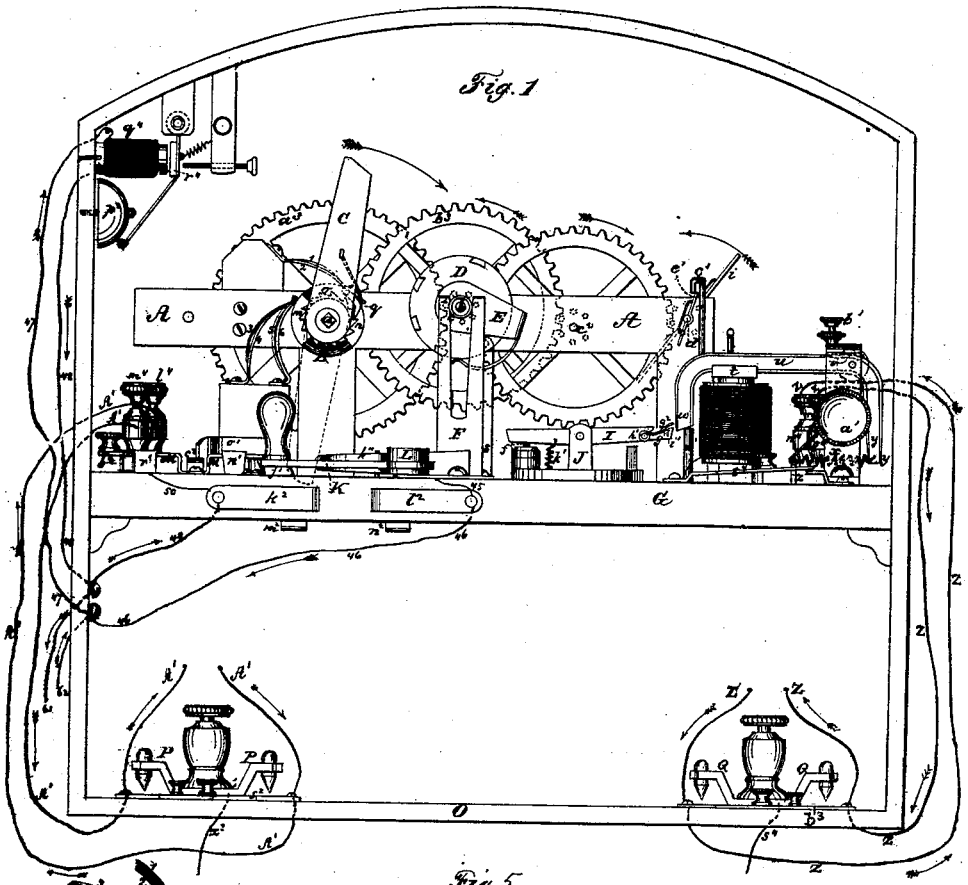
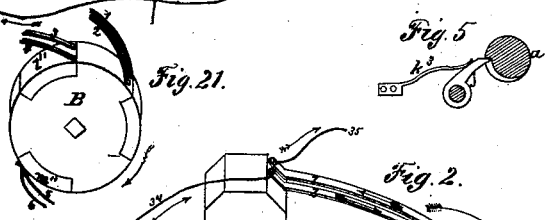
5 Sheets—Sheet 1.

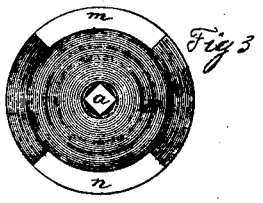
W. B. WATKINS.

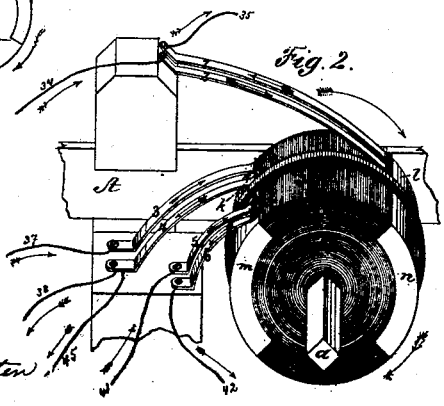
Self Acting Fire Detecting and Locating Alarm Telegraph System.

