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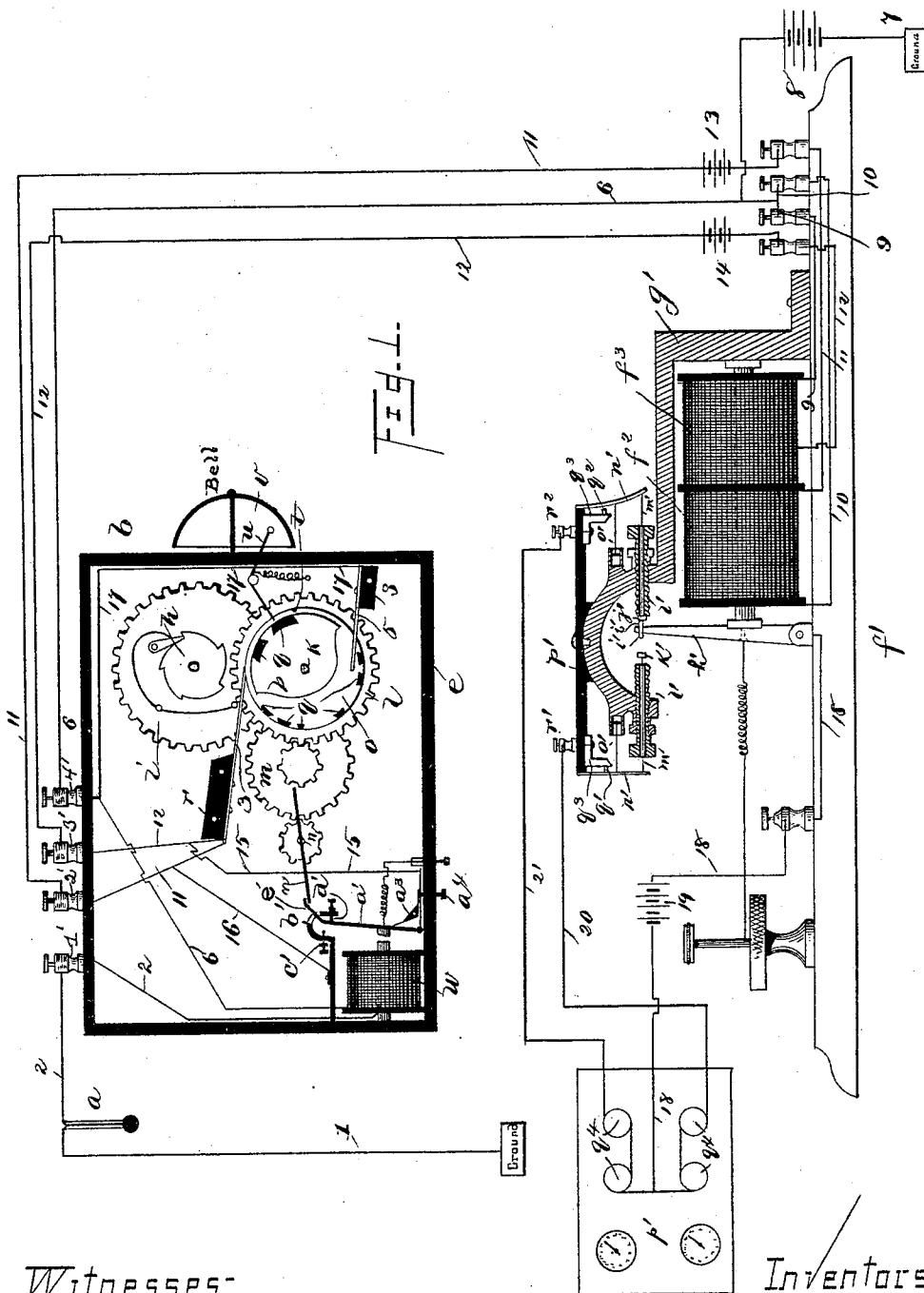
3 Sheets—Sheet 1.

