(No Model.)

2 Sheets—Sheet 1.

W. L. DENIO.

FIRE ALARM SYSTEM.

No. 410,318. Patented Sept. 3, 1889.

Fig. 1.

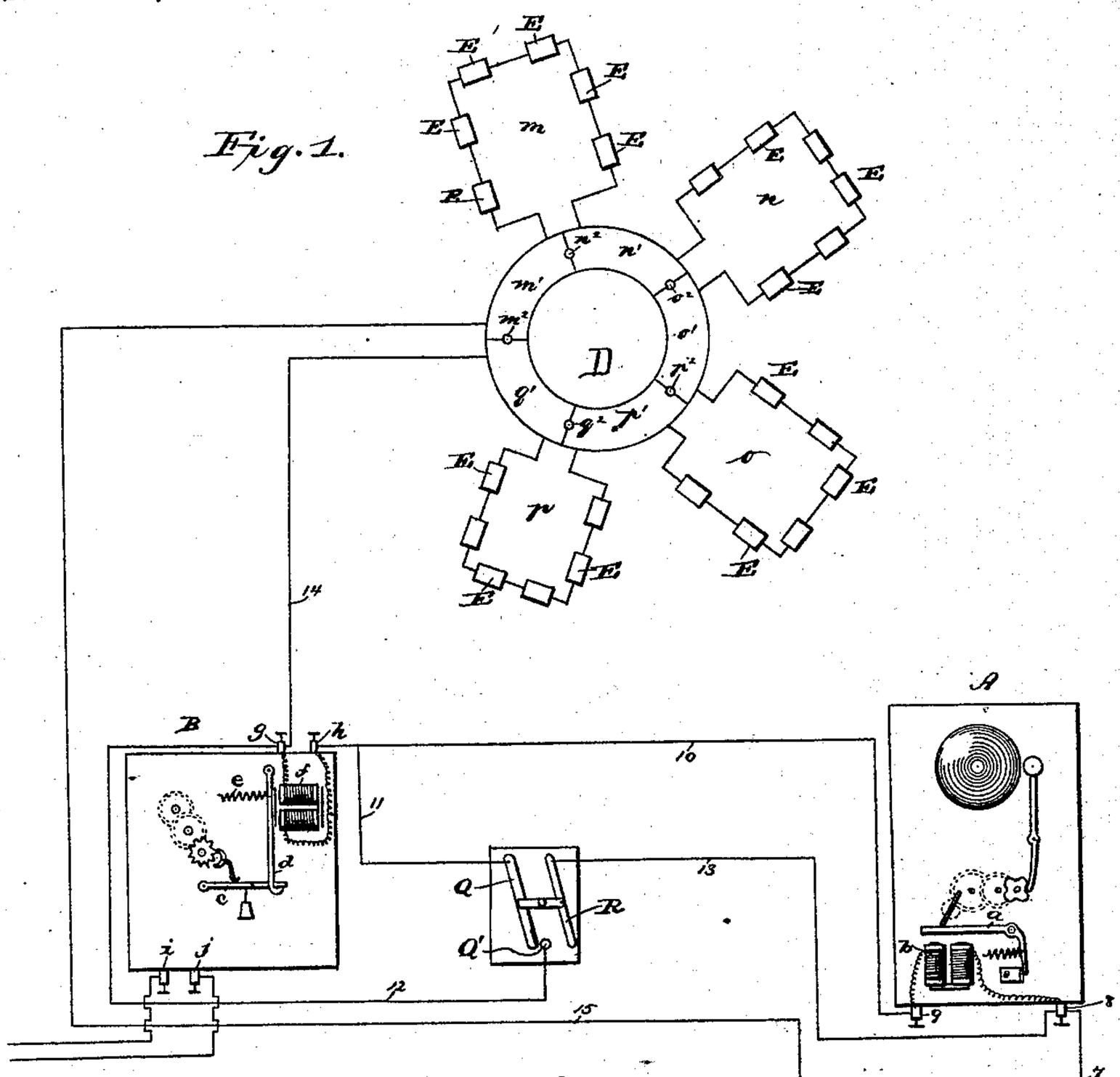
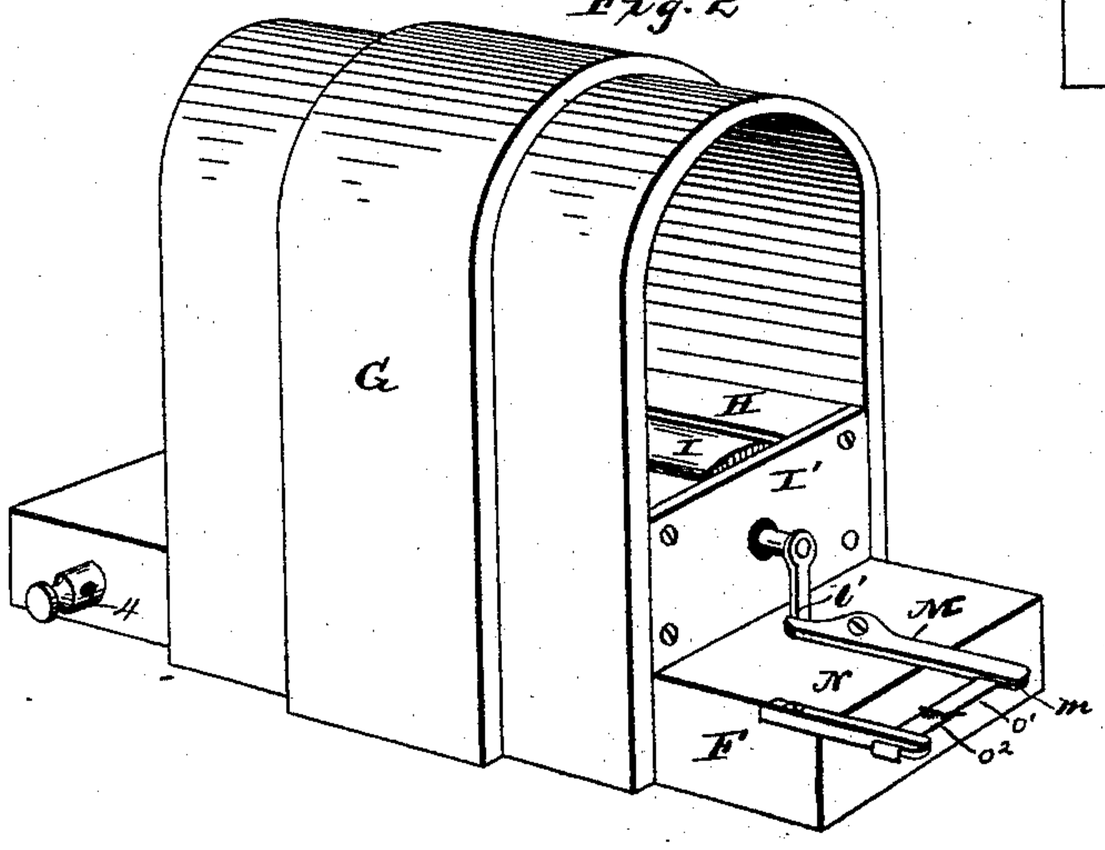


