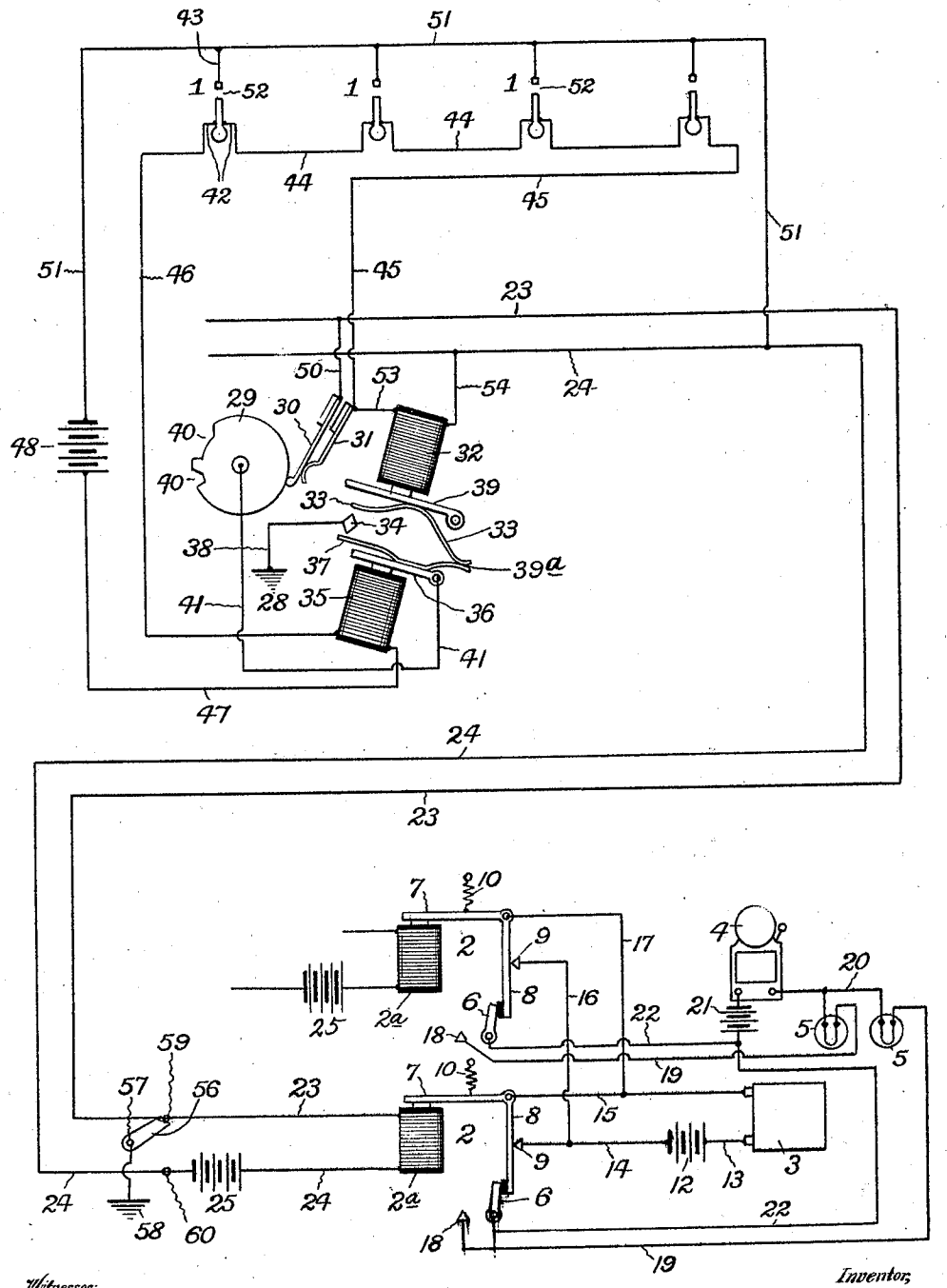
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AUTOMATIC AND ELECTRIC FIRE ALARM SYSTEM.

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UNITED STATES PATENT OFFICE.

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AUTOMATIC AND ELECTRIC FIRE-ALARM SYSTEM.