W. S. & M. C. COOK & A. H. MORROW.

AUTOMATIC ELECTRIC FIRE ALARM SYSTEM.

No. 460,464.

Patented Sept. 29, 1891.



Witnesses:
E. C. Duffy
H. E. Peck

Inventors
W. S. Cook M. C. Cook AND
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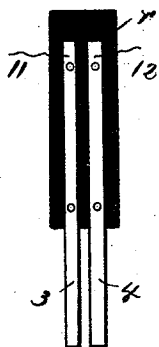
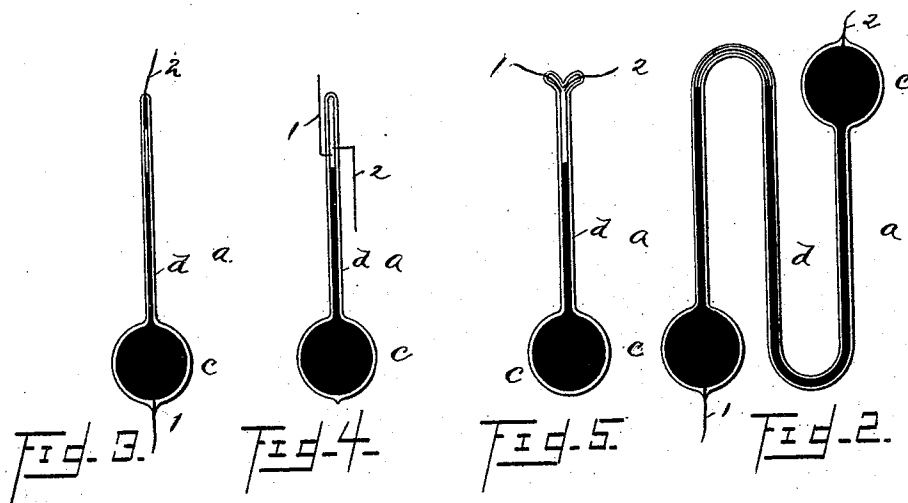
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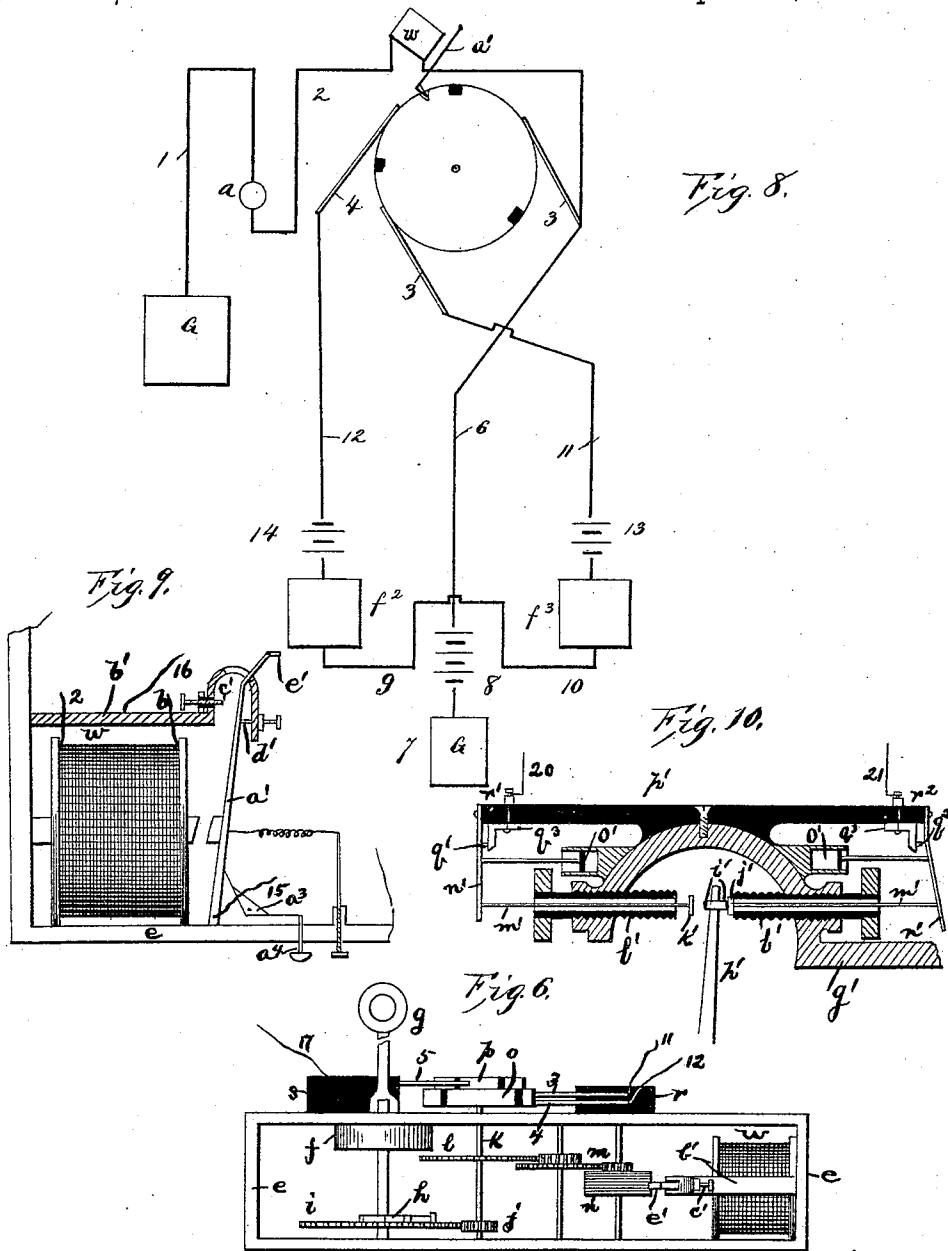
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UNITED STATES PATENT OFFICE.

