(No Model.) 2 Sheets—Sheet 1.

G. F. BULEN.

AUTOMATIC FIRE ALARM SYSTEM.

No. 421,853. Patented Feb. 18, 1890.

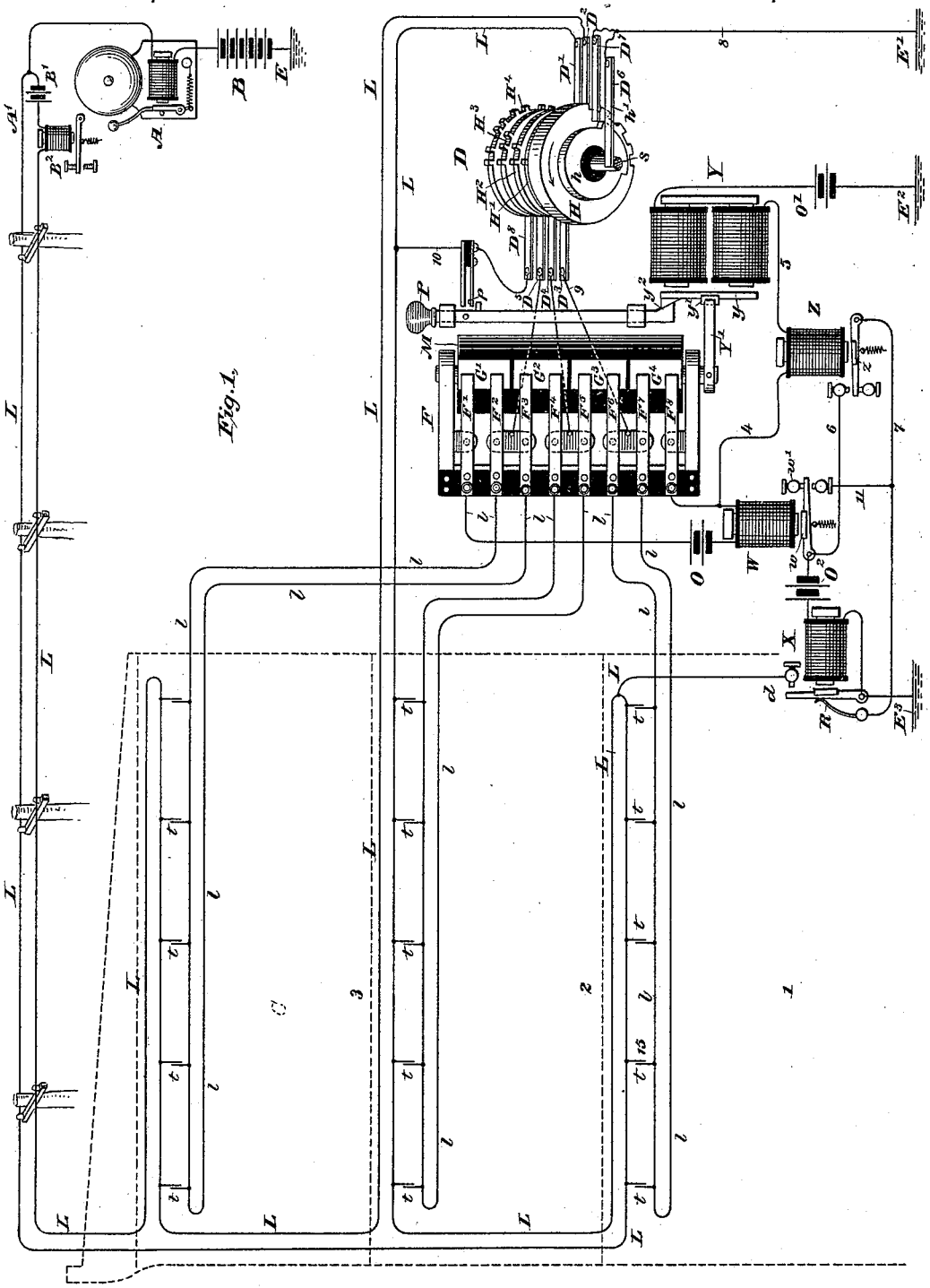

Fig. 1.

