

(No Model.)

3 Sheets—Sheet 1.

E. A. SPEER.
AUTOMATIC FIRE ALARM SYSTEM.

No. 564,229.

Patented July 21, 1896.

FIG. 1.

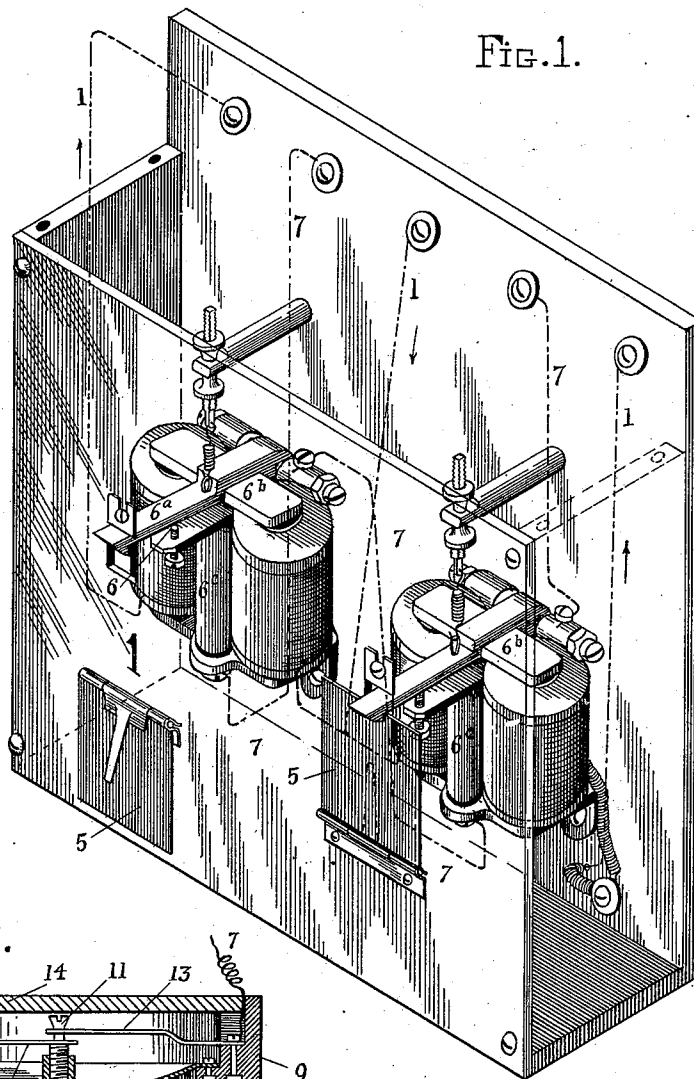


FIG. 2.

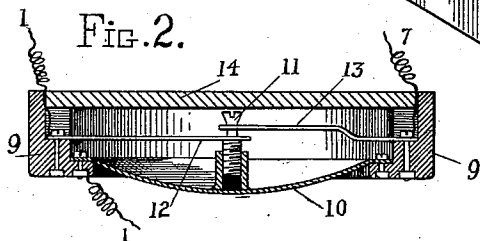
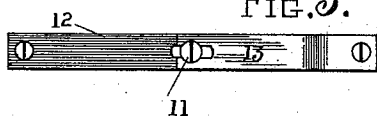


FIG. 3.



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(No Model.)

