil 52. The several floor lights 13 are connected by suitable leads 73 to appropriate jacks 74 on a connector strip 75, and the several room lights 17 are connected by suitable leads 76 to suitable jacks 77 on a connector strip 78. To avoid complication only one thermostatically operated switch 11 is indicated diagrammatically in Fig. 4, this switch being shown as that connected for disposition in the first room on the first floor.

A signal lamp 23 is preferably used to indicate when the A. C. source of power is effective (compare Fig. 1) and is shown as connected to the secondary 33 by a lead 79 and, through a suitable resistor 80, to the lead 68. Similarly, a signal lamp 24, as will be explained in conjunction with the diagram of Fig. 3 may be used to indicate when battery 47 is powering the system.

Contact points 54 and 57 are connected through leads 81 and 82, respectively, to lines 83 and 84 which run to the external station, as the fire department station, being shown as connected to suitable jacks 92 on the strip 75. As explained more fully hereinafter, the circuit including lines 83 and 84 is actuated by separating contact points 54 and 57, although if preferred for any reason the circuit including said lines 83, 84 may be actuated by closing contacts when the armature of the relay coil 52 is operated. The circuit including lines 83 and 84 may include a switch 86, as explained more fully in conjunction with Fig. 3, for preventing the sending in of a false alarm when said circuit is under inspection. Fig. 4 also shows a make and break switch 87 actuated by a coil 88 and a suitable flasher element 88' connected between line 84 and lead 50, so as to impose an intermittent signal on the circuit including lines 83 and 84 when a fire occurs, as to be explained more fully in conjunction with Fig. 3.

Contact points 55 and 58 are connected to lines 90 and 91, which are also shown as leading to suitable jacks 85 on the strip 75, the circuit including such lines 90, 91 being shown as opened when the armature of relay 52 is actuated, although if preferred a contact point 93 may be disposed for engagement with the contact point 55, as shown in Fig. 3, for closing the circuit including the lines 90 and 91 upon energization of the relay 52. The circuit including lines 90 and 91 may be used to actuate auxiliary signals, as gongs to arouse the occupants of a building for example, or to open the circuit of all fans so as to prevent accentuation of the fire by draft, etc. The series of floor lamps 13 may also have a lead 94 leading to a jack 95 on strip 75 and the double throw switch including contact points 60 may also be connected by lead 96 to a jack 97 on said strip 75, so that upon energization of the circuit including said contact points 60 the circuit including said leads 94 and 96 may be actuated for energization of additional signals or for performing other suitable functions.

In operation, as long as the source of current is connected to leads 32 of the transformer 30 the relay coil 40 is energized through the circuit including secondary 33, lead 38, coil 40 and lead 41, whereby the armature carrying contact points 42 and 43 is positioned to hold said points in engagement with the contact points 36 and 39. In the event of failure of the source of current through leads 32, relay coil 40 is de-energized and the armature of said relay is spring actuated to engage the contact points 42 and 43 with contact points 44 and 45, connecting the battery 47 into the circuit through leads 46 and 48. As soon as power is restored to the leads 32, however, coil 40 is re-energized, moving the armature carrying contact points 42 and 43 back into engagement with the contact points 36 and 39. As long as power is being received through the leads 32 lamp 23 is in circuit with the secondary of the transformer 30 through lead 79, resistor 80 and leads 68, 64 and 41, but the circuit of said lamp is

broken, as is apparent, when the battery 47 is cut into the circuit.