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 1.

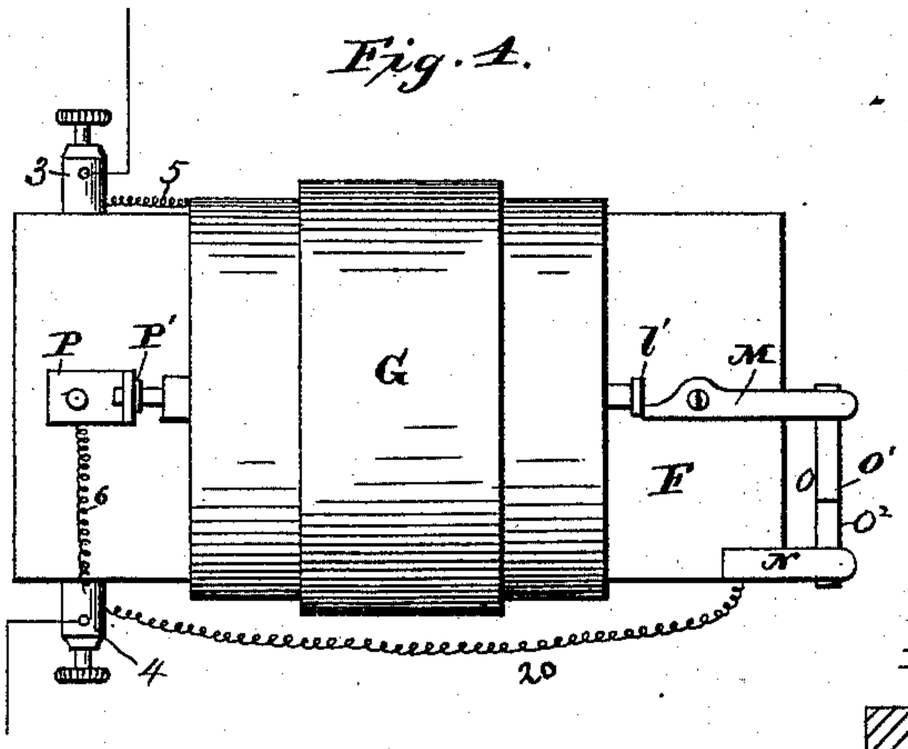


Fig. 3.

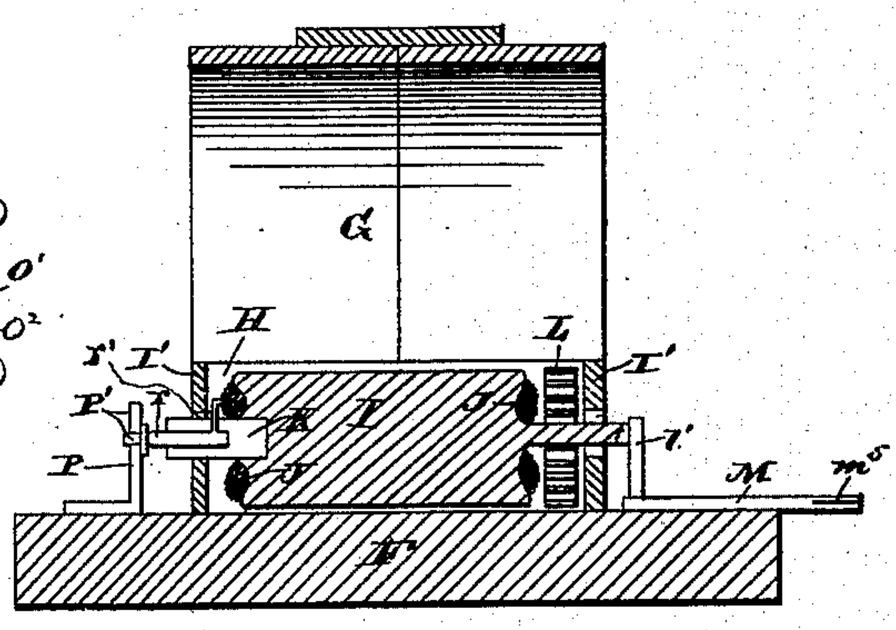


Fig. 5.