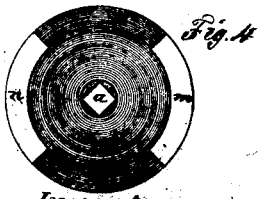
No. 111,410. Patented Jan. 31, 1871.











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5 Sheets—Sheet 2.

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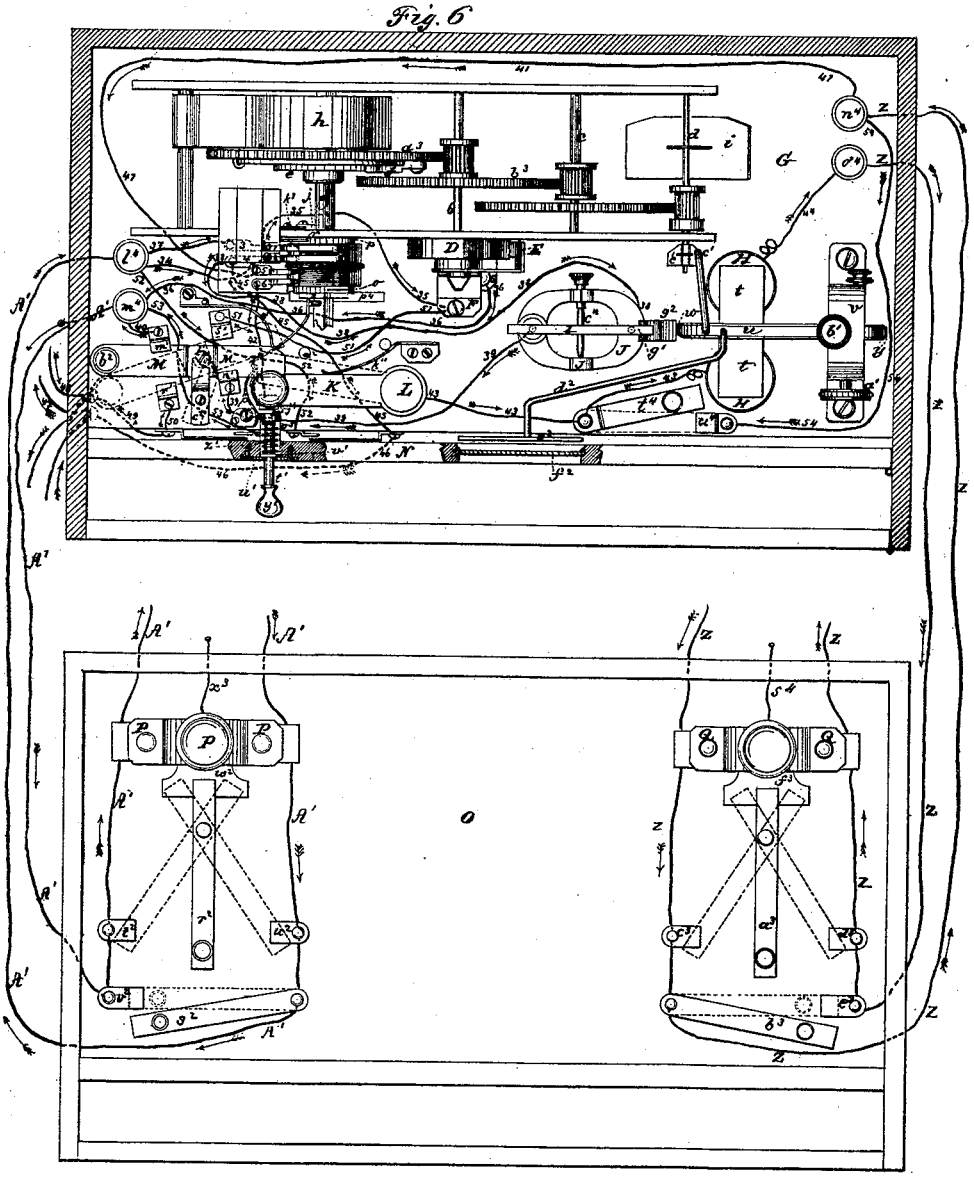
Self Acting Fire Detecting and Locating Alarm Telegraph System.