Assume that the contact points 42 and 43 are being held against contact points 36 and 39 and that a fire occurs in the first room on the first floor so as to complete a circuit through the thermostat 11. Current will now flow from the secondary 33 through contact points 36 and 42, leads 50 and 51, relay coil 52, lead 72, the lamp 17 designating room 1 at the annunciator, and the corresponding lead 76 to the corresponding jack on strip 78, through the now completed circuit of thermostat 11 to that jack 74 on strip 75 which is connected through lead 73 with the lamp 13 designating floor 1, and through the leads 70, 64 and 41 back to the secondary 33. Energization of the relay 52 moves the armature carrying contact points 53, 54 and 55 so as to engage contact point 53 with contact point 56 and remove contact points 54 and 55 from contact points 57 and 58. When contact points 53 and 56 are engaged the current flows from the secondary through lead 38, contact points 39, 43, contact points 53, 56 and lead 59, and assuming the double throw switch is in its upper position as shown on the drawings, it closes the circuit from lead 59 through pole 60, contact point 61, the bell 63 and leads 64 and 41. Thereby the bell 63 gives an immediate audible warning of the occurrence of the fire and the appropriate lamps 13 and 17 are lighted to show the floor number and room number where the fire exists. In the event that a lamp has burned out the circuit is still completed through the associated shunt resistor so that the signal is given.

It may be desirable to discontinue the operation of the audible signaling device after appropriate attention has been directed to the existence of the fire, and this may be done by moving the double throw switch to its lowermost position so as to engage the contact points 62, in which event the circuit from contact points 39 and 43 is completed through the contact points 53 and 56, leads 59 and 59', switch poles 60 and 60' and contacts 62, lead 65, resistor 66, lamp 67 and leads 68, 64 and 41. Thereby the lamp 67 is energized in place of the audible signal and will remain energized to show the audible signaling device has been cut out until the switch is moved to open the contacts 62. Meanwhile the circuit at the thermostatically operated switch 11 may be opened either by a decrease of temperature if the switch has been closed by its rate of rise operation or by replacing the thermostat if the switch has been destroyed. However, the lamp 67 will continue to burn as an indication that the audible signaling device provided by the bell 63 is cut out until the switch is thrown by hand.

Energization of the relay 52 including contact points 53, 54 and 55 disengages contact points 54, 57 and contact points 55, 58 thereby opening the circuits including the lines 83, 84 and the lines 90, 91, the former to produce an appropriate signal at the external fire station as more fully explained in conjunction with Fig. 3, and the latter to discontinue the operation of fans, energize additional signals, etc.

Fig. 3 illustrates a system, sometimes referred to as a supervised system, wherein means are included for indicating a break in any of the lines including the thermostatically operated switches of the several compartments so that no line will be out of service unknowingly when an emergency arises. While the circuits for actuating the signaling devices and performing the other functions heretofore described in conjunction with the embodiment of Fig. 4 may be, and for the most part are, the same as illustrated in Fig. 4, certain difference of detail is shown in Fig. 3, as will now be described, the parts that are shown as the same as in Fig. 4 being given the same reference characters.

As here illustrated, transformer 30 has a primary 31 with leads 32, and the opposite ends of the secondary 33 are connected through rectifiers 34 and 37 and leads 35 and 38 with contact points 36 and 39. As here illustrated, however, the solenoid coil 40 is connected at one end through lead 41 with an intermediate tap on the secondary 33, but its opposite end is connected by a lead 100 to a fourth tap 101 on said secondary 33 so that said coil may be energized at a lower voltage than in Fig. 4, assuming a transformer of the same size. Similarly, a battery 47 has one end connected through lead 46 to contact point 44, while its opposite end is connected through lead 102 with contact point 45. An intermediate tap on said battery 47 is connected through lead 103 to lead 41, and signal light 23 is connected at one end to lead 103 and through a suitable resistor 80 to lead 100 and the fourth tap 101. As long as current is being received by the transformer 30, signal lamp 23 is energized, but if the source of current through leads 32 is interrupted, lamp 23 will be deenergized.

The armature of relay coil 40, as in Fig. 4, carries contact points 42 and 43 and is spring urged to engage contact points 42 and 43 with contact points 44 and 45, but contact points 42 and 43 are held in engagement with contact points 36 and 39 as long as relay coil 40 is energized. To show when the circuit is being powered by battery current a signal lamp 24 (compare Fig. 1) is connected to the lead 104 extending from contact point 43 and to a lead 105 extending to the lead 38 which is connected to contact point 39. As long as contact points 39, 43 are held in engagement, lamp 24 is short circuited and therefore de-energized. When the battery is cut in, however, and the contact points 43 and 45 are engaged, lamp 24 is energized from the battery 47 through lead 102, contact points 45 and 43, lead 104, lamp 24, leads 105 and 38, secondary 33 of the transformer, and leads 41 and 103 back to the intermediate tap on the battery.