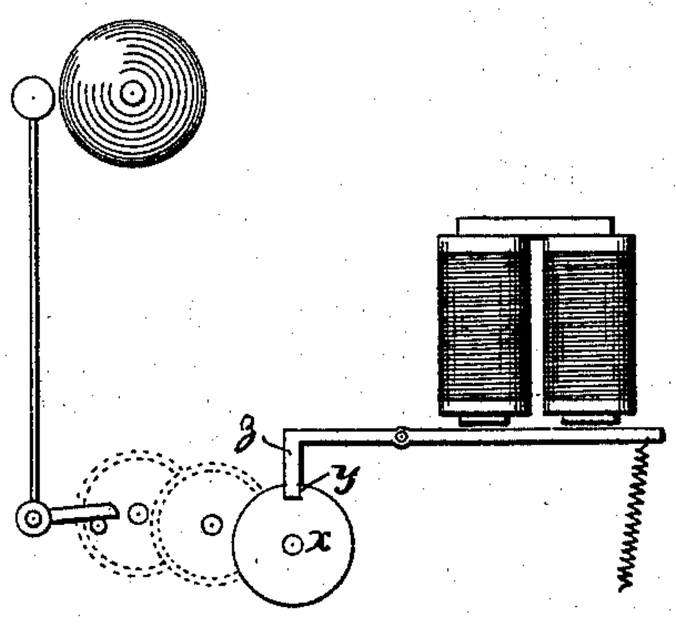
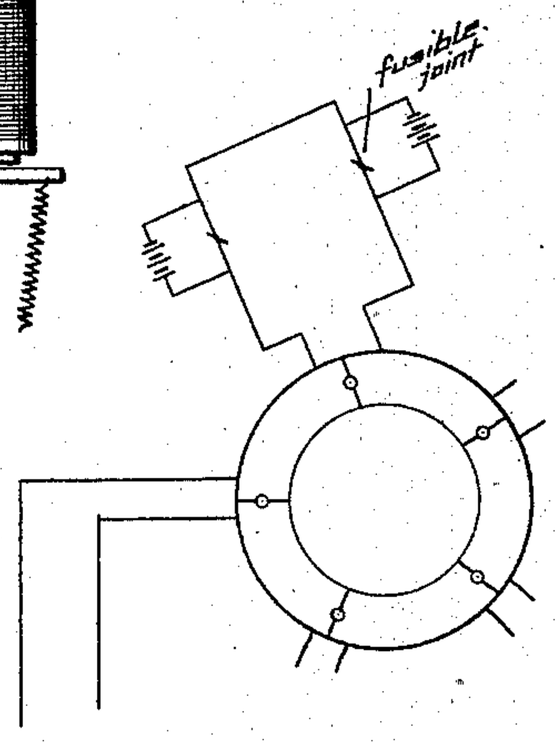


Fig. 6.



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UNITED STATES PATENT OFFICE.

WILLIAM L. DENIO, OF ROCHESTER, NEW YORK.

FIRE-ALARM SYSTEM.

SPECIFICATION forming part of Letters Patent No. 410,318, dated September 3, 1889.

Application filed July 13, 1888. Serial No. 279,807. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM L. DENIO, of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Fire-Alarm Systems; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, and to the figures and letters of reference marked thereon.

My present invention relates to fire-alarm telegraph and other analogous electrical systems operated by thermostatic devices, and has for its object to improve the circuit arrangements and operating devices, whereby the necessity of employing a charged main line is obviated and any or all of the operating devices and circuits can be tested independently or together when desired to denote whether they are in working condition; and to these ends it consists in certain novelties of construction and combination of parts, all as will be hereinafter fully described, and the novel features pointed out in the claims at the end of this specification.

Figure 1 is a plan view of the circuit arrangements of my improved system; Fig. 2, a perspective view of the current-generator and thermostat employed; Fig. 3, a vertical sectional view of the same; Fig. 4, a top plan view showing the circuit-connections; Fig. 5, a view of a modification; Fig. 6, a view of a modified circuit arrangement.

Similar letters of reference in the several figures denote similar parts.