1,102,666. Specification of Letters Patent. Patented July 7, 1914.

Application filed May 1, 1912. Serial No. 694,491.

To all whom it may concern:

Be it known that I, JOHN M. JOHNSON, a citizen of the United States, residing at Kansas City, in the county of Wyandotte and State of Kansas, have invented certain new and useful Improvements in Automatic and Electric Fire-Alarm Systems, of which the following is a specification.

This invention relates to automatic electric fire alarm systems of the class that register an alarm at a distance point (as in a central office) before a fire can gain sufficient headway to damage the building to any great extent.

The system is operated on a closed circuit from its own central office, by means of thermostatic circuit closers connected to bridge a signal controlling magnet.

The object of the invention is to provide an automatic fire alarm system that is thoroughly reliable, inexpensive of installation and maintenance, and still operative under such possible accidental conditions as breaks in line wires or in the thermostatic circuit closers employed; also giving automatic notice at the central office of such breaks in wires or thermostatic circuit closers.

A further object is to provide as a part of this system, a thermostatic circuit closer which is thoroughly accurate and sensitive and that shall not deteriorate in those respects by the oxidation to which ordinary thermostatic circuit closers are subject.

In order that the invention may be fully understood, reference will now be made to the accompanying drawing, which represents a house equipment, a central station equipment for two blocks of buildings, the line circuit connecting the two equipments and the earth connections.

The house equipment (shown above) diagrammatically shows several thermostatic circuit closers 1 and a signal mechanism or box, with their connections, as shown. The central equipment (shown below) shows two receiving relays 2, one tape recorder 3, one bell 4, and two flash lamps 5, 5; also a trouble switch. Describing first this central station apparatus, the instrument marked 3 is a magnetic tape recorder of the well known type, or any equivalent thereof, a detail illustration being thought unnecessary. The bell 4 is of the ordinary make-and-break vibrating armature type. For each block of buildings to be served, a drop switch 6, a flash-lamp 5, and a relay 2, are provided. Each relay comprises an electromagnet 2^a, a pivoted armature 7, having a contact arm 8, a fixed contact point 9, and a spring 10 that tends to break the normal contact between said arm and point. Each drop switch 6 is arranged to be tripped by its respective arm 8 when the latter breaks connection. The recorder 3 is in a circuit comprising a battery 12, a part of a relay arm 8, and wires 13, 14 and 15. This is the recorder circuit for one relay 2, and the recorder is in similar connection with every relay employed, as shown by wires 16 and 17, leading to the upper relay points. Each drop switch point 18 has a wire 19 leading to one of the lamps 5. The opposite terminals of each lamp are connected to the bell 4 by a wire 20. The bell is connected with a battery 21, whose opposite pole has a connection 22 with each drop switch 6. Each magnet of relays 2 is connected with two line wires 23 and 24, only one pair of which is shown to avoid unnecessary duplication. In each line circuit, at the central station, is a battery 25. Under normal conditions, line wire 23 is connected to ground as at 58, through the medium of a switch 56 that will be hereinafter referred to in describing the operation of the system.

The house apparatus.—The signal apparatus or "box" is fully shown and described in my copending application, and in the present case is sufficiently illustrated to convey a full and clear understanding of its operation. As diagrammatically shown, it consists of a clockwork driven code wheel 29, a brush 30 contacting said wheel, a contact-member 31, contacting said brush normally, a trip-magnet 32, a contact spring 33, a contact point 34, and an escapement (not shown) by means of which the magnet 32, when deënergized, sets the spring-driven wheel 29 in rotation. Within the box is also an emergency or grounding magnet 35 having an armature 36 provided with a contact spring 37. The point 34 is grounded at 28 through a wire 38. Spring 33 is fastened to the armature 39 of magnet 32, and tends to move into contact with point 34 but is normally restrained by said armature when the magnet is energized. Magnet 35 is also normally energized and holds its spring 37 out of contact with point 34. Springs 33 and 37 are in electrical contact at 39^a. The code-wheel 29 is formed with recesses 40, which are arranged according to the dots and

dashes of the Morse (or any preferred) code, so that when said wheel rotates the recesses will pass the tip of brush 30, permitting said brush to move toward the wheel, thereby breaking contact with the wheel and also with the contact member 31 during the transit of each recess 40. Said rotation may continue until the driving spring has lost its tension, the signal being thereby repeated for each revolution of the wheel 29. The function of the magnet 35 is to act, in case of breakage of any thermostat tube or "house" conductor, to send a warning signal to the central station through the associated relay 2. Wheel 29, or its shaft, is connected by a wire 41 or the frame of the mechanism, to the pivot of armature 36.