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AUTOMATIC ELECTRIC FIRE-ALARM SYSTEM.

SPECIFICATION forming part of Letters Patent No. 460,464, dated September 29, 1891.

Application filed October 13, 1890. Serial No. 367,966. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM S. COOK, MOSES CHALMER COOK, and ALBERT H. MORROW, of South Omaha, in the county of Douglas and State of Nebraska, have invented certain new and useful Improvements in Automatic Electric Fire-Alarm Systems; and we do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form part of this specification.

This invention relates to certain improvements in automatic electric fire-alarm systems.

The object of the invention is to provide a simple and exceedingly reliable automatic fire-alarm system, reliability and simplicity being particular objects in view. These objects are accomplished by and this invention consists in certain novel features of construction and in combinations of parts, more fully described hereinafter, and particularly pointed out in the claims.

Referring to the accompanying drawings, Figure 1 is a diagrammatical view of the complete system, parts thereof being in section. Figs. 2, 3, 4, and 5 are detail views of various forms of thermostats. Fig. 6 is a vertical section of the operating or call box. Fig. 7 is an elevation of the brushes and their holder of the main-line circuit-closer. Fig. 8 shows the circuits diagrammatically. Fig. 9 is a detailed enlarged view of the operating electro-magnetic devices of the call-box. Fig. 10 is a detail section of the contacts, &c., of the relay.

This system comprises a normally-open operating or alarm circuit including the thermostat and the operating electro-magnetic device of the call-box and extending to the station, a main circuit normally closed and connecting the call-box and station relay, and the local circuits operated by the relay and including the station indicator or register.

In the drawings, the reference-letter *a* indicates a thermostat, preferably one of the constructions shown in Figs. 2, 3, 4, and 5. One contact of the thermostat is grounded by wire 1, and wire 2 extends from the other contact

to call-box *b*. The thermostat of Fig. 2 consists of two bulbs *c*, each containing separate bodies of mercury and connected by the tube *d*, S-shaped in this instance. The two wires 1 & 2 are fused into the bulbs in electrical engagement with the mercury. When the temperature is below a certain predetermined degree, (preferably 150° Fahrenheit), the two bodies of mercury remain electrically separate; but when the temperature rises to or above such degree the two bodies of mercury expand and flow through the tube *d* into engagement, thus closing the circuit.

