J. G. NOLEN.

ELECTRICAL SIGNALING SYSTEM.

APPLICATION FILED FEB. 2, 1903.

922,320.

Patented May 18, 1909.

2 SHEETS—SHEET 1.

Fig. 1.

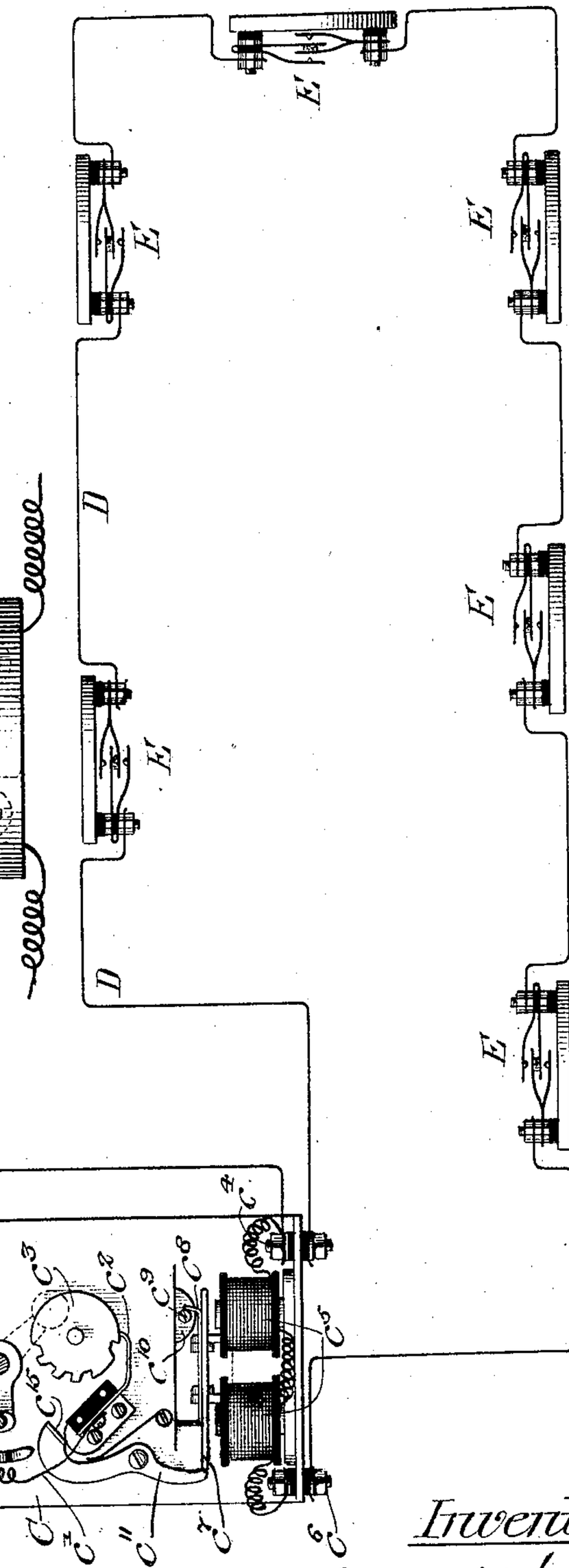


Fig. 1ª.

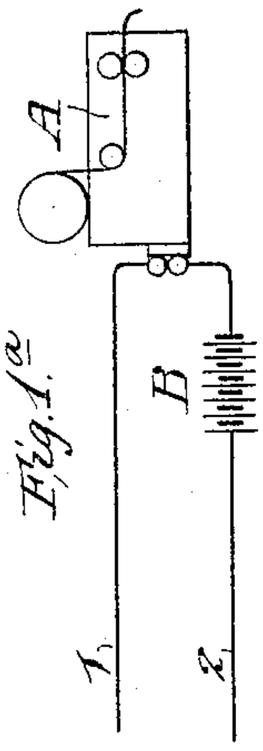


Fig. 2.