1, 1, designate mercury thermostatic circuit closers, which are placed in any desirable number and situations in the building to be protected. Each thermostatic circuit closer consists of a glass tube provided with a bulb and containing metallic mercury; two wires 42 fused into the glass tube so as to form contact with the mercury but not with each other; and a third wire 43, fused into said tube so as to enter the bore above the mercury, at such point that when the temperature at the thermostatic circuit closer is raised to 160 degrees Fahr., the mercury will touch said third wire 43, thereby closing an electric circuit which transmits the alarm. The wires 42 are provided for the purpose of giving notice of the breakage of any thermostat at the central station, and to that end they are connected in series by wires 44, and in a circuit including a wire 45, connected to contact member 31, and a wire 46 connected to magnet 35 in the signal box. From this magnet a wire 47 leads to a battery 48, whence a wire 51 leads past all the thermostats, connects with each wire 43, and taps the line wire 24 that connects with magnet 32. Thus the normal path of this house circuit is from the battery 48 by wire 47, magnet 35, wire 46, through the mercury of each thermostatic circuit closer, wires 44, wire 45, contact members 31, and 30, wire 50, to line wire 23. From the other line wire 24, wire 51 leads back to the battery 48. Thus the house circuit described is in connection with the line circuit, and the polarities of batteries 48 and 25 are in harmony with each other. The function of battery 25 is to hold its respective relay 2 closed during operation of any other of the relays 2 in case of fires. As indicated in the drawing, a battery as 25 is provided for each line circuit and relay 2. The open spaces 52 in the thermostatic circuit closers represent the spaces between the unexpanded mercury columns and the ends of the contact wires 43. It will be observed that a current from battery 48 normally makes a circuit through the grounding magnet 35, by way of wire 47, wire 46, wires 44, thermostatic circuit closers 1, wires 45 and 53, to magnet 32, wires 54, 24 and 51, to said battery. This local circuit, I term the house circuit. The function of said magnet 35 is to cause operation of the sytsem when a line wire becomes broken. When such a break occurs the house circuit will be opened and magnet 35 will be weakened and will release its armature, thereby permitting spring 37 to contact the point 34, which establishes a ground connection, as will presently be fully described.

Before I describe the operation of the set of apparatus shown, it is to be understood that a complete equipment will consist of a number, say 24, of signal boxes and a like number of central relays 2, etc., and that each signal box has a distinctive code character which its code wheel 29 is adapted to send.

Supposing the thermostats and all connections to be in normal condition and that a fire starts in the building, raising the temperature at one or more thermostatic circuit closers to 160 degrees, or higher, the mercury expands and makes contact with wire or wires 43. Electricity then flows, say from battery 25 through wire 24, to the building in which the fire started, and taking the path of least resistance will be diverted from magnet 32 and will pass through wire 51, through the expanded mercury column or columns, to sealed-in wires 42, thence by wire 45, contact members 31 and 30, wire 50, line wire 23, magnet of relay 2, and wire 24, back to battery 25. The magnet 32 being thus weakened, spring 33 draws armature 39 down and the latter trips the escapement (not shown) permitting the code wheel 29 to rotate. When the first depression 40 passes the brush 30, said brush will break contact with the wheel, also the member 30 will break its contact with member 31, the break between the latter thereby opening the circuit in which is the central relay 2, armature 7 of which will move up, causing arm 8 to leave contact point 9 and also to throw the drop switch 6. Switch 6 closes the circuit in which is the right-hand lamp 5, lighting same; the same current rings the bell 4 continuously until switch 6 is restored. The lamp 5 indicates which block the fire is in. The signals recorded by the tape (or other device) of the recorder 3, tell in what building the fire is. Dots and dashes may be printed by the opening strokes of the armature lever in recorder 3, so that they will correspond with the depressions 40 of the code wheel 29. As the code wheel 29 will stop in a closed circuit position, the relay 2 will be reclosed, regardless of the condition of the thermostats. As soon as the thermostat or thermostats which caused the alarm have cooled sufficiently, the mercury will break the alarm connec-

tions and current from battery 25 will again flow through magnet 32 reinforcing that of battery 48; the armature 39 will return to its normal position. The clockwork is wound up to prepare the mechanism for another operation.