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Fig. 2.

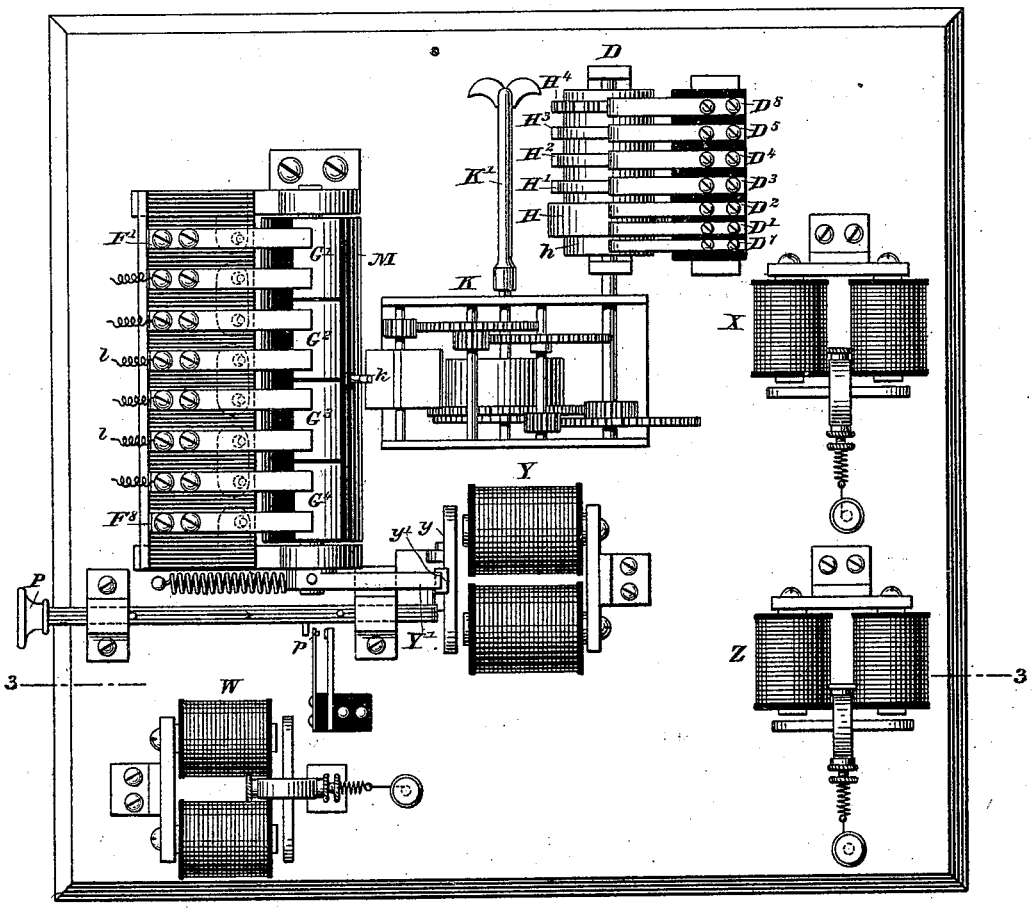
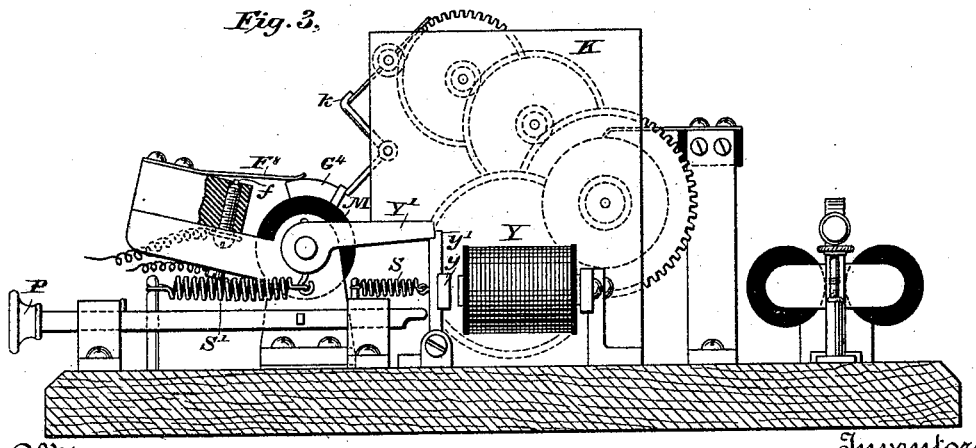