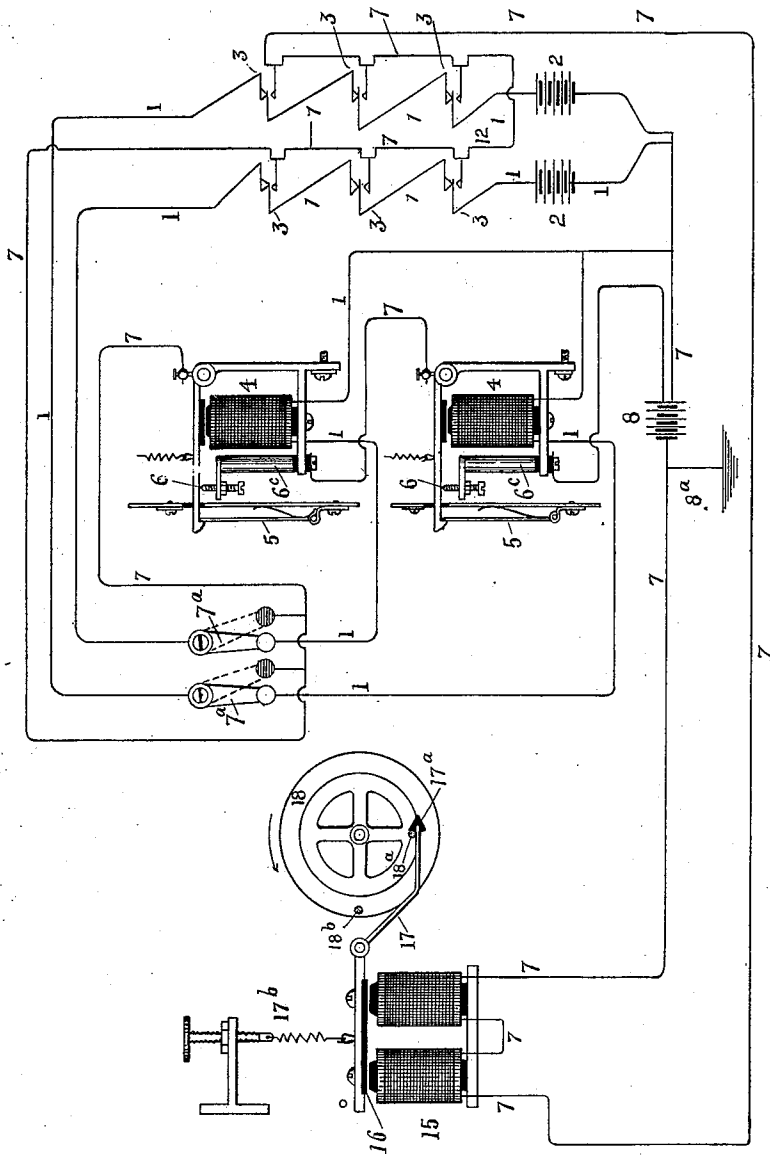
3 Sheets—Sheet 2.

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Fig. 4.



WITNESSES:

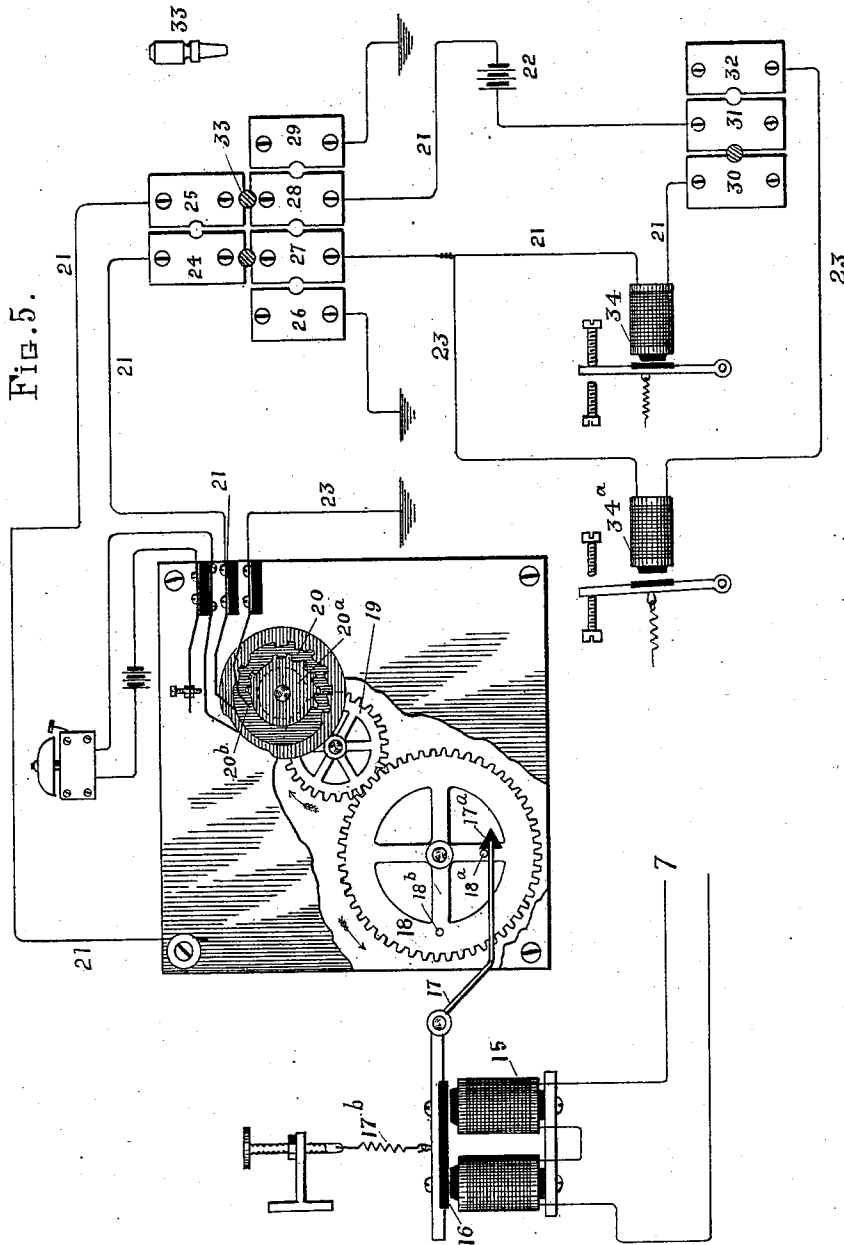
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UNITED STATES PATENT OFFICE.

EDWIN A. SPEER, OF TOLEDO, OHIO, ASSIGNOR OF THREE-FOURTHS TO
JASPER P. COLLINS, OF SAME PLACE.

AUTOMATIC FIRE-ALARM SYSTEM.

SPECIFICATION forming part of Letters Patent No. 564,229, dated July 21, 1896.

Application filed May 3, 1895. Serial No. 547,976. (No model.)

To all whom it may concern:

Be it known that I, EDWIN A. SPEER, a subject of the Queen of Great Britain, residing at Toledo, Lucas county, Ohio, have invented
5 a certain new and useful Automatic Fire-Alarm and Signaling System, of which the following is a specification.

In the use of automatic fire-alarms it is highly necessary that breaks of any wire or
10 line, grounds or crosses of foreign wires which tend to divert or disturb the circuits of electricity controlling the system, batteries which have run down or lost their strength, and other derangement of any of the parts should
15 at all times be immediately signaled and made known to the attendant; that this should be done without giving such alarm as will unnecessarily call out the fire department; that in case of a break or derangement in the line
20 there should be instant means at hand for temporarily maintaining protection to the buildings in the circuit until the lines can be repaired, and that the contrivances by which these results are attained should not in any
25 manner interfere with the entire efficiency of the system in giving prompt and certain alarm in the case of actual fire.

My invention relates to and its object is to provide means for accomplishing the results
30 above indicated.

To this end my invention consists in the devices and arrangement of parts hereinafter described and shown, and illustrated in the accompanying drawings, made part hereof, in
35 which—

Figure 1 is a perspective view of my annunciator and circuit-breaker, hereinafter referred to, shown with a transparent front and with the top and one end of its case removed; Fig. 2, a diametrical sectional elevation of my thermostat, hereinafter referred to; Fig. 3, a plan view of the contact-strips forming part of said thermostat; Fig. 4, a diagram illustrating the arrangement of electric wires,
45 batteries, thermostats, circuit-breakers, annunciators, and signaling mechanism applicable to a two-story building, as hereinafter specified; and Fig. 5, a side elevation of transmitting or signaling instrument, in connection with a diagram showing switchboard,
50

wiring, and registers of a central receiving-station arranged according to my system.