No. 111,410. Patented Jan. 31, 1871.

Fig. 6



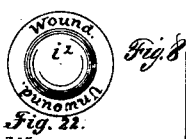


Fig. 22.

Fig. 8

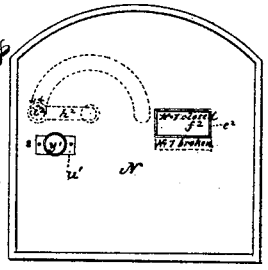
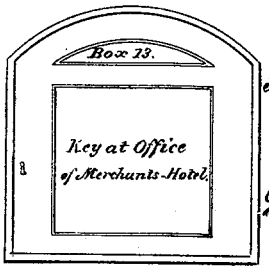


Fig. 7



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5 Sheets—Sheet 3.

W. B. WATKINS.

Self Acting Fire Detecting and Locating Alarm Telegraph System.

No. 111,410. Patented Jan. 31, 1871.

Fig. 9.

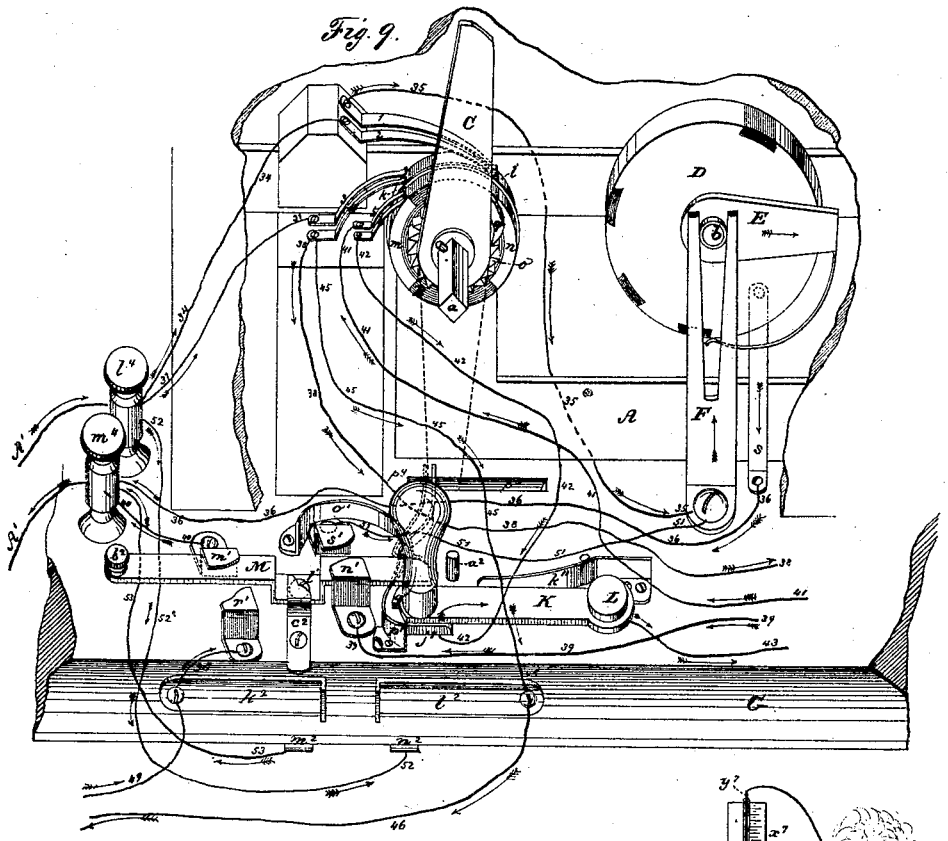


Fig. 24.