Fig. 3.



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UNITED STATES PATENT OFFICE.

GEORGE F. BULEN, OF TOMPKINSVILLE, NEW YORK.

AUTOMATIC FIRE-ALARM SYSTEM.

SPECIFICATION forming part of Letters Patent No. 421,853, dated February 18, 1890.

Application filed June 18, 1889. Serial No. 314,688. (No model.)

To all whom it may concern:

Be it known that I, GEORGE F. BULEN, a citizen of the United States, residing in Tompkinsville, in the county of Richmond and State of New York, have invented certain new and useful Improvements in Automatic Fire-Alarm Systems, of which the following is a specification.

The object of the invention is to provide a system of protection by means of electric circuits and suitable connecting apparatus which shall be provided with every practicable means to make it reliable in operation, and which shall indicate at the central office not only the existence but the exact location of a fire that has taken place within the building or space under the protection of the system.

The invention will be readily understood by inspection of the accompanying drawings, in which—

Figure 1 is a plan or diagrammatic view of the circuits and the parts of the instruments therein connected. Figs. 2 and 3 are respectively plan and side views of the transmitter.

The main line L in Fig. 1 extends from the central station A, where the main battery B is located, to the building C, the outlines of which are represented in dotted lines, and passes through the several stories of the building marked 1, 2, and 3. The main line is preferably double throughout the circuit, one reason being that if one of the wires is broken the circuit is not destroyed, but the system will operate through the remaining wire.

All the stories of any building under the protection of the system, or as many of them as may be desired, are arranged as shown in the three stories of the building illustrated in the drawings.

At one part of the circuit in the building, wherever convenient, (in this case from the second story,) the main line L is carried to the transmitter at D; also at another point (preferably from the lowest story) the main line is connected with another part of the transmitter, as at *d*. The main circuit is normally open, and it may be traced from the earth at E at the central station throughout the line L and the several stories of the building, terminating in the two strips D′ and D^2 at one part of the transmitter and at the contact-points at *d* at another part. The strips D′ and D^2 rest upon the insulated piece H, thus leaving the circuit open at that point, as stated. The main circuit, however, has three paths to the earth through the transmitter represented at E′, E^2, and E^3.

Throughout the building and by the side of the main circuit in each story extends the local circuit *l*, *l*, &c., and this local circuit from each story passes through that portion of the transmitter marked F in such a way as to make of the local wire in all the stories a single circuit, which includes the battery O and the magnet W. This single local circuit is made up of the several circuits which extend through the different stories of the building by means of the strips F′ F^2 to F^8, and the plates G′ G^2 G^3 G^4, upon which the strips F′, &c., rest. Thus the local circuit throughout the building may be traced from the battery O through strip F′, the plate G′, the strip F^2, the upper story of the building to the strip F^3, the plate G^2, the strip F^4, the second story of the building, the strip F^5, the plate G^3, the strip F^6, the lower story of the building, the strip F^7, the plate G^4, the strip F^8, the magnet W back to the battery. This local circuit is therefore a closed circuit, and by this means the armature *w* is held toward the magnet W and against the stop *w*′. The main and local circuits thus described are connected at as many points as desired throughout the several stories of the building by thermostats or other thermal devices *t*, and except through these devices there is no electrical contact between the circuits. As illustrated in the drawings, the circuits and apparatus are in their normal positions and ready to indicate the occurrence of a fire or any other cause which may place the two circuits in connection.