The construction of Fig. 3 consists of the single bulb *c*, having the tube *d* extending up therefrom, one of the wires being in electrical connection with the mercury in the bulb and the other wire extending into the upper end of the tube and ending at the point to which the mercury will rise at the predetermined degree of heat. Figs. 4 and 5 also show the single bulb and tube, the two wires entering the tube *d*, and in Fig. 4 one contact is movable and raised into engagement with the other contact by the mercury. In Fig. 5 the two contacts are stationary and separate, and when the mercury rises it engages both, and thus bridges the space between and electrically connects the contacts.

The call or signal box *b* consists of a suitable rectangular case *e*, mounted on a base and inclosing a clock-work and electro-magnetic devices.

f is the clock-spring, provided with key and pawl-and-ratchet mechanism *h*.

i is the bull-wheel, meshing with pinion *j* on shaft *k*. Gear *l*, mounted on this shaft, meshes with gearing *m*, which drives the escapement-fan *n*. This clock-work operates circuit-closers for the main and auxiliary or operating circuits, consisting of two metal disks *o* *p*, mounted on an extended end of shaft *k*. These two disks are in electrical connection with each other, and each is provided with one or more insulating-pieces *q*, inserted in their periphery, as shown, so that each box will transmit a certain individual signal. A pair of metallic brushes 3 4, carried by insulated holder *r* and insulated from each other, bear on the periphery of the main-line disk *o*, and a brush 5, carried by insulating-holder

s, bears on the periphery of auxiliary disk *p*. A stud *t* projects from the under disk to engage the clapper *u* of bell *v* when the disks revolve and sound the bell to indicate that the box is in operation. *w* is an operating-magnet located in said box, provided with swinging armature *a'*, held back by a spring, as usual. The outer end of this armature moves in a recess in a bracket *b'* between the contacts *c' d'*, the contact *c'* being insulated from the bracket and the point *d'* in electrical connection therewith. The outer end of the armature is provided with an extended end *e'*, which extends through an opening in the bracket into the path of the escapement-fan and holds the same against rotation when the armature is in its normal position away from the magnet, this arm or extension *e'* being of such length that it will release the fan when the armature is drawn to the magnet. *f'* is the station-relay. This relay is double—i. e., is provided with two or more separate actuating-coils *f² f³*—and is carried by bracket *g'*, mounted on a suitable base. *h'* is the swinging armature of the relay, provided with the usual retractive spring and at its upper extended end with the opposite contacts *i'*, in electrical connection with the armature-lever, and moving between and adapted to alternately engage the two spring-contacts *j' k'*. The bracket *g'* is extended above and beyond the magnets. *l' l'* are two horizontal adjustable internally-insulated tubes or hollow screws mounted in said bracket, with their inner ends respectively on opposite sides of the upper end of said armature-lever. The two contacts *j' k'* are located on the outer ends of conducting push-rods *m' m'*, respectively extending through said insulating-tubes, and at their outer ends respectively secured to the lower ends of contact-springs *n' n'*, at their upper ends respectively secured to the outer projecting ends of the insulated support *p'*, mounted rigidly on bracket *g'*. These contact-springs constantly tend to spring in against contact-points *q' q²*, respectively. These contacts *q' q²* are carried by metallic brackets *q³*, depending from support *p'*, and electrically connected, respectively, with the two binding-posts *r' r²*, mounted on said support. Each contact-spring *n'* is provided with a dash-pot *o'* to render it slow in movement. Each station is also provided with register or indicator *p'*, in which *q⁴* indicates the connections to the various magnets thereof.