As in Fig. 4, a secondary relay coil 52 operates an armature carrying contacts 53, 54 and 55. Associated with the contact point 53 is contact point 56 connected by lead 59 to an audible signaling device 63 as a bell connected to the lead 104 that extends from contact point 43. When relay coil 52 is energized and contact points 53 and 56 are engaged, the circuit is completed from secondary 33 through lead 41, contact points 53 and 56, lead 59, signaling device 63, lead 104, contact points 43 and 39, and lead 38 back to the secondary 33. As here illustrated, only an audible signal is thereby energized when a fire occurs, but if preferred a visible signal may be thrown in as a substitution by a double throw switch as more fully explained in conjunction with Fig. 4.

In the circuit shown in Fig. 3 the several room lamps 13 with their associated shunt resistors 14 are connected to suitable jacks 106 on connector strip 107 and connected in series as above explained to a lead 108 running to the relay coil 52. Appropriate leads 109 extend from the several jacks 106 to the series connected thermostatically operated switches for each floor. Only one switch, assumed to be for room No. 1 on the first

floor, is shown at 11. The several lights 17 for like numbered rooms with their associated shunt resistors 18 are connected to suitable jacks 110 on a connector strip 111, and are connected in series as heretofore explained to a lead 112 extending to contact point 42.

In this embodiment provisions are made so that upon the occurrence of any break in any of the circuits including the floor and compartment signal lines, a warning signal of such break is given at the annunciator. To this end each of the jacks 106 on strip 107 is electrically connected through one contact of all of the thermostats on the same floor to a corresponding jack 113 on a connector strip 114. Connected to each of said jacks 113 is a relay coil 115, all of said relay coils 115 being connected to a lead 116 extending to the lead 112. The armature of each of said relay coils 115 is spring biased to close a pair of contacts 117, one contact of each pair being connected to said lead 116 and the other contact of each pair being connected through a lead 118 to a suitable signaling apparatus, here illustrated as including an audible signaling device 119 and a signal light 25 (compare Fig. 1) with which may be associated a suitable shunt resistor 120 so that the circuit will be actuated even if a lamp burns out. The lamp 25 and resistor 120 are connected by a lead 121 to a lead 122 extending to lead 104 which is in circuit with contact point 43. As long as the circuit through the thermostatically operated switches on the same floor (assuming any given floor) is complete from the secondary 33 through contacts 36 and 42, leads 112 and 116, the relay 115 for that floor, leads 109, lamp 13, lead 108, coil 52, leads 122 and 104, contact points 43 and 39 and lead 38, contact points 117 are held open. However, upon the occurrence of a break at any point in the circuit just referred to, coil 115 becomes de-energized, contacts 117 are closed by the before described spring action of the armature associated with said coil 115, and the circuit from contact points 36, 42 extends through leads 112 and 116, the closed contacts 117, lead 118, signaling devices 119 and 25, leads 121 and 104, contact points 43, 49 and lead 38. Thereby warning is given at the annunciator that there is a break in a floor circuit.