By reference to Figs. 2 and 3 it will be seen how the several parts are maintained in their relative positions. The portion of the instrument at D is operated by the clock-work K, wound by the key K′. The train K is held from operation by the catch or lever *k*, which itself is held in position by a pin upon the cylinder M. The cylinder M carries the plates G′ G^2, &c., which serve as connections between

the various parts of the local circuit which extends throughout the building, as described. The magnet Y and its armature *y* control the movement of the cylinder M. The spring S holds the armature *y* away from the poles of the magnet Y, and the spring S′, which is connected to the shaft of the cylinder M, tends to turn the latter toward the right. This is prevented by means of the lever Y′, which rests upon the top of the armature-lever *y′*.

Let us suppose now that a fire has taken place in any part of the building, and that by means of any one of the thermal devices *t* a connection is made between the main wire L and the local circuit *l*. The result is that the powerful battery at B at the central station is thrown from the main circuit onto the local circuit through the connection made by the thermostat, and the main circuit will then find its way to the earth through the said local circuit, passing through the magnet W, the wire 4, the magnet Z, the wire 5, the magnet Y to the earth at E^2. In its path it meets the two batteries O and O′; but as these are very small they tend in no way to effect the strong current from the battery B. The first effect of the main current thus passing over the route described is that the armature *z* of the magnet Z is attracted and a local circuit is established over the wires 6 and 7, which includes the battery O^2 and the magnet X. The effect of this, if continued, would simply be to cause the bell at A to be rung through the operation of the rheotome R, connected with the magnet X, by alternately bringing the main circuit to ground at E^3 through the point *d;* but the same current also energizes the magnet Y, which causes it to attract its armature strongly. The arm Y′ is thus released, the spring S′ immediately turns the cylinder M a distance sufficient to remove the plates G' G^2, &c., from under the ends of the springs F' F^2, &c., and the effect of this is at once to isolate the various local circuits extending through the different stories of the building. This isolation remains as regards all the stories except the one in which the connection between the two circuits has been made as described; but the circuit in the story of the building in which the fire has occurred, being in the main circuit, is at once connected with the earth at E′ through the device D, for, as indicated in the diagram, the two strips F, which form the terminals of the local circuit in each story, are connected with the springs or strips D^3 D^4 D^5. This connection is made as soon as the cylinder M has been turned and the plates G′, &c., have been removed from under the ends of the strips F. By reference to Fig. 3 it will be seen that these strips F are bent upward while resting upon the plates G; but if the latter are removed the strips F will fall and strike upon the contact-points *f*, which contact-points are connected, respectively, with the strips D^3, D^4, and D^5. It will be seen therefore that as soon as the cylinder M has been moved, as described, so that the strips F fall from the plates G, then the several stories are connected separately, each with its strip D^3, D^4, or D^5. But as the fire is supposed to have taken place in one story only, then the local circuits in the other stories of the building are left open, while the local circuit in the story in which the fire has occurred, being connected with the main line and its battery, will go through the device D through its strip D^3, D^4, or D^5. Again, it will be seen that as soon as the cylinder M is turned, as described, the catch or lever *k*, which prevents the train K from operating, is released, and by means of the train the cylinder D commences to turn and continues as long as the train is provided with power by its spring. The cylinder D is turned in the direction of the arrow, as shown in Fig. 1. The cylinder D consists of the shaft *s* and the disks H, H′, H^2, H^3, and H^4. The disk H has connected with it the part *h*. The disk H and *h* is insulated from the shaft *s*. The other disks H′, H^2, H^3, and H^4 are electrically connected with the shaft *s*.