The operation in case of accidents to the apparatus will be briefly described.

(A) In case the line wire 23 be broken but no fire exists in the house, the house circuit through magnet 32 remains closed and as magnet 32 is not sufficiently weakened to release the code wheel 29, the line circuit being broken (as supposed) its relay 2 opens, thus operating the recorder, the bell and the proper light. The recorder will run out tape because of the release of its mechanism, but will not, of course, record signals thereon under said conditions.

(B) In case a thermostat breaks, letting its mercury run out thus breaking the circuit through wire 44, the line circuit 23 and 24 will remain in its closed condition. The house circuit being opened, the current in the line circuit will be weakened, thereby weakening the emergency magnet 35, and as a result its armature 36 will vibrate or flutter, causing spring 37 intermittently to touch point 34, thereby causing the relay armature 7 to vibrate or flutter, and this movement will trip the drop switch, cause sounds in the bell and recorder, and flash the associated lamp 5, which tells what block the trouble is in.

(C) In case of a combination of accidents (A) and (B), the recorder 3 will run out tape, the bell will ring, and the block-designating lamp 5 will flash.

(D) In case of breakage of any wire within the building protected, the operation will be the same as in case (B).

(E) In case a fire occurs while line wire 23 is broken, current passes through the thermostat or thermostats affected, thus short-circuiting the magnet 32 which trips the code wheel 29 and the latter rotates; also, spring 33 then touches contact point 34, making a ground connection between the code wheel and the ground by way of wire 41, armature 36, spring 37, spring 33, point 34 and wire 38. Hence, when the code notches 40 pass the brush 30 they break contact therewith, and using as line conductors the unbroken line wire and the ground, the circuit of the associated relay 2 is opened and closed, thereby causing the recorder 3 to give out the proper signal on the tape and working the block lamp and bell, as usual. Upon the restoration of the thermostatic circuit closers to normal condition the magnet 32 will pick up its armature and the clockwork will be rewound.

(F) In case of a fire occurring while a house wire or a thermostatic circuit closer is broken and line wire 23 is broken, at the same time, owing to the house circuit break, the magnet 35 will weaken and release its armature; spring 37 will touch the point 34. As one of the thermostatic circuit closers will close its connection, current will be diverted from magnet 32, which will release its armature; spring 33 will close on the point 34 and the code wheel be released. The circuit will then be, starting at battery 25, wire 24, coil of relay 2, wire 23, ground 58 to the ground 28, wire 38, point 34, spring 37, armature 36, wire 41, code wheel 29, brush 30, member 31, wire 53, coil 32, wire 54, and unbroken line wire 24 back to battery 25. The code wheel operates the relay 2 in the usual manner, causing a proper record to be made on the tape in recorder 3, and actuating the other visible and audible signals 4 and 5.

The fact of one or more of the thermostatic circuit closers being broken (*i. e.* empty of mercury) will not prevent the above described operations, for this reason: If, say, the first one at the left be broken and the third one shown be closed by heat, the current from line wire 24 passes by wires 51 and 43 through the mercury of the closed thermostatic circuit closer, thence by wire 45 and spring 33 to the ground at 28, thus completing connections between the box and the relay 2 of the line affected.