Similarly all compartments of corresponding number have their thermostatically operated switches connected through one of the contact points of the several switches of that circuit and through lead 125 to a corresponding jack 126 on a connector strip 127. To each of the jacks 126 is connected a relay coil 128, the opposite ends of all of said coils being series connected by lead 139 extending to lead 104. The armature of each coil 128 has associated therewith a pair of contacts 129, each of said armatures being biased as by a spring to close said contacts on de-energization of the corresponding relay. One contact of each pair 129 is connected in series with said lead 139 while the opposite contact of each pair is connected in series with a lead 130 extending to an audible signaling device 131 and a signal lamp 26 (compare Fig. 1) with which may be associated a shunt resistor 132. Said audible and visible signaling devices are connected by lead 133 to the lead 112 extending to contact point 42. As long as any circuit through all of the rooms of corresponding number is complete current may flow from contact points 39 and 43 through leads 104 and 139, relay coil 128, lead 125 to the thermostatically operated switches of the rooms of corresponding number, lamp 17, and through lead 112 to contact points 42 and 36. Upon occurrence of a break in any of said circuits, however, the corresponding relay coil 128 will be de-energized because of the interruption of the circuit therethrough, contact points 129 associated with such circuit will be closed owing to the spring bias of the armature of the relay in which the de-energized coil 128 exists, and a circuit is now completed from contact points 39, 43, through leads 104 and 139, closed contacts 129, lead 130, signaling devices 131 and 26, and leads 133 and 112 to contact points 42, 36.

Each of the relay coils 115 and 128 in the aforesaid circuits is a high resistance coil so that the amount of current flowing therethrough will not energize the associated signal lights 13 and 17 even though, as above explained, they are in series connection with said coils 115 and 128, respectively, when there is no break in the line. Upon the occurrence of a break, however, it will be observed from the tracing of the foregoing circuits that the signal lights 13 and 17 are no longer in the circuits which respectively actuate the signaling devices 119, 25 and 131, 26.

The armature of relay coil 52 with contacts 53, 54 and 55 is normally biased as by a spring so as to hold contact point 54 in engagement with contact point 57. Contact points 54 and 57 are respectively connected by leads 81 and 82 to lines 83 and 84 leading to the signal device at the fire station as explained in conjunction with the embodiment of Fig. 4. Positioned for cooperation with contact point 54 is a contact point 140 connected by lead 141 to lead 104. Also positioned for cooperation with contact point 55 is a contact point 93, contact points 55 and 93 being connected to leads 90 and 91 extending to additional signaling devices, or for interrupting fan circuits, or for performance of like functions as explained in conjunction with the embodiment of Fig. 4. When the relay coil 52 is energized by the closing of the circuit at any thermostatically operated switch, contact point 54 is withdrawn from contact point 57 to interrupt the circuit through lines 83 and 84, while simultaneously contacts 53, 56, and contacts 54, 140 and contacts 55, 93, are engaged. Closure of contacts 53 and 56 energizes the bell 63 as before explained. The closure of contacts 55, 93 energizes the circuit including lines 90, 91, although if preferred actuation of the armature may open said circuit as in Fig. 4.

Closure of contact point 54, 140 connects lead 104 from contact point 43 through lead 81 to line 84. Connected across line 84 and lead 112 is a relay coil 142 and a suitable flasher element 142' for actuating a make and break switch 87 connected between lines 83 and 84, thereby intermittently interrupting said circuit whereby an interrupted signal is applied to said line 83, 84 when the circuit through said lines 83, 84 is opened at 57, 54. In the preferred embodiment of this invention, as will appear from the detailed explanation of Fig. 5, the circuit to the outside station as a fire station through lines 83 and 84 is normally closed and a signal is transmitted to the outside station when said circuit is opened, as on the occurrence of a fire, by the separation of contact points 57 and 54. However, in the preferred embodiment, a signal should also be given at the outside station in the event of any break in the lines to said outside station. As a break will give a continuous signal at the outside station the make and break device 87, producing an intermittent signal at the outside station,

will thereby distinguish at the outside station between a fire and a break in the line.

It is sometimes desirable to open the annunciator casing for purposes of inspection. In order to avoid a false alarm being transmitted to the lines 83, 84 during the course of said inspection, a switch 86 is connected across said lines 83 and 84 and associated with the door of the cabinet, said switch being so constructed as to be opened by the closure member when in locked position so that the circuit including lines 83 and 84 depends for actuation thereof on the opening of said circuit at contact points 57, 54. When the cabinet is opened, however, and the closure member releases switch 86 it is biased to closed position so as to maintain a closed circuit through the lines 83 and 84 and prevent actuation of said circuit as long as said closure member is open. Thereby any testing of the circuit in the annunciator will not energize the circuit including lines 83 and 84 and send a false alarm to the fire station.