The operation of this part of the transmitter is as follows: It will be observed that from the earth E′ the wire 8 extends to the two strips D^6 and D^7, D^6 being connected with the shaft *s* and D^7 resting over the part *h* of the disk H. As soon as the cylinder D begins to turn in the direction of the arrow, as shown, the first effect is to put the disk H in connection with the ground by means of the strip D^7 and the projection *h′* extending over the part of the periphery of *h*. As the main line is connected with H by means of the two strips D′ and D^2, it is evident that the main line is thus sent to ground at E′ through the wire 8. It will be noticed that parts of the disk, H, just ready to go in contact with the strips D′ and D^2, are cut away. In this instance there are four such places cut from the edge of the disk. The result will be that as the cylinder D is turned and the periphery of H passes under the strips D′ and D^2 the circuit will be closed and opened four times by means of the spaces cut from the periphery of H, after which the strip D^7 will pass out of contact with *h* by passing over the end of the raised portion of its periphery. This action will cause the bell at the main station A to be struck four times, and this is intended to indicate the number of the building in which the fire has occurred. As the cylinder D continues to turn in the direction of the arrow, as shown in Fig. 1, the several disks H′ H^2 H^3 are brought under the strips D^3, D^4, and D^5. The disk H′ has one projection upon its periphery, H^2 has two projections, and H^3 has three projections. Now, as the main circuit is completed through the local circuit of one of the floors, it will be completed through the disk which is brought into contact with the strip D^3, D^4, or D^5 connected with that floor, and the result is that the bell at A will be struck once, twice, or

thrice, according as the local circuit in the first, second, or third story of the building has been connected with the main circuit by the action of the thermostat, as described. This operation will be repeated as long as the cylinder D continues to turn, the bell striking first the number of the building, as indicated by the breaks in the periphery of H, and then the number of the floor on which the fire has occurred, depending upon which strip D^3, D^4, or D^5 is thus put into the main circuit.

To be more particular, let it be supposed that a fire has taken place at the point 15 in the first story of the building, and by means of the thermostat at that point the main line L has been connected with the local circuit *l*, the result will be that the main battery B, crossing from the main line L to the local line *l* at the point 15, will pass for an instant over the entire local circuit, through the strips F, the plates G, the magnets W, Z, and Y to the earth at E^2. The magnets Z and Y will be energized as described, the cylinder M will be turned to the right, so that the strips F and the plates G are separated. The local circuit in the first story will thus be isolated from the local circuit in the other stories, and the connection will be made from the point 15 through the wire *l* in the first story to the contact-point under the strips F^6 and F^7, which are in the circuit of that story, through the wire 9 to the strip D^3. The cylinder D being started, as has been described, the bell at A will first be caused to strike four times by the operation of the disk H, and then as the disk H′ carries its projection under the strip D^3 it causes the bell to strike once because the connection is made between the strip D^3, the disk H′ by means of its one projection, the shaft *s*, the strip D^6, the wire 8, to the earth at E′. This will be repeated so long as the cylinder D is caused to turn by means of the train K. It is intended that these signals shall be repeated, say five or six times, so that the attention of the proper officer in the main office at A shall not fail to be attracted.

It sometimes happens that it is desired to call the attention of the main office to a building before any of the thermostats have acted, and for this purpose a device for sending an alarm manually is shown at P in Figs. 1 and 2. It consists of the handle and rod P, working back and forth stiffly in guides, as shown, and in the case of Fig. 1 sets the transmitter in operation by means of the wedge-shaped pieces on the end of the rod P and the armature, as shown at y^2. When the rod P is pulled outward, it will be seen that the armature *y* is pressed against the poles of the magnet the same as though the latter were energized, and the same result will follow—namely, the cylinder M is caused to revolve and the cylinder D is also released. In this case, however, as there has been no connection made between the local and main circuits, the result will be that the main battery B does not find its way to the ground by either of the circuits of the stories of the building; but when the knob P is pulled the circuit-closing points at *p* are brought together, and this gives the main battery a circuit through the line 10, circuit-closing points *p*, the strip D^8, and the disk H^4. This latter disk is provided with several pairs of projections, so that when it passes under the strip D^8 the main circuit is closed twice several times at intervals, thus giving two strokes several times upon the gong A in the central station. It will be seen, however, that as the cylinder D is set in operation in the same way as has been before described, a signal will be sent by means of the disk H, whereby the number of the building will be given, and then instead of the number of the floor several pairs of strokes will be given, thus indicating that a manual signal has been sent in from the building, either without a fire or because it has been discovered before any of the thermostats have been operated.