Like numerals represent like parts throughout the drawings.

It should be understood that my system is
55 designed to afford protection to any number of buildings connected in series to a line-wire leading out from the central receiving-station, following the circuit of the buildings included in the system and running back to the central office, making a single wire, both ends of
60 which terminate as a loop at the central office.

In each of the buildings in the system is a series of thermostats, suitably secured to the ceilings or walls of the building, and electrically connected with a signaling instrument
65 provided for each building in the system, which signaling instrument is connected with the line-wire above mentioned. The thermostats referred to are designed and constructed
70 in connection with the signaling instruments, to give the alarm when an undue degree of heat is present, or when a break or derangement of any of the lines or batteries takes place; also, to transmit a signal which shall indicate the presence of dangerous heat or fire.
75

In my system every wire which may be called upon to perform any service, together with the thermostats above mentioned, are constantly in closed circuit, so that the breaking of any line, the operation of any thermostat, or the undue disturbance of battery or current will, by the opening of the circuit, transmit such signal as will lead to immediate investigation and to any necessary correction or adjustment of the part at fault.
80

Referring to the drawings, 1 is an electric line or wire run in each building from batteries 2, leading through thermostats 3 and magnets 4 of the annunciators and circuit-breakers, which magnets hold, normally closed, the drop or shutters 5 of the annunciator, indicating the location of the disturbance. Line 1 is also connected to one pole of the battery 8, hereinafter referred to.
85

In the annunciator, 6 is the contact-point for making and breaking the fire-alarm circuit, presently to be described, and 6^a is the lever carrying the armature 6^b and controlling said contact 6.
90
100

7 is a line in closed circuit with battery 8, leading through the annunciators (*i. e.*, binding-post 6^a, contact-screw 6, and lever 6^a) and the magnet 15 of the transmitting instrument. This line 7 is also looped into each one of the thermostats 3, but its closed circuit is normally disconnected from the thermostats, except when this circuit is shunted by the action of heat upon one or more of the thermostats. Line 7 is connected to earth, as at 8^a.

I do not limit my invention to any specific form of thermostat, as many modifications of such instrument suitable to my purpose will obviously suggest themselves to those skilled in the art; but for illustration I have shown in Figs. 2 and 3 a thermostat well adapted for use in this connection. This thermostat consists of a ring or frame 9, of some non-conducting substance, preferably of glazed porcelain, having an inwardly-projecting annular flange, upon which is secured the rim of a concavo-convex diaphragm 10, composed of suitable metal which is an electrical conductor and which expands or contracts sensitively under varying temperatures, such as zinc. This diaphragm carries on its inner concave side an interiorly-screw-threaded socket-piece, into which is screwed adjustable contact-piece 11, provided with a head, as shown in the drawings. From one side of the interior of the ring 9 projects a metal strip or tongue 12, recessed at its inner extremity to form a two-pronged fork. The shank of screw 11 plays between these two prongs without contact, but the screw is provided with a shoulder which is normally in contact with the under side of the prongs of tongue or strip 12. From the opposite side of the interior of ring 9 projects a like metal strip or tongue 13, forked in like manner, and astride of but out of contact with the shank of screw 11, the inner extremity of piece 13 lying between the extremity of piece 12 and the head of the screw 11. After the contact-pieces 11, 12, and 13 are adjusted a disk or cap 14, preferably of glazed porcelain, is fitted into a flanged recess in the back of the ring 9, and while one side of the diaphragm is exposed the interior of the thermostat is hermetically sealed up, and is proof against moisture and dust. The diaphragm 10 and strip or tongue 12 are connected with the wires of line 1, and this circuit is maintained normally closed through the contact of the shoulder of the adjustable piece 11 with the forked end of piece 12. Piece 13 is connected with the wire of line 7 and is normally out of contact with the screw 11.