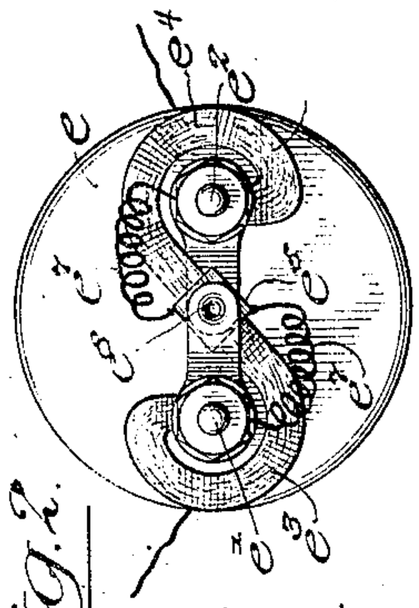
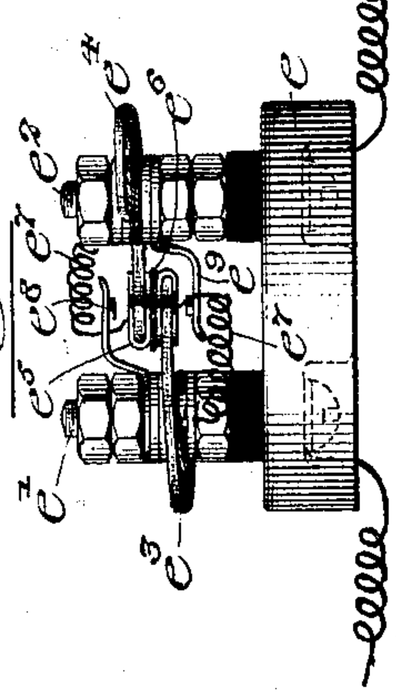


Fig. 3.



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2 SHEETS—SHEET 2.

Fig. 3.