The operating and auxiliary circuit extends from the ground through wire 1 to the thermostat and through wire 2 and post 1' to the operating-magnet *w*, and from thence by wire 6 and post 4' to the station, where it is grounded at 7 and passes through the operating-battery 8. At the station the auxiliary circuit is connected with each coil of the relay-magnet by branches 9 10. The normally-closed main circuit is formed by wires 11 12, passing through posts 2' 3', respectively, and

connected, respectively, with the two brushes 3 4, and from thence extending to the station and respectively through the coils of the relay-magnets. At the station the two sides of the main circuit are provided with the relay operating-batteries 13 14.

In the call-box the main circuit is normally maintained closed by wire 15, electrically connecting wire 12 and the armature *a'* of magnet *w*, and a wire 16, electrically connecting wire 11 and bracket *b'*, so that electrical connection between wires 11 and 12 is normally maintained, and the call-box is normally shunted when the magnet *w* is not in operation by said wires 15 and 16 through armature *a'*, contact *d'*, and bracket *b'*. The brush 5 is connected by wire 17 with the wire 6, so as to connect it in the auxiliary circuit. At the station the local circuits are formed by the single return-wire 18, electrically connected with the relay-armature and provided with the register-operating battery 19, and the two wires 20 21, connected with the binding-posts *r' r²*, respectively, and with a set of register-magnets, and both connected with the return-wire.

In practice one call-box is usually employed for each house and the thermostats are placed in the various rooms of the house and connected with the call-box, which is itself connected with the main station. If the parts are in their normal conditions, the main signaling-line closed, and the operating alarm-circuit open, and the call-box shunted, if there is a fire in any room of the building the mercury in the thermostat of that room is caused to rise, thereby closing the operating-circuit from the ground over wires 1 2 and through the thermostat, the magnet *w*, wire 6, the battery 8, and the ground, hence actuating the call-box electro-magnetic device and drawing forward the armature *a'* and throwing the call-box into the main circuit by breaking the connection of the main circuit through armature *a'* and contact *d'*, and also as the armature is drawn forward it releases the escapement-fan, thereby setting in operation the clock-work of the box, which operates the circuit making and breaking mechanism by rotating disks *o p*. As these disks rotate, the main line is closed, when the brushes 3 4 are electrically connected through metal of the disk *o*; but when they engage the insulating-blocks the main line is momentarily opened, whereby the relay loses its power and the armature thereby is drawn back by its spring. As the relay-armature moves back its contact *i'* disengages contact *j'* and engages contact *k'*, thereby momentarily closing a local circuit through return-wire 18 and its battery, the relay-armature, contacts *i' k'*, rod *m'*, spring *n'*, contact *q'*, bracket *q³*, binding-post *r'*, and wire 20, and register, thereby making a dash on register-tape. The disk continues to rotate, thereby swinging the relay-armature back and forth and giving signals, which are received and re-

corded by the register. If while the main line is broken in one or more places a thermostat is closed, the operating alarm-circuit is closed, as before described, and the operating-battery and electro-magnetic device release the operating mechanism of the box, thereby rotating the circuit making and breaking disks, which make and break the main signal-circuit between the brush 5 of the auxiliary line and the main-line brush connected with the unbroken side of the main circuit (the other side being dead) through the metal of the two disks. As the disks rotate, the main circuit is made and broken through the relay-magnet by means of the branches connecting the auxiliary with said relay, so that said wire can constitute the return-wire for either side of the main circuit. When the main circuit is broken by any cause, the relay-armature is drawn back by its spring to its normal position, thereby, as before described, closing one local circuit and opening the other and operating the register to show that the circuit is broken. When the signals are transmitted over the circuit formed by the neutral or auxiliary line and one side of the main circuit and this circuit is closed, the relay-armature is drawn forward out of engagement with contact k' , allowing it and its adjoining parts to slowly return to their normal positions, while the armature-contact i' electrically engages contact j' , thereby momentarily closing a local circuit through wire 18, its battery, relay-armature, contacts $i' j'$, push-rod m' , (carrying contact j'), spring n' , point q^2 , bracket q^3 , post r^2 , and wire 21, and register-magnets. The relay-armature controls the local or register-operating circuits and swings back and forth as the operating-circuit is closed and opened by the call-box, each movement of the armature closing a local circuit and operating an indicator or register. Each contact $j' k'$ and its respective push-rod and spring is provided with a dash-pot o' to retard and render the movement of these parts slower than that of the armature, so that when an armature-contact i' engages a contact j' or k' the dash-pot connected with said contact will render its spring n' slow in starting, and thereby hold said spring longer in contact with contact q' or q^2 , so that the circuit will be closed between the armature-contact and the push-rod contact and the spring n' and contact q' or q^2 before said contact q' or q^2 and spring n' separate. The dash-pots also prevent a contact j' or k' moving with and in contact with the armature when leaving the same, for if this happened spring n' and point q' or q^2 would engage and close a circuit when the armature was moving away from the point j' or k' thereof.