An examination of the box will disclose that a manual signal has been sent, as the handle P will be pulled out. In Fig. 2 this manual device is more conveniently shown as being operated by pushing the knob P inward, which makes contact between the circuit-closing points at *p* and pushes the armature *y* toward the poles of the magnet Y in the same way as has been described with reference to Fig. 1, and producing the same result.

Should the local circuit in the building at anywhere be broken, the result will be that the circuit which includes the battery O and the magnet W, and which extends throughout the building, will be opened. The result of this will be that the armature *w* will be drawn away from the poles of the magnet by its spring, and the circuit of the battery O^2 will be closed through the wire 11 and the rheotome connected with the magnet X. This will give the main circuit a ground through the point *d*, and will cause a continuous ringing of the bell at A, thus indicating that the local circuit in the building is broken and requires attention.

Should a ground be established at any point of the local circuit, then a circuit will be made through battery O, magnet W, wire 4, magnet Z, wire 5, magnet Y, and battery O′ to earth at E^2, the two batteries O and O′ operating together. These will operate magnet Z, but not magnet Y, because the latter is adjusted only to be operated by the main battery; but the rheotome-circuit through wires 6 and 7, magnet X, and battery O^2 is completed, and the bell A in the central office is rung, because the main circuit is intermittently grounded at *d* and E^3.

At the central station A, at the point A′, a device is shown which is of importance in indicating the condition of the circuit. In the loop forming the main conductor is placed the battery B′ and the magnet B^2. As the

loop forms a complete circuit in itself, the magnet B^2 is kept energized and its armature is held to its poles. Should the wire be broken, the armature falls away, and thus gives notice of the break. Again, should the line be grounded between the central station and the building C, the magnet A is energized, but no continuous alarm is given; but in such a case, if a fire occurs, the results of the operation of the transmitter are given upon the magnet B^2, because the loop-circuit is opened at the disk H when the strips D′ and D^2 meet the breaks in its periphery. Again, when the circuits and apparatus are all in normal condition and an alarm is given, as has been described, the main magnet A and the loop-magnet B^2 operate together, thus indicating that the line is intact. Thus every provision is made for the reliable transmission of the signals, and every accident to disarrange the system is provided for, and the cause can be found and remedied.

I claim as my invention—

1. In a fire-alarm system, the combination of a main line from the central station to the building or area under protection, a local circuit comprising a given number of normally-connected sections and in proximity to said main line within said building or area, thermostats in connection with said main and local lines, an automatic circuit-controlling device, through which the sections of the local line are connected in series, and an electro-magnet in a circuit adapted to be completed by the closing of a connection between said main and local lines by one of the thermostats, and adapted when energized to set in operation the said circuit-controlling device, whereby the several sections of the local line are isolated from each other, as set forth.

2. In a fire-alarm system, the combination of a main line from the central station in the building or area under protection, a local circuit comprising a given number of normally-connected sections and in proximity to said main line within said building or area, thermostats in connection with the main and local lines, an automatic circuit-controlling device, through which the sections of the local line are normally connected in series, a starting electro-magnet therefor adapted to be energized by the closing of a connection between the main and local lines, whereby the several sections of the local line will be isolated from each other, a transmitter or signaling mechanism in said building, and electrical connections from each section of the local line to the same, as set forth.

3. In a fire-alarm system, the combination of a main line from the central station to the structure to be protected, a local line within said structure in proximity to the main line and composed of a given number of sections or divisions connected up in closed circuit, an earth-connection from said local circuit, an automatic signaling device connected with the main and local circuits, an electro-magnetically operated circuit-controller, by which the sections of the local circuit are connected or by which they are isolated, connected with the said ground-connection, and thermostats connected with the main line and the several sections of the local line, and adapted to establish connection between the two when affected by a certain rise in temperature, as described.