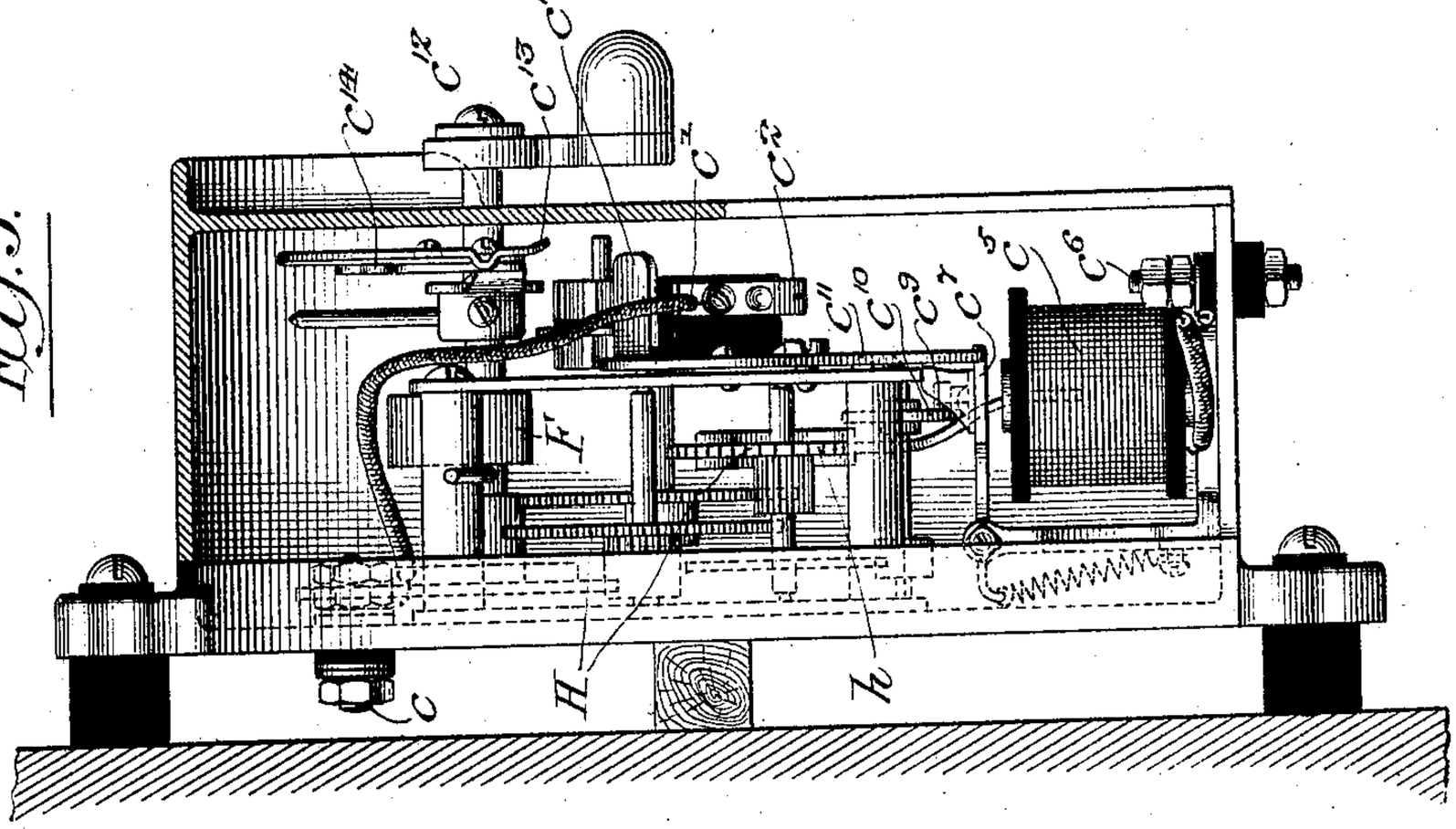
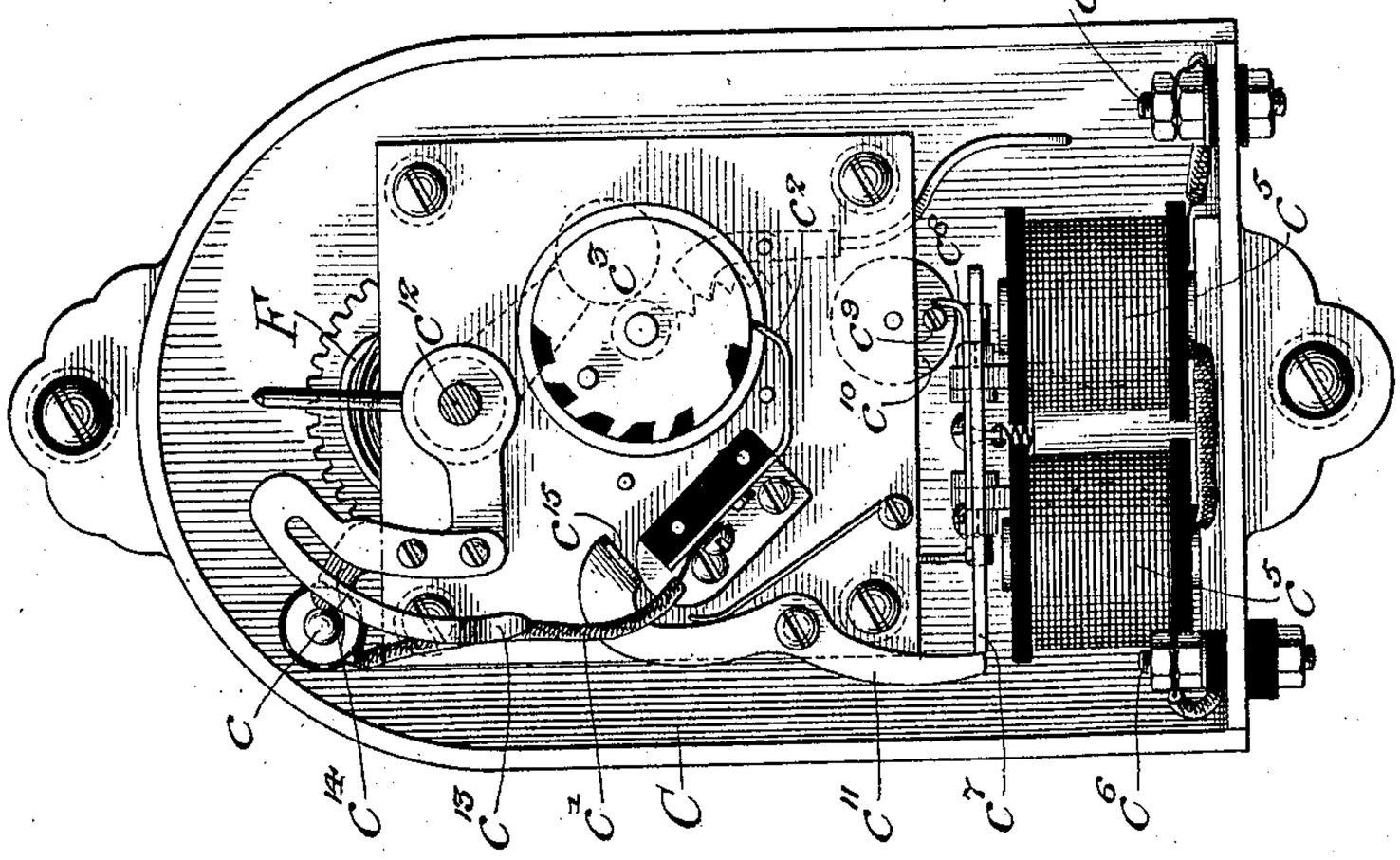