Should the line wire 24, instead of line wire 23 be broken, the system will operate over the unbroken wire and the ground, but in order to provide for such contingency, I provide adjacent the relays 2, a grounding switch, which is shown on the drawing as an ordinary manual two-point switch. In actual practice I shall employ an automatic switch as will be disclosed in my separate application for Letters Patent. As herein shown, the switch lever 56 is pivoted at 57 and said pivot is connected permanently with a ground 58. Switch points 59 and 60 are connected to the respective line wires. Normally the switch will be left on point 59, as shown. Now, suppose the line wire 24 be broken between the two buildings, or between battery 25 and its connection with wire 51, the relay 2 on that line will open, thereby notifying the attendant, and as the recorder 3 will not print code, it will be known that a line wire is broken. The attendant will then place the switch arm 56 on point 60, thus grounding line wire 24 close to the battery 25, thereby establishing a line circuit through line wire 23 and earth, except that said circuit will be open in the signal box between point 34 and spring 33. Now, suppose a fire to start and to operate a thermostatic circuit closer 1, the said spring 33 will make contact with point 34, closing the circuit of relay 2, and the code wheel will send the identifying letter or signal to the recorder 3, while the line wire 24 is broken.

In the claims, the term "signal box" is to be understood as meaning any signal box of the kind described in this specification.

The term "switchboard" as qualifying certain elements, is to be understood as equivalent to "central station" or the like.

Having thus described my invention what I claim and desire to secure by Letters Patent, is:

1. In a system of the kind described, a signal box containing a starting magnet, a thermostatic circuit closer having normally open contacts connected in shunt around the terminals of said magnet, a battery and a normally closed circuit for said magnet, a line circuit connected with said magnet and shunt connection, a line circuit battery, and a switchboard relay operated by said signal box over the line circuit.

2. In a system of the kind described, a mercury thermostatic circuit closer having an open terminal and two mercury-connected terminals, a battery connected with said open terminal, an electromagnet, a switch operated by said magnet, wires connecting said battery and magnet in series with said mercury-connected terminals, a line circuit, a connection between the line circuit and said open terminal, and a switchboard relay and battery in the line circuit.

3. In a system of the kind described, a mercury thermostatic circuit closer having an open terminal and two mercury-connected terminals, a battery connected with said open terminal, an electromagnet, a switch operated by said magnet, a ground to said switch, wires connecting said battery and magnet in series with said mercury-connected terminals, a line circuit, a connection between the line circuit and said open terminal, and a switchboard relay battery in the line circuit, and a ground connection to the line circuit adjacent said relay.

4. In a system of the kind described, a plurality of mercury thermostatic circuit closers, each having an open terminal and two mercury-connected terminals, a battery wire tapped to the open terminal of each thermostatic circuit closer, wires connecting the mercury-connected terminals of the several thermostatic circuit closers in series, a battery in series with said wires, a line circuit, a connection between the line circuit and said battery wire, and a switchboard relay and battery in the line circuit.

5. In a system of the kind described, a plurality of mercury thermostatic circuit closers, each having an open terminal and two mercury-connected terminals, a battery wire tapped to the open terminal of each thermostatic circuit closer, wires connecting the mercury-connected terminals of the several thermostatic circuit closers in series, a battery and electromagnet in series with said wires, a switch operated by said magnet, a ground connection to said switch, a line circuit, a connection between the line circuit and said battery wire, a switchboard relay and battery in the line circuit, and a ground connection to the line circuit adjacent said relay.

6. In a system of the kind described, a house circuit comprising a battery wire, thermostatic circuit closers, a magnet and a battery, a line circuit comprising a battery wire, a battery, a second wire, and a switchboard relay, the battery wires of the two circuits being connected together, each of said thermostatic circuit closers having an open terminal, taps from the house circuit battery wire to said open terminals, and a signal box connected with the line circuit for sending a code signal over line to said relay.

7. In a system of the kind described, a series of mercury thermostatic circuit closers, each having a pair of mercury-connected terminals and a third terminal normally separated from the mercury, a house circuit comprising a battery, a magnet, and wires connecting said mercury-connected terminals in series, a wire from said battery tapped to the open terminal of each circuit closer, a line circuit, a switchboard relay in said circuit, means actuated by said magnet for operating said relay in case of loss of mercury from a thermostatic circuit closer, and switchboard signals operated by said relay.

In testimony whereof I affix my signature in the presence of two witnesses.

JOHN M. JOHNSON.

Witnesses:
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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."