The call-box is provided with means whereby it can be started mechanically from the exterior of the box, said means consisting of an angle-lever α^3 , pivoted within the box, having one arm engaging the armature of the electro-magnetic starting device and the other

bearing against end of push-rod α^4 , so that when the push-rod is forced in by the finger the angle-lever will throw in the armature and release the fan. When the call-box has transmitted its signal once, the bell on the exterior thereof is sounded.

This system is automatic, requires no attention or operators, and even if the main line is broken the system can be arranged so that when the main line breaks a bell will strike, and when there is a fire, and a box begins to operate, the signal will be given on the fire-bell and also registered on paper at the station. This renders the invention of great value for large buildings, factories, and small towns, as well as for cities, and if there is a fire in any room of the building the call-box of the building will turn in an alarm to the station before a person could run across the street to turn in an alarm. By this system, even if the main line is broken, all the boxes can still turn in an alarm.

It is obvious that an alarm-bell might be included in the circuit at the station, although I do not deem it necessary to illustrate such a common arrangement; also the device p' can be any suitable registering device or indicator for recording the signal or alarm, so that the attendant knows exactly which box has turned in the alarm although he may not be present at the moment the alarm is turned in. Any suitable device such as those now in use can be employed for this purpose.

The many advantages of this system are obvious.

It is evident that various changes might be resorted to in the form and arrangement and constructions of the parts described without departing from the spirit and scope of our invention. Hence we do not wish to limit ourselves to the precise construction herein set forth.

What we claim is—

1. A fire-alarm system comprising a normally-open alarm-circuit grounded at both ends and including the thermostat and the starting electro-magnetic devices of the call-box and extending to the station, the normally-closed signal-circuit connecting the call-box and station-relay, and the local circuit or circuits controlled by said relay and connected with said alarm-circuit and actuating the register or indicator.

2. In a fire-alarm system, the combination of a call-box, a normally-open alarm-circuit grounded at both ends and extending to the station and including a thermostat and the call-box, and a normally-closed metallic main signal-circuit controlled by the call-box and connected with said alarm-circuit and sources of electricity.

3. In a fire-alarm system, the combination of an alarm-circuit including a thermostat and a battery and connected at both ends to form a return or complete circuit and extending to the station, and a signaling-circuit connecting the call-box and relay, the alarm-circuit

at the station being connected with both sides of the main line to form a return for either side and at the box connected therewith through the circuit make and break mechanism, said alarm-circuit being normally cut out from the signal-circuit.

4. In a fire-alarm system, the signaling-circuit and the neutral line, in combination with the station-relay having the separate coils affecting the same armature, said neutral line being grounded at both ends and connected through said separate coils with both sides of the signaling-circuit, so as to act as a return for either side.

5. A relay having its armature-lever carrying contacts, in combination with circuit makers and breakers operated by the opposite movements of said lever, and the operating mechanism for said makers and breakers, comprising push-rods, spring-arms, and dash-pots, arranged and connected substantially as described.

6. A relay having the bracket carrying push-rods on each side of the armature-lever, said lever forming a suitable contact and alternately electrically engaging and moving said push-rods, contact-springs operated by said push-rods, and stationary contacts which the springs constantly tend to engage.