Fig. 4.



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UNITED STATES PATENT OFFICE.

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ELECTRICAL SIGNALING SYSTEM.

No. 922,320. Specification of Letters Patent. Patented May 18, 1909.

Application filed February 2, 1903. Serial No. 141,435.

To all whom it may concern:

Be it known that I, JAMES G. NOLEN, a citizen of the United States of America, and resident of Chicago, Cook county, Illinois, have invented a certain new and useful Improvement in Electrical Signaling Systems, of which the following is a specification.

My invention relates to signaling systems adapted more particularly for use in giving fire alarms. In a certain type of fire alarm apparatus, a normally closed circuit is employed, and this circuit when automatically opened by a rise in temperature causes a signal to be given at a local or distant point. Prior to my invention, fire alarm apparatus of this character has been open to many objections, among which was the impossibility of distinguishing between a true alarm of fire and an accidental break in one of the circuit conductors. In apparatus of this character, it has been usual to employ thermostatic devices which would automatically open the circuit, so as to cause a signal to be transmitted to the desired point. But obviously, a simple break or rupture at any point in a circuit would produce a signal of the same character, and in this way the fire departments have been frequently made to respond to an alarm of fire, only to find that the signal was produced by an accidental break or rupture in the circuit, and that no fire existed.

Now in order to overcome the foregoing difficulties, and in order to prevent the giving of false fire alarms, I provide an arrangement whereby the operation of a thermostat and a breaking of a line or circuit conductor will produce signals so different in character that the operator or attendant at the station where the signals are received can easily distinguish between them. This of course can be accomplished in various ways, but as a simple and effective arrangement for carrying out this broad aspect of my invention, I provide thermostats which, when operated, do not permanently open the circuit, but which, when effected by heat, merely open and then instantly close the said circuit. With these thermostat devices which break-and-make the circuit, I employ a signal transmitting device which is capable of transmitting two distinct signals, one to indicate the presence of fire in the building in which the thermostat devices are located, and the other to indicate merely a break or rupture in one of the circuit conductors. Thus, broadly considered, my invention contemplates fire alarm signal transmitting apparatus capable of transmitting two distinct signals, one a true alarm of fire, and the other indicating merely a break in one of the circuit wires. With this arrangement, the operator or attendant at the signal receiving station can notify the fire department if the signal indicates fire, and can also notify the proper persons if the signal indicates a break in one of the circuit conductors. Thus the operator or attendant at the signal receiving station is not only in a position to receive alarms of fire, but also to maintain a certain supervision over the system, so as to insure the making of repairs in the system as soon as necessary.