In line 7 is magnet 15 (see Figs. 4 and 5) of the instrument, designed to transmit signals to the central office. This magnet, being in closed circuit, constantly holds its armature 16. This armature is attached to detent 17, which engages a stop on escapement-wheel 18 in spring-actuated clock-train 19, which drives the make-and-break signal-

wheel 20. This wheel is provided with the usual teeth or insulated portions and through its contact-piece is normally in closed circuit with line-wire 21 and battery 22, forming a metallic circuit embracing the central office and the various buildings designed to be protected. The detent and escapement, 17 and 18 more in detail, comprise the lever 17, fulcrumed near its middle, carrying armature 16 at one end and double-toothed dog 17^a at the other end. Upon escapement-wheel 18 are two stops 18^a and 18^b. These stops are about one-quarter of the circumference of the wheel apart and are at different radial distances from the center of the wheel. The lever 17 is provided with a spring 17^b, which, when the magnet 15 lets go, pulls the outer end of the lever upward, throwing the dog 17^a at the other end of the lever downward, releasing stop 18^a and permitting the escapement-wheel 18 to make a quarter-revolution, when the dog engages stop 18^b, holding the wheel and its train fast. Now, if the magnet pulls down the outer end of the lever the dog is lifted, releasing stop 18^b, permitting the escapement-wheel to make three-quarters of a revolution, when the dog again engages stop 18^a and again holds the wheel and its train fast. During the quarter-revolution of the escapement-wheel and its train, the prearranged signal is transmitted once and during the three-quarters revolution which follows the signal is repeated three times, the first signal being precautionary or indicating derangement of the lines or apparatus, the second signal giving the alarm of fire.

Upon the same arbor which carries the make-and-break signal-wheel 20 is another make-and-break wheel which rings an alarm-bell in the usual way in a local circuit. (See Fig. 5.) Upon the same arbor and electrically connected therewith is a third make-and-break wheel 20^a, having the usual teeth or insulated parts. The finger or contact piece 20^b, which coöperates with the wheel 20^a, is connected with wire 23, which leads to earth. It should be noted that make-and-break wheel 20 is in normal connection with its contact-piece, and is designed to transmit signals by the breaking of its closed circuit 21, and that make-and-break wheel 20^a is normally out of connection with its contact-piece and is intended to transmit signals by the closing of its normally open circuit.

At the central office the terminals of line 21 are connected with a switchboard or plug cut-out board, which, for illustration, may consist of metal plates, numbered from 24 to 31, inclusive, electrically connected by plugs 33. (See Fig. 5.) In circuit 21 at the central office is magnet 34, which actuates the receiving and recording instrument, (not shown in the drawings,) or a relay controlling the same. This magnet records or transmits signals by letting go its armature when the circuit is broken. At the central station is

also magnet 34^a, connected to the plug cut-out board and adapted to be thrown into circuit 21 23, but normally out of such circuit. This magnet also actuates through a relay or otherwise a receiving and recording instrument, (not shown,) but its action is by attracting its armature when its circuit is closed.

The operation of my device is as follows:

Assuming that all the parts are properly adjusted and arranged in operative relation and that the circuits in lines 1, 7, and 21 are closed, now if any thermostat in the system be exposed to a temperature higher than the safety limit, to which the instrument is adjusted, the resultant expansion of diaphragm 10 moves the shoulder of screw 11 away from contact strip or tongue 12, breaking the contact between these two pieces, thus opening circuit 1. Magnet 4 of the annunciator, with which the thermostat is connected, now loosens its hold upon its armature, and lever 6^a is lifted by its spring from contact-point 6 in circuit 7, thus breaking this circuit. Magnet 15 in circuit 7 in the transmitting instrument now lets go of its armature 16, causing detent-lever 17 to swing, throwing downward dog 17^a, which releases stop 18^a upon the escapement-wheel 18. This wheel, driven by its spring-actuated train, now makes a quarter-revolution, when stop 18^b is engaged by the dog 17^a, and the escapement-wheel and its train are brought to a stop. During this partial revolution of the wheel 18 the transmitting instrument has sent over line 21 its preconcerted signal, the breaks in line 21 being recorded or transmitted through a magnet or relay 34 at the central office. The single signal transmitted during the quarter-revolution of the wheel 18 to the attendant at the central station indicates undue heat at the point signaled from, or a break in the lines at that point, or the running down of a battery, or some other disturbance of the electric current on one of the lines. At this precautionary signal an inspector is sent quickly to the point of disturbance and the office attendants are on the alert for what may follow. Now if the heat at the thermostat continues to increase, the diaphragm 10 continues to expand, carrying with it its contact-screw 11, until finally the head of this screw comes in contact with spring or tongue 13, which is connected with line 7. It will be seen that line 1 and line 7 are now connected through the thermostat, and that the force of both batteries 2 and 8 are thrown into line 7, which sufficiently energizes magnet 15 in the transmitting instrument to pull down its armature, throwing upward the detent 17, releasing stop 18^b on escapement-wheel 18, permitting this wheel to make a three-quarter revolution, during which time the preconcerted signal is transmitted and repeated three times, giving to the central station the alarm of fire. An advantage of this arrangement and operation is that if, after the first alarm, the ther-

mostat shall cool off so as to restore circuit 1 the closing of the drops or shutters 5 on the annunciator by hand, thus restoring contact 6, will not be sufficient to cause magnet 15, armature 16, detent 17, and escapement-wheel 18 to send in the second alarm, indicating fire, and thus to unnecessarily call out the fire department, for it will be seen that the spring 17^b, attached to the armature 16, may be adjusted at such tension that while battery 8 alone will hold the armature the united strength of the batteries 2 and 8 will be necessary to draw down the armature after it has once been released. It will also be seen that this united action of the two batteries can only be obtained through the shunt of the thermostat when contact-pieces 11 and 13 come together through the influence of dangerous heat or when the switch 7^a, provided for testing the circuits 1 and 7, is used to shunt the two lines together. The test by the switch here referred to is made by throwing out of circuit the switch-arm, which is normally in circuit 1, thus causing the annunciator and transmitter to act in the same manner as when circuit 1 is broken by the separation of contact-pieces 11 and 12 of the thermostat, as above described. The switch-arm is now thrown still farther and brought against a contact-point in line 7, when the transmitter acts as if contact-pieces 11 and 13 in the thermostat had met, as above described. In practice these switches 7^a are located inside the transmitter-box, the door of which, when open, serves as an automatic switch to electrically disconnect the transmitter from line 21, so that no false alarms shall be sent to the receiving-station during the tests.

The grounding at one point of wire 7 by a branch, as at 8^a, Fig. 4, serves as a safeguard against the crossing of foreign wires leading to earth, as the short circuit thus formed would cause the magnet in the annunciator or transmitter to let go its armature, and thus to transmit a cautionary signal, as above described.

The operation of my invention, thus far described, relates only to the working and breaks or derangement of the wiring or the apparatus inside the buildings included in the system. Should a break occur on line 21 outside of the buildings, this fact would be indicated by magnet 34 at the central station letting go its armature without indicating any particular number or signal. Now, while the break is being located and repaired the buildings may all be brought into temporary communication with the central station by connecting magnet 34^a with earth, which may, for example, be accomplished as follows: Plugs connecting plates 25 and 28 and plates 30 and 31 are removed and plates 24 and 25 and plates 28 and 29 and plates 31 and 32 are electrically connected by plugs. The circuit is now from battery 22 through plates 28 and 29 to ground, and from battery through plates 31 and 32, wire

33, magnet or relay 34^a, plates 27, 24, and 25, and the unbroken part of line 21 to the transmitting instruments at the buildings on the line, and thence to earth. When the plugs
5 are arranged as above described, magnet 34 is out of circuit and inoperate, but magnet 34^a is in open-ground circuit and operates and registers when this circuit is closed and opened, which is accomplished by the teeth of wheel
10 20^a making contact with its piece 20^b when the clock-train of the transmitting instrument is set in motion, as above described. Plug cut-out plate 26 and its ground connection, Fig. 4, are designed simply to furnish
15 means for testing the circuit of magnet 34^a, and need not be further described.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. An automatic fire-alarm, comprising a
20 circuit containing a relay and battery and controlled by a two-point thermostat, a second circuit controlling an alarm, a battery in said second circuit, and means controlled by the second point of the thermostat for throwing
25 the batteries into combined action for sending the fire-alarm, substantially as and for the purpose specified.