Heretofore in systems of the class to which my present invention relates it has been customary to employ one or more closed circuits embodying alarm apparatus, a current-generator, and a thermostat, the simplest form of the latter consisting of a strip of fusible solder adapted to be melted by a rise in temperature, breaking the circuit and thus sounding the alarm; but such devices and circuit arrangements are objectionable in that any diminution in the strength of the battery would sound an alarm. Other devices have been used employing open circuits, but these necessitate a separate circuit for each thermostat, thus increasing the cost of the plant, and will not permit the circuits to be tested save by an operation of each one separately. Therefore it is desirable to provide an arrangement that will overcome these and other objections, and this my herein-described invention provides for.

I will first describe the general construction and operation of the various devices in the circuits and then describe the manner of connecting them, which form the subject-matter of the present invention.

A represents an alarm apparatus, preferably consisting of a bell and a hammer operated by a train of gears embodying a suitable spring-motor, said motor being held in check by an armature *a*, adapted to project against the regulating-fan, the armature being normally retracted by a spring in the path of the fan or any other operating part of the mechanism and arranged to be drawn by an electro-magnet *b*, so as to release said mechanism and allow it to vibrate the bell-hammer and sound an alarm.

B represents a signal-box of the ordinary or any preferred construction, arranged to send a predetermined signal over a main telegraph-line, indicating, preferably, the building where the system is placed. The escapement or any other portion of the mechanism of the box is arranged to be arrested by a suitable weighted detent or annunciator-drop *c*, held normally elevated by engagement with a shoulder formed in the end of an armature *d*, which latter is retracted by a spring *e* and operated in a direction to allow said detent to be dropped by an electro-magnet *f* when the latter is energized by a current. The binding posts or points of connection on the box are represented by *g h i j*, the two latter being connected to the fire-alarm station to which the signal is to be sent and the two former connecting inside the box with the terminals of the coils of magnet *f*.

C is a magneto-call of any well-known type, having the binding-posts *k l* preferably arranged close together, so that by the insertion of a plug *t* in between them the call will be cut out; but of course any other form of switch device can be employed for the same purpose.

D is a switch-board of any desired construc-

tion, at which the various circuits containing the thermostatic devices center, preferably with the circuit terminals or plates m' n' o' p' q', preferably arranged in a circle, as shown. The terminals of what we will call the "main" circuit, as it contains the operating parts, communicate with plates m' q'; those of the next circuit m with m' n; those of circuit n with plates n' o'; those of circuit o with plates o' and p'; those of circuit p with plates p' and q'. Perforations m^2 n^2 o^2 p^2 q^2 are provided between these plates, into which a plug can be inserted for the purpose of short-circuiting any or all of the circuits, as when desired to test the main line or to cut out a circuit wherein there is known to be a fault.

A greater or lesser number of circuits can be provided as desired, and each of them is adapted to contain one or more current-generators rendered operative by heat, as will be hereinafter described, designated generally by the letter E. One of these devices is shown in detail in Figs. 2, 3, and 4. Referring to said figures, the apparatus will be seen to consist, generally, of a small magneto-generator, F representing the base, G the field-magnets, H the pole-pieces thereof, and I the armature. Across the ends of the pole-pieces are provided connecting-plates I' I', in which the armature has its bearings. The armature is preferably of the well-known Siemens type, the two coils J J being electrically connected, and while the forward portion of the shaft is preferably formed integral with the core, or at least in metallic connection therewith, the rear portion is formed of insulating material K, fastened to the armature and extending through the rear connecting-plate I'. Extending through this portion K and projecting at the rear is a metallic rod r, its inner end connected by a pin r' with one terminal of the armature-coil, and the other terminal of the coil connecting with the armature-core or the forward extension thereof. Inclosing one end of the armature-shaft is a spring L, preferably connected at one end to said shaft, the other being attached to the base or pole piece. This spring is adapted by the rotation of the shaft in one direction, by hand or otherwise, to be wound up, and when released to rapidly rotate the armature. An arm or stop l' projects from the forward end of the armature-shaft, being in electrical connection therewith, and on the base of the instrument is provided a pivoted lever M, its short arm adapted when it is moved in one direction to project in the path of arm l', and by engaging therewith prevent the rotation of the armature. The outer end of this lever is preferably provided with a slot or recess m^5, and a projection N is provided on the base, correspondingly slotted. When the armature is rotated so as to wind up the spring and the lever M is turned on the pivot, with the short arm engaging the projection l', holding the armature from rotating, a connecting-link O, having its ends bent over, is slipped in the slots in arms M and N, preventing the turning of the lever and holding the armature from rotation. This link is preferably composed of two sections O' O², connected by solder fusible at a low temperature—say 150° Fahrenheit—though it is obvious that a connecting-link composed wholly of readily-fusible solder would answer the same purpose. It will be seen from the above arrangement that when the lever M is released by the severing of the link-connection the spring will be permitted to rapidly rotate the armature and generate a current in the coils in the ordinary manner.