In the accompanying drawings: Figure 1, is a diagram illustrating an automatic fire alarm system embodying the principles of my invention. Fig. 1ª shows a signal-receiving apparatus and shows a current at the center station. Fig. 2, is a plan of my improved thermostat for producing the break-and-make action in the circuit. Fig. 3, is a side elevation of the device shown in Fig. 2. Fig. 4, is a front elevation of the signal transmitting mechanism. Fig. 5, is a side elevation of the signal transmitting mechanism.

Referring to Figs. 1 and 1ª, the system as a whole may include a signal receiving device A, located at a distant station, and also a battery B, which is also preferably located at the signal receiving station. The line conductors 1 and 2 preferably lead from the signal receiving station to the signal transmitting mechanism C, which latter is located in the substation or building which it is desired to protect against fire. This signal transmitting device or mechanism preferably includes an insulated binding post c, to which the line conductor 1 is connected, and which is in turn electrically connected by the conductor c^1 with the insulated spring contact finger c^2. This contact finger and the rotary contact disk c^3 electrically contacting with the casing constitute the make-and-break device for transmitting the signal over the line circuit to the signal receiving station. The other line conductor 2 leads to a similar binding post c^4 insulated from the casing, which is in turn connected with the electro-magnet c^5. The other terminal of this magnet is connected to another binding

post c^6 which is in electrical connection with the casing. The armature c^7 of this magnet normally maintains the clock-work of the signal receiving device in a wound-up condition, by reason of its projection c^8 engaging the pin c^9 on the wheel c^{10}.

A locking lever c^{11} is adapted to engage and hold the armature in a depressed condition when the latter is pulled down by the electro-magnet. The crank-shaft c^{12} of this signal transmitting device, which, it will be observed, is in the nature of a call box, is provided with a pair of projections c^{13} and c^{14}, adapted to successively engage the upper end portion c^{15} of the said locking lever. Normally, the circuit is closed from one conductor through the make-and-break device and the casing of the box and the magnet coils to the other conductor. The current flowing through this normally closed line circuit is, however, normally shunted around the electro-magnet by the normally closed shunt D, having its terminals connected to the two binding posts c^4 and c^6.

The signal transmitting device or mechanism C is preferably termed a master box, and is located in any suitable part of the building to be protected. The shunt D is then arranged to extend through the different parts of the building, and is provided at different points, say in the different rooms of the building, with the thermostatic break-and-make devices E. Referring to Figs. 2 and 3, it will be seen that each of these improved thermostats consists preferably of a base e, upon which are mounted the two binding posts e^1 and e^2. The end portions of the shunt conductor are joined to these binding posts at the under side of the base, preferably as shown in Fig. 3. If made of metal, the said base is preferably insulated from the two binding posts. Upon the two posts are mounted the spiral or semi-spiral-shaped mica springs e^3 and e^4, each having its end provided with a copper or other metallic tip e^5. The two tips are normally soldered together by the fusible material e^6, and each metallic tip is connected to a binding post by a conductor e^7. Metal contacts e^8 and e^9 are mounted respectively on the binding posts e^1 and e^2 and arranged above and below the soldered joint or union between the two tips. When the two tips are thus soldered together, the two mica springs are under more or less tension. When connected in the shunt circuit, as shown in Fig. 1, the metal tips and solder of each thermostat are in the circuit. Now as the solder of each thermostat is preferably capable of fusing at a temperature above the normal, say at 125 Fahrenheit, it follows that the melting of the solder at any point, and the consequent giving away of the joint, will cause a break in the shunt circuit. And this is not all. The break in the circuit is instantly followed by the closing of the circuit, inasmuch as the tips of the two mica springs are instantly brought into contact with the two contacts e^8 and e^9. Thus, as its name implies, each break-and-make device is capable, under the influence of heat above the normal, of producing a break in the circuit, which is then instantly followed by a making or closing of the circuit.