2. An automatic fire-alarm, comprising a circuit containing a relay and battery and controlled by a two-point thermostat, a second
30 circuit containing a battery and controlling an alarm, means controlled by the first point of the thermostat for sending a preliminary signal, and means controlled by the second
35 point of the thermostat for throwing the batteries into combined action for sending the fire-alarm, substantially as and for the purpose specified.

3. A normally-closed circuit containing a
40 battery, a magnet in said circuit whose normally-attracted armature controls a detent which, in turn, controls an alarm, a spring adapted to retract said armature, another battery, in combination with a two-point thermostat of the opening of which permits the release of the armature, to send a preliminary
45 signal, and the further operation of which unites said two batteries, to again actuate said armature to send the fire-signal, substantially as and for the purpose specified.

4. In combination, a normally-closed circuit containing a two-point thermostat and a relay, a second normally-closed circuit controlled by the relay and containing an alarm-
55 controller, adapted to give a preliminary and a fire signal upon the actuation of the first and second points of the thermostat respectively, the arrangement of said thermostat and circuits being such that the repeated
60 operation of the first point of the thermostat shall, of itself, be insufficient to produce a fire-alarm, substantially as and for the purpose specified.

5. In an automatic fire-alarm and signaling
65 system, a series of thermostats, one or more magnets controlling circuit-breakers, and an

electric conductor in normally-closed circuit with said thermostats and said magnets, in combination with an electrically-controlled signaling instrument, an electric conductor
70 in normally-closed circuit with said signaling instrument through the contact-pieces of said circuit-breaker, and means in said thermostats for closing said latter circuit independently of said circuit-breakers, substantially
75 as and for the purpose specified.

6. In an automatic fire-alarm and signaling system, a series of thermostats, one or more magnets controlling circuit-breakers, and an electric conductor in normally-closed circuit
80 with said thermostats and said magnets, in combination with an electrically-controlled signaling instrument, an electric conductor in normally-closed circuit with said signaling instrument through the contact-pieces of said
85 circuit-breaker, and means in said thermostats for shunting the currents of said former circuit and said latter circuit together, substantially as and for the purpose specified.

7. An automatic fire-alarm and signaling
90 system, comprising a series of thermostats, one or more circuit-breakers, an electric conductor in normally-closed circuit with said thermostats and controlling said circuit-breaker, an electrically-controlled signaling
95 instrument, an electric conductor in normally-closed circuit with said signaling instrument, controlled by said circuit-breaker and connected with said thermostats, a receiving or recording instrument, and an electric line
100 connected and normally in closed circuit with said signaling instrument and with said receiving or recording instrument, substantially as and for the purpose specified.

8. In an automatic fire-alarm and signaling
105 system, a thermostat comprising a frame or case, an expansible body, such as a concavo-convex disk or diaphragm secured therein, composed of a conducting metal, a normally-closed circuit including said diaphragm, an
110 adjustable make-and-break contact-piece mounted upon, carried by and electrically connected with said diaphragm, two other contact-pieces in said thermostat, one being in the normally-closed circuit with said dia-
115 phragm, the other being connected with another circuit, a battery connected with each of said circuits, the arrangement of the parts being such that the initial expansion of said diaphragm breaks said normally-
120 closed circuit, and the further expansion of said diaphragm electrically connects said diaphragm with the other of said two contact-pieces, and throws said two batteries into combined action for transmitting the fire-
125 alarm, substantially as and for the purpose specified.

EDWIN A. SPEER.

In presence of—

FREDERICK L. GEDDES,
L. E. BROWN.