Fig. 3 also illustrates leads 143 and 144 respectively connected to the bell circuit 59, 63, 104 and to the lead 122 from the coil 52, so that upon the occurrence of a fire and the actuation of the relay coil 52 not only will the bell 63 be energized but any other suitable signaling apparatus connected to the circuit which includes leads 143 and 144, such for example as gongs on the several floors to awake sleepers or otherwise give warning, may be energized at the same time that the signaling devices at the annunciator are energized.

Fig. 6 is a diagrammatic showing to illustrate the simplicity of the wiring that can be used embodying the present invention. Assuming in conformity with the illustrative diagrams a building of five floors each of which has twelve compartments, so that there are sixty in all, all of the thermostatically operated switches 11 on the same floor, taking the top floor by way of illustration, are connected in series through one contact point at each switch by leads 147, 148, 149, 150 and 151, whereby only two leads 147 and 151 are required from each floor to corresponding jacks 152 on the room loop connector strip 153. Similarly, taking the corresponding compartments 154, 155 and 156 in the diagram of Fig. 6 it will be observed that the opposite points of all of the thermostatically operated switches 11 in corresponding rooms are connected by leads 157, 158 and 159 to a pair of common leads 160 leading to jacks 161 on the room loop connector strip 162. Therefore, instead of sixty pairs of leads, which would be required if a signaling device individual to each compartment were provided, only seventeen pairs of leads are required in the selected illustration, one pair for each floor and one pair for each compartment numbered 1, one pair for each compartment numbered 2, etc., on the several floors.

Fig. 5 is a wiring diagram of the preferred type of installation at the external or fire station, being illustrated as appropriate for ten different buildings, although as will be apparent to those skilled in the art the building indicator may be expanded to include any number of buildings by merely multiplying the number of circuits including indicators for the respective buildings, the signal circuits being preferably subdivided into convenient panels when the number of buildings involved becomes relatively large.

As shown, terminal strips 165 and 166 have corresponding pairs of jacks 167 and 168, here shown as ten in number. The connectors on strip 166 are connected in series as shown at 169 to any suitable source of electrical energy as the terminal of a battery 170 of any suitable size, for example twenty-four volts for the installation illustrated. Each of the jacks 167 is connected by a lead 171 to one end of a relay coil 172 which when energized holds contact points 173 in open position. All of said coils 172 are connected in series with a lead 174 extending to the opposite terminal of battery 170.

A lead 175 extends from one of each pair of contact points 173 to one terminal of a signal lamp 176, around which is connected a suitable shunt resistor 177 so that the circuit may still be energized to perform the functions hereinafter described even though the lamp 176 may have burned out. The opposite terminals of each lamp 176 and resistor 177 are connected by a lead 178 to one of the terminals 179 of the lever of a double throw, double pole switch. Contact point 180 of this switch is connected with the like points of all of the switches of the series by a lead 181 which extends to one terminal of an audible signaling device 182, as a buzzer, siren or other appropriate device. The other terminal of said audible signaling device 182 is connected by a lead 183 to the corresponding contact points 184 on the several switches. Each double throw switch also includes contact points 185 and 186 to be engaged by contact points 179 and 184 when the lever of the switch is thrown to its lowermost position as viewed in the drawings. The contact point 185 of each double throw switch is connected to a lead 187 extending to a suitable resistor 188 which is connected in series to the audible signaling device 182. The contact point 186 of each of said switches is connected to a lead 189 which is connected through a suitable resistor 190 to a visible signaling device, such as a lamp 191, which in turn is connected to a lead 192 which extends to the other of the two contact points 173 of each switch. A suitable test switch or button 193 is connected in shunt between the leads 192 and 175.