With the foregoing arrangement, suppose that the building in which the signal transmitting mechanism and the thermostats are located catches fire and one of the thermostats is operated. The momentary break in the shunt circuit is sufficient to throw the current into the coils of the electro-magnet, and thereby cause the latter to attract its armature. The said armature when attracted releases the spring-operated clock-work of the signal transmitting device, and the rotation of the disk c^3 then produces a make-and-break action in the line circuit. This make-and-break action, which is of the usual character—that is to say, which is of the character usually produced by an ordinary call box, results in the transmitting of a signal over the line circuit to the station at which the signal receiving device A is located. When the armature is pulled down by the magnet, the spring pressed locking lever c^{11} is thrown over until its lower end is in the path of the armature. Thus the armature is locked down until the projection c^{13}, which is in the nature of a flexible spring, passes over the projection c^{15} of the locking lever, thereby throwing the lower end of the latter out and releasing the armature. When thus released, the armature is free to rise, inasmuch as the thermostat which started the operation has again closed the circuit, and has in this way deënergized the magnet. Thus, as soon as released, the armature rises, and its projection c^8 again engages the pin c^9 on the rotary wheel c^{10}. In this way, the normal action of one of the thermostats produces merely a momentary or instantaneous energizing of the magnet, allowing the armature to rise and prevent the wheel c^{10} from making more than a predetermined number of revolutions or turns. This predetermined extent of make-and-break action on the part of the make-and-break device in the signal transmitting mechanism produces a signal of predetermined character at the signal receiving station, and one which is easily recognized by the operator or attendant as an alarm of fire. Suppose now that one of the wires forming the shunt conductor becomes broken or ruptured at some point, the break in the shunt circuit will then throw the current in the normally closed line circuit through the coils of the electro-magnet, and in this way start the operation of the clock-work in the call box or signal transmitting device, substantially in the manner already

described. But the balance of the operation is entirely different. When the projection c^{13} strikes the upper end of the locking lever, it throws the said lever out of engagement with the armature, but inasmuch as the shunt is still open and the magnet still energized, the armature cannot rise, and the clock-work is permitted to run on and continue the transmission of the signal. This continued or extended make-and-break action continues until the operation of the clock-work comes to a termination by reason of projection c^{14} throwing the lever c^{11} over to its limit of movement where it may stop further movement of the projection c^{14} so that when the break in the line is closed the armature rises at once, and when the motor is subsequently wound the parts are all conditioned for functional operation, with the armature unlocked and in raised position. Thus the call box or signal transmitting device is given a limited or relatively small extent of operation when a thermostat is operated, and is given a continuous or practically unlimited operation when a break or rupture occurs in one of the shunt wires or conductors. This, as explained, produces two signals so different in character that the operator or attendant at the signal receiving station has no difficulty whatever in distinguishing between them.

By the use of mica springs in the thermostats, the same are rendered much more sensitive, it being impossible for the heat necessary to melt the solder to be conducted from the latter through the springs to the body or base of the device. In other words, the heat is concentrated at a point where it is needed to melt the solder, and cannot be conducted away from this point by any other parts of the device. Thus, as stated, the thermostats are rendered much more sensitive than would be the case with metallic springs.

The call box or signal transmitting device C can be of any suitable, known or approved character. For example, it may be constructed as shown in Figs. 4 and 5, this form, as far as the general construction is concerned, being one that is known and used at the present time. In this box, the power of the spring F is transmitted to the rotary contact disk c^3 through the medium of the gear wheels and pinions constituting the clock-work H. The arrangement involves, of course, the ordinary escapement h. The wheel c^{10}, previously described, is of course an additional element or feature of this call box, and is also driven by the said spring and clock-work. The other additional elements or features, such as the armature, magnet, locking lever, and unlocking devices have been previously described and need no further explanation.