At the rear end of the armature is provided a spring-arm P, secured to the base and provided on its upper end with a contact-piece P', preferably of carbon, to make a good electrical connection with the pin r, connected with the armature-coils, as described. The electrical connections of this generator are clearly shown in Fig. 4. Suitable binding-posts 3 and 4 are provided, the former being connected to the magnet pole-piece by conductor 5, while from the latter a wire 6 passes to spring P, and another to projecting arm N, so that it will be seen there are two complete circuits through the instrument, one entering at 3, passing through the pole-pieces, armature-spring L, arm l', lever M, link O, arm N, wire 20, to post 4, and the other from post 3, passing to the pole-pieces, to the spring L, to armature I, armature-coils, pin r, contact P', spring P, and wire 6, to post 4. Of these two circuits the one first mentioned is of the least resistance, and extends around the armature-coils and to and through the link O, while the latter forms a shunt through the coils and will not be operative except when the former is broken by the separation of the link-sections.

This apparatus is described in detail, as it is a desirable part of the present system, though its construction is not herein claimed, but forms the subject-matter of another application filed simultaneously herewith, Serial No. 279,808.

A number of the thermostatically-operated generators are preferably provided in each of the circuits m, n, o, and p, being located in the different parts of a building to be protected, and are in normal or set position—that is, with the armature springs or motors wound up and the armatures retained by the levers M and links O.

As before stated with reference to Fig. 1, the alarm A, signal-box B, magneto C, switches Q and R, and switch-board D are preferably located at a central station—as the office or superintendent's room—if the invention is applied to a factory or mill, while the thermostatic devices are at outlying points.

From the post l of the magneto a conductor 7 extends to post 8 at the alarm apparatus, a

conductor 10 connects post 9 with the post *h* on the signal-box, and conductor 11 extends from said post to a switch-arm Q, mounted on a suitable base.

Q′ represents a contact with which the arm Q is arranged to co-operate, connected by conductors 12 with binding-post *g* on the signal-box.