7. In a relay, the combination of the magnets and armature, the bracket above and extending beyond the magnets over the upper end of the armature, a circuit-closer carried by said bracket and comprising a contact-spring tending to spring against a stationary contact and arranged to be forced therefrom by the armature-lever, and a dash-pot for said spring, substantially as described.

8. In an electric fire-alarm system, the combination of a call-box, a station receiving-instrument, the continuous or loop signal-circuit, including the make and break mechanism of the box and the station-instrument, and the neutral line grounded at both ends connected with both sides of the signal-circuit through said station-instrument and through said make and break mechanism to form a return for either side of the signal-circuit.

9. In a fire-alarm system, the combination of a thermostat, a call-box comprising electro-magnetic starting mechanism, a station receiving-instrument, a main signal-circuit including the call-box and receiving-instrument and grounded at both ends, and the grounded alarm-circuit including the thermostat and said starting mechanism of the box and extending over said neutral line-wire, substantially as described.

10. In a fire-alarm system, the combination of a circuit-closer, such as a thermostat, a call-box comprising make and break mechanism and electro-magnetic starting mechanism, a station receiving-instrument, the main signal-circuit including said make and break mechanism and the receiving-instrument, and an

alarm-circuit grounded at both ends and including the circuit-closer and said starting mechanism and extending to the station and connected with the main circuit to form a return for either side thereof, substantially as described.

11. In a fire-alarm system, the combination of a transmitting-instrument, a receiving-relay comprising separate coils acting on the same armature, the signal-circuit including the transmitting-instrument and relay-coils, the neutral line grounded at both ends, at one end connected with both sides of the signal-circuit at the transmitting-instrument, and at the other end connected with both sides of the signal-circuit through said relay-coils, and sources of electricity, substantially as described.

12. An electric fire-alarm system comprising a receiving-instrument at the station, the transmitting signaling-instrument, the signaling-circuit including said station and signaling-instruments, the alarm-circuit extending through the signaling and receiving instruments and connected with the signaling-circuit to form a return for either side thereof, the circuit-closer, such as a thermostat, in the alarm-circuit, said alarm-circuit being connected at opposite ends to form a return or complete circuit, and sources of electricity for said circuits.

13. In an electric fire-alarm system, the normally-open alarm-circuit, the circuit-closer, such as a thermostat, therein, the signaling-circuit, the call-box comprising the circuit-breaking disks and brushes, including said two circuits, actuating means therefor, the controlling-magnet in the box in the alarm-circuit having its armature arranged when normal to hold said actuating means, a shunt connection from the signal-circuit, of which said armature forms one terminal, and a contact engaged by the armature when normal the other terminal, by which the circuit-breaker is normally shunted, and the station-relay or receiving-instrument through which said two circuits are connected by branch connections, said alarm-circuit being connected to form a suitable return.

14. The box consisting of the circuit-breaking disks and their brushes, clock-work to actuate the same, the controlling-magnet, the armature thereof being extended to hold said actuating means when normal, two contacts between which said armature swings, and shunt connections to the armature and to one of the contacts, engaged by the armature when normally arranged, so that the signal-circuit breaker is normally shunted from the signal-circuit.

15. The call-box comprising the circuit-breaking disks and brushes, the actuating clock-work therefor having the regulator-fan, the controlling-magnet, the slotted bracket having opposite contacts, the magnet-armature working between said contacts and hav-

ing an extended end extending through the slot of said bracket into the path of said fan when the armature is normal, and shunt connections closed and opened by said armature.

5 16. The box consisting of circuit-breaking disks and brushes and actuating clock-work therefor having a regulator-fan, the controlling-magnet having its spring-armature normally extending into the path of said fan, a
10 shunt connection closed by said armature when normal, and the bell-crank lever arranged to throw the armature from normal

and having operating means extending to the exterior of the box.

In testimony that we claim the foregoing as 15
our own we affix our signatures in presence of two witnesses.

WILLIAM S. COOK.
M. CHALMER COOK.
A. H. MORROW.

Witnesses:

C. H. SOBOTKER,
JOHN W. COOK.