Thus it will be seen that while my improved fire alarm system is in accordance with certain rules or requirements of the Underwriters' Association, with respect to normally closed signaling circuits, it is nevertheless of such character that a break or rupture in the circuit conductor cannot be mistaken for an alarm of fire.

What I claim as my invention is:

1. In an automatic fire alarm system, a normally-wound transmitter adapted to transmit a plurality of signals, means, including an electro-magnet, for controlling the transmitter to condition it to send a long signal when the magnetic conditions of the electro-magnet are varied from normal for a long interval, and to condition said transmitter to send a shorter signal when the magnetic condition of the magnet is varied and restored, a signal receiving device, circuit connections between the make-and-break devices of the transmitter and the receiving device, a break-and-make thermostat, and suitable connections for said thermostat whereby it operates when actuated to vary and instantly restore to normal the magnetic condition of the transmitter-controlling electro-magnet.

2. In an automatic fire alarm system, a normally closed circuit including the make-and-break device of a motor-driven signal transmitter, the signal transmitter, a signal receiver, a battery, and a thermostatic device for breaking and immediately reclosing the circuit, an electro-magnetic transmitter-controlling device arranged to condition the signal transmitter for sending a long signal when the magnet is continuously energized and for sending a short signal when momentarily energized, and circuit connections for said electro-magnetic device wholly shunting the portion of the circuit including the thermostatic devices, whereby its magnetic condition is controlled by the condition of the thermostat.

3. In an automatic fire alarm system, a main circuit, a supervisory circuit, normally shunting a portion of the main circuit, a signal transmitter having electro-magnetic controlling means wholly included in the portion of the main circuit shunted by the supervisory circuit, said transmitter being adapted to transmit one signal upon the break-and-make of the supervisory circuit and another signal upon the continued break of the supervisory circuit, and a thermostat operating to break and immediately reclose the supervisory circuit.

4. In an automatic fire alarm system, a source of current supply, a signal-receiving instrument, a signal-transmitting instrument, electro-magnetic means for controlling said transmitting instrument, said transmitting instrument being adapted to transmit its characteristic signal a predetermined number of times when the magnetic condition of the controlling electro-magnet is varied

from normal and then restored to normal, and to transmit its characteristic signal a different number of times when the magnetic condition of the electro magnet is varied from normal and maintained in such varied condition, a line circuit including the source of current supply, the signal receiving instrument, the signal transmitter, and the transmitter-controlling electro-magnet, a circuit wholly shunting the transmitter-controlling electro-magnet, and a thermostat in the said shunt circuit adapted when actuated to vary and subsequently restore the shunt circuit and thereby vary and restore the magnetic condition of the transmitter-controlling electro-magnet.

5. In a signaling system, the combination of a signal receiving device, a signal transmitting mechanism suitably connected with said device, said mechanism being adapted to transmit a short signal in case of fire and a long signal in case of a break in a circuit conductor, said mechanism involving normally wound clock-work and a releasing magnet, means for supplying current through the line circuit, said circuit being normally closed, the coils of said magnet wholly constituting a part of said circuit, a normally closed shunt extending around the coils of said magnet, a plurality of break-and-make thermostats in said shunt, the said signal transmitting mechanism comprising also means adapted for automatically locking and unlocking said armature, whereby the said normally wound clock-work is permitted to release and limit the extent of operation in case of fire, but whereby said clock-work is released and allowed to run down in case of a break in one of the shunt conductors and means for supplying the signaling current being located at the central station, whereby there is a normally charged circuit containing the signal initiating device.

Signed by me at Chicago, Cook county, Illinois, this 17th day of January, 1903.

JAMES G. NOLEN.

Witnesses:
WM. A. HARDESS,
HARRY P. BAUMGARTNER.