R is a switch-arm arranged to co-operate with contact Q′, and connected by conductor 13 with the post 8 of the alarm apparatus. The binding-post *g* is connected by conductor 14 with contact-plate *q′*. Binding-post *k* is connected by conductors 15 with plate *m′* of the switch. The switches Q and R are preferably connected for simultaneous operation by a cross-bar of non-conducting material, though this is not essential, as independent switches could be employed. When in normal position ready for operation by the breaking out of a fire, the plug *t* is placed between the posts *k* and *l*, the switches Q R off the contact Q′, and all the plugs out of the switch-plate for the various circuits. This forms a closed circuit starting at post *l* and extending through wire 7, post 8, the alarm-magnet *b*, post 9, conductor 10, post *h*, signal-box magnet *f*, plate *q′*, through the various circuits containing the current-generators and the shunts around the armature-coils, out at plate *m′*, back to post *k*, and thence to *l*. No current is on this line, and hence all the devices are inoperative. Should a fire occur at one of the outlying stations—say on circuit *m*—a fusible link O at this point would be released and the spring L would cause its armature to be rotated a few turns, sufficient to generate a current in its coils, which would pass over the circuit just mentioned, and operating the alarm-magnet, releasing the alarm mechanism to allow it to ring the alarm-bell, and operating the signal-box magnet and causing the armature to release the call mechanism to send a signal to the fire department or any other station desired. The circuit would still remain closed, and should a fire occur at another station before the current-generator was returned to first position by the insertion of another fusible or separable link O, another generator E, on the same or another circuit, could be operated, sending another current over the line and sounding the alarm-bell again. In case the apparatus is designed to be used in this manner, it would be necessary to have the armature of the alarm mechanism return to normal position and catch and retain the mechanism after a certain time. This may be accomplished by any suitable means—such, for instance, as in Fig. 5—which, instead of the armature catching and holding the regulating-fan, a separate wheel *x*, geared to the operating mechanism, is provided with a notch *y*, into which an arm *z* from the armature drops, said arm merely resting on the periphery of the wheel during the rotation while sounding the first alarm, but dropping into the notch and stopping the mechanism when this is completed, and being withdrawn therefrom upon the energizing of the magnet a second time, allowing the alarm to be sounded again. When the second signal is sent, the circuit, instead of passing around the armature of the current-generator first operated, would pass through it, but would nevertheless be sufficient to operate the alarm-magnet. No signal would be sent from the signal-box, of course, unless it were reset or else constructed substantially the same as the modification of the alarm just described.

All the devices can be readily returned to first position and the apparatus will be ready for another operation, as before described.

In systems of this general character it is oftentimes desirable to test the various parts or the whole system without operating one of the thermostatically-operated current-generators described, and when desired to test the whole system it is only necessary to withdraw the plug between posts *k* and *l* and operate the magnet C, sending a current over the line, causing the same operation as described, and if all parts of the circuit are properly connected the bell in the call will sound as well. If not, it will be silent; or, in lieu of this, other forms of generators could be employed. Still, as the system is particularly adapted for the purpose of dispensing with the use of battery, I prefer the devices shown. When desired to test the alarm-circuit above to see that it operates properly, it is only necessary to place switch Q on contact Q′ and insert a plug between plates *m′* and *q′*, remove plug *t*, and operate the magneto, which will cause the circuit from the latter to pass from *l* over 7, magnet *b*, post 9, line 10, to post *h*, to conductor 11, to switch Q, contact Q′, conductor 12, post *g*, conductor 14, plates 9′ and *m′*, and line 15, to magneto; or, if desired to test any or all of the generator-circuits as well, those can be inserted as desired by a manipulation of the plugs in the switch-plates.

If it is desired to test the whole circuit without operating the alarm or signal box, switch R is placed on contact Q′ and the magneto operated. This will cause the current to pass from *l* over conductor 7, to post 8, conductor 13 to switch R, to Q′, to conductor 12, to post 9, conductor 14, and plate 9 to and through any of the circuits plugged in, to plate *m′* and conductor 15, to magneto again. The magneto being preferably of the ordinary description such as used for telephone calls, the bell at the box will be rung when the circuit is in working condition, indicating the fact to the person testing. When the other tests are to be made and the alarm sounded, it is not essential to employ the bell at the magneto, and a current-generator of any approved type could be used there, though I prefer to employ it.

The advantages of the herein-described sys-

tem will readily present themselves to those skilled in the art, the principal ones being the employment of a normally-closed circuit with current-generators arranged to be cut in circuit and rendered operative upon the line when a fire breaks out.

While it is designed to employ the circuit-generators shown in preference to batteries, it is obvious that batteries could be employed located at each of the stations in the place of the magnetos in a shunt of high resistance, and fusible joints be employed in the main circuit adapted to be melted by heat, and thus cut in the battery, allowing it to send a current over the main circuit and operate the alarm, as described. This arrangement is shown in Fig. 6, only two stations being shown.