A second source of electrical energy, as a battery 194, is connected by leads 195 and 196 to suitable jacks 197, 198 on a terminal strip 199. Jack 197 is connected by lead 200 to lead 183 and jack 198 is connected by lead 201 to lead 192. Other leads 202, 203 and 204 may extend from additional jacks on said strip 199 to the leads 181, 189 and 187, respectively, for actuating suitable signal lights or performing other functions depending on the closure of the circuits including the respective leads.

Assume that a fire has caused the circuit including the lines 83 and 84 of Figs. 3 and 4 to be open in building No. 1. As long as said circuit is closed energy from the battery 170 will energize the corresponding relay coil 172, the circuit through said relay coil including lead 169, jacks 168 and 167 and leads 171 and 174. The armature of said relay coil 172 being biased to normally move the contact points 173 into engagement, de-energization of coil 172 results in the closure of the contact points 173. This closes the circuit from the battery 194 through the signal light 176 and associated resistor 177 corresponding to building No. 1, the circuit including lead 196, jack 198, leads 201 and 192, closed contacts 173, lead 175 and lamp 176, and assuming that the associated double throw switch is in its uppermost position as viewed in the drawing, the circuit continues through lead 178,

contact points 179 and 180, lead 181, audible signaling device 182, leads 183, 200, jack 197 and lead 195. Thereby an audible signal is given to advise of the existence of the fire while, under the foregoing assumption, the signal light 176 of building No. 1 is lighted to show where the fire is. In the event that the lamp 176 is burned out, the audible signal is still given because of current flowing through the resistor 177, and the building on fire can be determined by opening the switches including contact points 179, 180 until such opening of a switch discontinues the operation of the audible signal, thereby showing that the fire is at the building associated with the signal lamp whose switch when opened stops the audible signal.

If it is desired to discontinue the operation of the audible signal after proper warning of the existence of the fire has been given, as for example where the audible signal may be a siren for gathering a volunteer fire department, the operation of the audible signal can be discontinued by throwing the double throw switch from its uppermost to its lowermost position as shown in the drawing, engaging contact points 179 and 184 with contact points 185 and 186, respectively. This interrupts the circuit through lead 181 and audible signaling device 182 and cuts in the resistor 188 through lead 187 and contact points 179 and 185. Simultaneously, the lead through the visible signaling device 191 is completed so that a visible signal will show that the audible signal has been cut out, the circuit from battery 194 now including lead 196, jack 198, lead 201, lamp 191, resistor 190, lead 189, contact points 186 and 184, leads 183 and 200, jack 197 and lead 195.

If it is desired to test the circuits, such may be done by closing the switch 193 around the contact points 173 and it will be observed that the circuits are then in the same condition as if a relay coil 172 had been de-energized, so that the several circuits may be tested for operability under the same conditions as if by interruption of the circuit through a relay coil 172 the contact points 173 had been closed.

As before pointed out, the relay coil 52 may close the circuit to the external station to initiate the signal thereat, but it is preferred that the external signal be initiated by opening the circuit as hereinabove described. Such an arrangement has the advantage that if there is any break in the lines from any building to the central fire station, that also opens the corresponding circuit and gives warning at the central station of the interruption in the line. In order that the signal at the central station shall differentiate a break in the line from a fire, the relay-actuated make and break device, 87, 88, shown in Figs. 3 and 4 provides that when the circuit including the lines 83, 84 running to the circuit of Fig. 5 is opened by the occurrence of a fire as above explained, the audible signaling device 182 at the fire station will not give a continuous signal but an interrupted signal, whereas if there is a break in the lines, the signal will be continuous.

It will therefore be perceived that the present invention provides a relatively simple but highly efficient fire alarm system that may be installed in hotels, apartment houses, schools, hospitals, warehouses, stores, office buildings, etc., of any number of stories and of any number of compartments on each floor, while providing at any suitably convenient central location an automatic signal as soon as a fire starts in any compartment, the exact location of the fire being indicated by use of a minimum number of signaling devices. The annunciator at the central station may be disposed in the building where the warning given may be immediately received by a hotel clerk, building janitor, etc., or it may be disposed so that it is readily accessible to firemen arriving at the building, or if desired an annunciator may be disposed at both locations. Furthermore, the system is such as to automatically send a signal to the central fire station so that the fire department is immediately warned of the existence of a fire in a particularly identified building.