4. In a fire-alarm system, the combination of a main line from the central station to the structure to be protected, a normally-closed local circuit in the said building, a battery and magnet in said local line, a second local circuit controlled by said magnet, a vibrator connected therewith and adapted to intermittently close the circuit of the main line, an earth-connection from the closed local circuit, and thermostatic circuit-closers between the main line and the wires of the closed local circuit, as set forth.

5. A fire alarm-system comprising the circuits and apparatus combined and arranged as follows, to wit: a main line from the central station containing a gong or alarm indicator and extending to and throughout the structure to be protected, a closed local circuit in the building the wires of which are run in proximity to the main line and connected therewith through thermostatic circuit-controllers, a connection from the said closed circuit to earth, a circuit-controller containing a given number of plates through which separate sections of the local circuit are connected, an electro-magnet for operating or starting the same and included in a circuit from the main line through the said earth-connection, whereby on the energizing of the magnet the said sections will be isolated from each other, an automatic signaling device or transmitter adapted to be started in operation by or immediately subsequent to the action of the circuit controller, and circuit-connections whereby given signals are transmitted first from the main line to ground and then from the main line to ground through that section of the local line with which the main may be electrically connected through a thermostat, as set forth.

6. The combination of the main line extending from the central station to and throughout the structure to be protected, a local circuit composed of sections run in proximity to the main line, a circuit-changer with two sets of contact-plates, one set adapted to connect the ends of the several sections in a closed circuit, the other to connect each section independently with a signaling-instrument, an earth-connection from the local circuit, an electro-magnet therein for controlling or operating the circuit-changer, and thermostatic circuit-closers connected to the main and local lines, respectively, as set forth.

7. The combination of the main line extending from the central station to and throughout the structure to be protected, a local circuit composed of sections run in proximity

to the main line, a signaling device or transmitter, a circuit-changer with two sets of plates, one set adapted to connect the ends of the several sections in closed circuit, the other to connect each section with a corresponding signal-disk, an earth-connection from the local circuit, and thermostatic circuit-closers connected to the main and local lines, respectively, these devices being arranged in substantially the manner described, the action or operation of the signaling device being controlled by or dependent upon that of the circuit-changer, which in turn is operated by a current passing from the main line through the earth-connection, as set forth.

8. The combination, with the main line L, the local circuit *l*, composed of sections one in each room or part of the structure to be protected, the thermostats *t*, the series of plates connecting together the sections of circuit *l*, the local battery O, and magnet W in said circuit, the normally-open local circuit containing battery O^2, and vibrator magnet X, adapted to intermittently ground the main line when by the interruption of the circuit *l* and demagnetization of magnet W the circuit of battery O^2 is closed, as set forth.

9. The combination, with the main line L, the local circuit *l*, composed of sections one in each room or part of the structure to be protected, the thermostats *t*, the series of plates connecting together the sections of circuit *l*, the earth-connection from circuit *l*, the magnet Z, included therein, the normally-open local circuit containing battery O^2, and vibrator-magnet X, adapted to intermittently ground the main line, whereby the passage of a current from the main line through the local line and its earth-connection and the energizing of magnet Z the circuit of battery O^2 is closed, as set forth.

10. The combination, with the main line L, the local circuit *l*, composed of sections one in each room or part of the structure to be protected, the thermostats *t*, the circuit-controller, having a series of contact-plates by which the sections of the local circuit are connected in a closed circuit, an earth-connection from the local circuit, and an electromagnet Y therein for operating the circuit-controller when the main line is grounded through one of the thermostats, as set forth.

In testimony whereof I have hereunto subscribed my name this 14th day of June, A. D. 1889.

GEO. F. BULEN.

Witnesses:
DANL. W. EDGECOMB,
CAROLINE E. DAVIDSON.