I have shown and described both the alarm and the call box as embodying mechanically-operated devices controlled by an electro-magnet, the operation of which latter allows the mechanism to sound the alarm or send the signal; but this is only because the current produced by the operation of magneto-generators is so small and the time of its operation short that it is better adapted to release the motors of the mechanism than to operate them alone; but it is obvious that when the magnets are larger or arranged to operate for a greater length of time they could operate these devices directly.

I claim as my invention—

1. In a fire-alarm system, the combination, with a normally-closed but uncharged main circuit and an alarm included therein rendered operative by a current, of a series of current-generators located in a shunt of the main circuit, a readily-fusible joint controlling the main circuit between the ends of the shunt, operating when melted by heat to break the main circuit, substantially as described.

2. In a fire-alarm system, the combination, with a normally-closed but uncharged main circuit, and an alarm included therein rendered operative by an electrical current, of a series of current-generators, each located in a shunt of the main circuit, a readily-fusible joint interposed in the main circuit between the ends of the shunt, operating when melted by heat to break the main circuit, substantially as described.

3. In a fire-alarm system, the combination, with a normally-closed but uncharged main circuit, and an alarm included therein rendered operative by an electrical current, of a series of magneto-generators, each located in a shunt of the main circuit, motors for operating said generators and stops for holding said motors in check, fusible joints holding said stops in position to arrest the motors, said joints being included in the main circuit, substantially as described, whereby upon the melting of the joint the generator will be allowed to operate and the main circuit between the ends of the shunt be broken, as set forth.

4. In a system such as described, the combination, with an uncharged closed main circuit, of a series of current-generators arranged to be separately and independently included therein, an alarm in said circuit rendered operative by a current, a signal-box in another circuit embodying an alarm operating to send a predetermined signal, and an electro-magnet in the main circuit for operating said signal-box, whereby upon the charging of the main line the alarm will be sounded and a signal sent by the box, substantially as described.

5. The combination, with a closed main circuit, of a series of current-generators adapted to be separately and independently included therein, an alarm included in said circuit, a second circuit and a signal-box arranged to send a signal over the same, an electro-magnet controlling the signal-box normally in the main circuit, a shunt around said electro-magnet, and a manually-operated switch for controlling said shunt, substantially as described.

6. In a system such as described, the combination, with an uncharged closed main circuit, of a series of current-generators adapted to be included therein, an alarm in said circuit, a second circuit, a signal-box included therein controlled by an electro-magnet, the latter normally in the main circuit, a shunt around said alarm and electro-magnet, a switch controlling said shunt, a current-generator and alarm, (such as the magnets and its bell,) and a switch for placing the latter in the main circuit, substantially as described.

7. The combination, with the closed but uncharged main circuit, of a series of current-generators adapted to be separately and independently included therein, an alarm in said circuit, a signal-box arranged in a separate circuit controlled by an electro-magnet normally in the main circuit, a shunt around said magnet, and a manually-operated switch controlling said shunt, substantially as described.

8. The combination, with the closed main circuit, of a series of devices included in the main circuit for changing its electrical condition, an alarm in the main circuit, a signal-box arranged to send a signal over another circuit and controlled by an electro-magnet, the latter normally in the main circuit, a shunt around the alarm and electro-magnet, a switch controlling said shunt, a current-generator and alarm, (such as the magneto and its bell,) and a switch for placing the latter in the main circuit, substantially as described.

9. In a fire-alarm system, the combination, with a normally-closed but uncharged main circuit, and an alarm included therein rendered operative by an electrical current, of a

series of magneto-generators with the coils of each located in a shunt of the main circuit, motors for operating said generators held in check by readily-fusible connections, said connections forming part of the main circuit, substantially as described, whereby upon the fusing of the connection the generator will be allowed to operate and the main circuit between the ends of the shunt broken, as set forth.

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