The system may also be so constructed that any break in any of the lines leading to the annunciator or the lines leading from the annunciator to the external fire station is indicated by appropriate signals so that the system will not be out of order due to undiscovered breaks in the lines when an emergency arises. The system not only provides for any desired number of visible and audible signals and provisions for controlling fans, fire doors, etc., but it also provides ready indication of the condition of the system, the source of power being used, etc. Thereby all of the several objects are attained by a system of minimum complexity and utilizing an annunciator for the central station which is simple and compact and which provides easily readable indications as to the location of the fire.

While the embodiments of the invention illustrated on the drawings have been described with considerable particularity, it is to be expressly understood that the invention is not limited thereto, as the same is capable of receiving a variety of expressions as will now be apparent to those skilled in the art, features illustrated and described may be omitted if not desired, they can be combined in various ways, parts may be replaced by equivalents, etc., without departing from the spirit of this invention. Reference is therefore to be had to the appended claims for a definition of the said invention.

What is claimed is:

1. In a fire alarm system for a building comprising a plurality of compartments on each of a plurality of floors, at least one thermostat disposed in each of said compartments, a pair of circuits associated with each of said thermostats, switch means associated with each thermostat and operable thereby to close both of the circuits associated therewith, one of said circuits including all of the thermostatically operated switch means on the same floor and the other of said circuits including all of the thermostatically operated switch means in compartments of corresponding number, a visual signaling means individual to and operable by each of said floor circuits, a visual signaling means individual to and operable by each of said circuits for compartments of corresponding number, said floor circuit signaling means and said compartment circuit signaling means being located in juxtaposition for simultaneous observation, a relay in each floor circuit and in each circuit associated with compartments of corresponding number, a switch associated with each relay and normally held in open position by said relay, a circuit connected to all relay operated switches associated with the floor circuits, a circuit connected to all relay operated switches associated with the circuits for compartments of corresponding number, and signaling means associated with each

of said last named circuits and operable upon closing of any one of the relay operated switches for indicating a break in the associated circuit.

2. In a fire alarm system for a building comprising a plurality of compartments on each of a plurality of floors, at least one thermostat disposed in each of said compartments, a pair of circuits associated with each of said thermostats, switch means associated with each thermostat and operable thereby to close both of the circuits associated therewith, one of said circuits including all of the thermostatically operated switch means on the same floor and the other of said circuits including all of the thermostatically operated switch means in compartments of corresponding number, a visual signaling means individual to and operable by each of said floor circuits, a visual signaling means individual to and operable by each of said circuits for compartments of corresponding number, said floor circuit signaling means and said compartment circuit signaling means being located in juxtaposition for simultaneous observation, a relay in circuit with all of said first named circuits and operable upon the actuation of any of said thermostatically operated switch means, a normally closed switch operable by operation of said relay, a circuit normally closed by said switch and extending to an external station, a second normally open relay operated switch at said external station having its relay coil connected in said last named circuit, signaling means at said external station operable by said second relay operated switch when said last named circuit is opened, and means in said last named circuit for intermittently closing the same and operable by said first named relay operated switch to distinguish a fire signal from a signal arising from a break in the line.

3. In a fire alarm system for a building including a plurality of compartments on each of a plurality of floors, at least one thermostat in each of said compartments, a switch associated with each thermostat and operable thereby upon the occurrence of a fire, a circuit associated with all of the thermostatically operated switches on the same floor which is closed upon the actuation of any thermostatically operated switch on said floor, a circuit associated with all of the thermostatically operated switches in compartments of corresponding number which is closed by the actuation of any thermostat in corresponding compartments, a signaling device in circuit with each of said floor circuits for indicating the floor at which a thermostatically operated switch is closed, a signaling device in circuit with each of said circuits for corresponding compartments for indicating the compartment number at which a thermostatically operated switch is closed, central station means at which all of said signaling devices are disposed for indicating by comparison of two signaling devices the exact location by floor and compartment number where a thermostatically operated switch has been actuated, a relay operated switch in circuit with each of said floor circuits, a relay operated switch in circuit with each of said circuits of corresponding compartment number, a circuit connecting the relay operated switches in all of said floor circuits, a second circuit connecting all of said relay operated switches in said circuits for corresponding compartments, and signaling means in each of said two last named circuits and disposed at said central station means for indicating when a relay operated switch has been actuated.

4. In a fire alarm system for a building including a plurality of compartments on each of a plurality of floors, at least one thermostat in each of said compartments, a switch associated with each thermostat and operable thereby upon the occurrence of a fire, a source of current, a central indicating station, a plurality of floor loop circuits connected across said source of current and each extending from said central station and connecting one side of all the thermostatically operated switches on one floor in series with one another, supervisory indicating means at said central station connected with said floor loop circuits and operable upon a break in any thereof, a plurality of compartment loop circuits connected across said source of current and each extending from said central station and connecting the other sides of all the thermostatically operated switches of compartments of corresponding number in series with one another, supervisory indicating means at said central station connected with said compartment loop circuits and operable upon a break in any thereof, a signaling device in circuit with each of said floor loop circuits for indicating the floor at which a thermostatically operated switch is closed, a signaling device in circuit with each of said compartment loop circuits for indicating the compartment number at which a thermostatically operated switch is closed, one of said floor signaling devices and one of said compartment signaling devices being operated when their associated floor loop and compartment loop circuits are connected by closure of one of the said thermostatically operated switches, and said signaling devices all being disposed at said central station for indicating by floor and compartment number the exact location where a thermostatically operated switch has been closed.

5. A fire alarm system as defined in claim 4, said supervisory indicating means comprising a plurality of relay coils one in series with each floor loop and compartment loop circuit, a plurality of indicating circuits one connected to each floor and compartment loop circuit, and a switch in each of said indicating circuits that is held open when the relay coil in the associated loop circuit is energized.

6. A fire alarm system as defined in claim 5, said relay coils being connected in series with said signaling devices in said loop circuits and having sufficient resistance to limit the current flowing in said loop circuits to a value less than that at which said signaling devices are operated.

7. In an alarm system for a building including a plurality of compartments and a plurality of floors, at least one switch in each of said compartments closable upon the occurrence of an abnormal condition therein, a source of current, a plurality of loop circuits connected in parallel with one another across said source, said circuits including floor loop circuits each connecting one side of a group of switches on the same floor in series with one another and compartment loop circuits each connecting the other sides of a group of switches in correspondingly numbered compartments on different floors in series with one another, each loop circuit including a signaling device between one side of said source and said switches and a current limiting means between the other side of said source and said switches for limiting the current normally flowing in said loop circuit to a value insufficient to actuate its signaling device, the current limiting means of said floor loop circuits all being located

on the same side of said source and the current limiting means of said compartment loop circuits all being located on the opposite side of said source, whereby closing of any switch causes increased current to flow in and to actuate the signaling devices of the associated floor and compartment loop circuits.

8. An alarm system as defined in claim 7 together with supervisory devices one associated with and operated by each of said current limiting means upon a decrease of said normal current.

9. An alarm system as defined in claim 7 each of said loop circuits including a relay, and supervisory means associated with each relay and operated by a decrease of said normal current.

10. An alarm system as defined in claim 9 comprising supervisory signaling means the circuit of which includes a plurality of parallel control switches each associated with and operated by one of said relays.

11. An alarm system as defined in claim 7 comprising a relay connected between said source of current and said loop circuits and operable by said increased current, and an alarm circuit controlled by said relay and extending to an external station.

12. An alarm system as defined in claim 11, said alarm circuit being normally closed and including signaling means at said external station operated by decrease of current in said alarm circuit to provide a supervisory signal, and make and break means for said alarm circuit, the operation of said relay opening said alarm circuit and energizing said make and break means to provide an intermittent alarm signal at said external station.

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