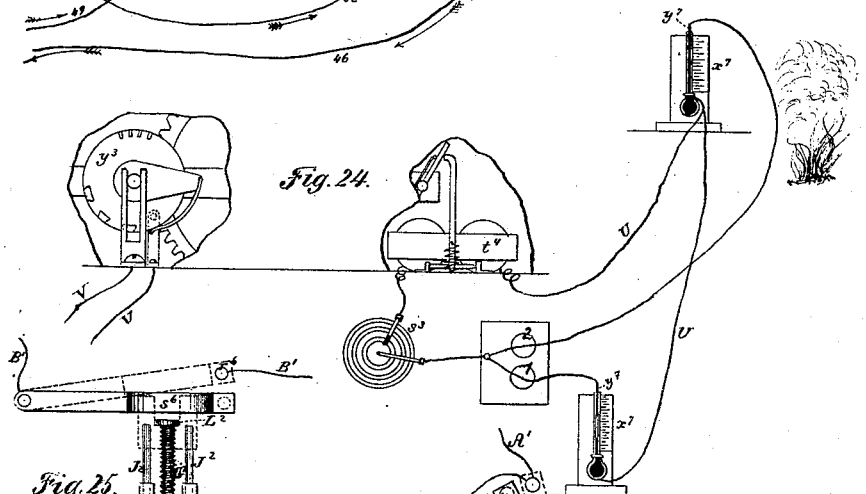
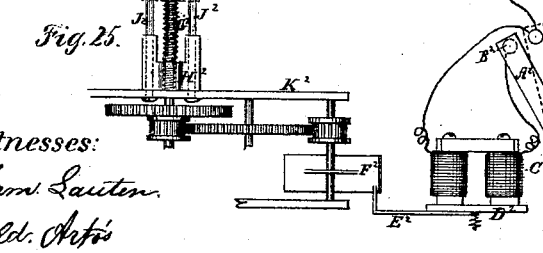


Fig. 25.



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5 Sheets—Sheet 4.

W. B. WATKINS.

Self Acting Fire Detecting and Locating Alarm Telegraph System.

No. 111,410. Patented Jan. 31, 1871.

Fig. 10.

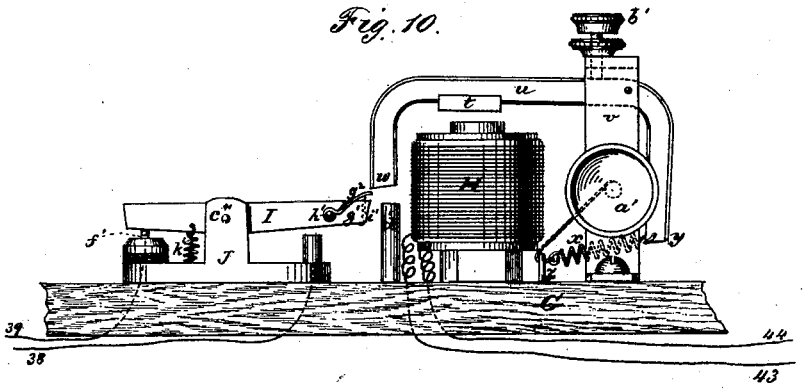


Fig. 11.

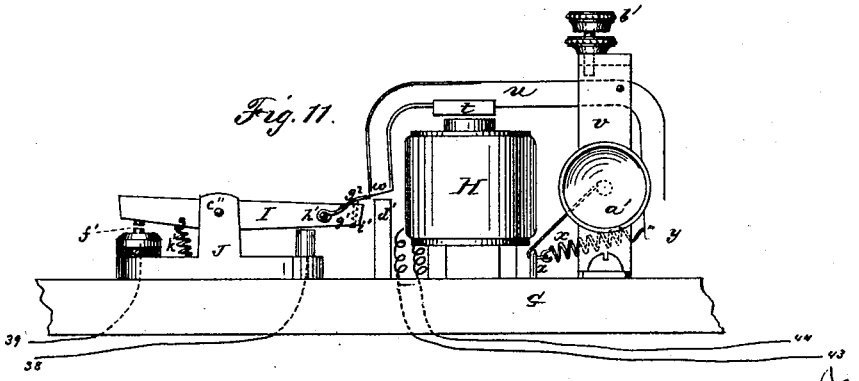


Fig. 12.

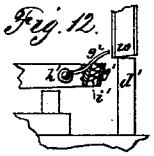


Fig. 14.

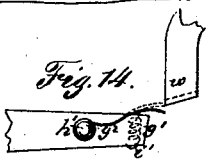
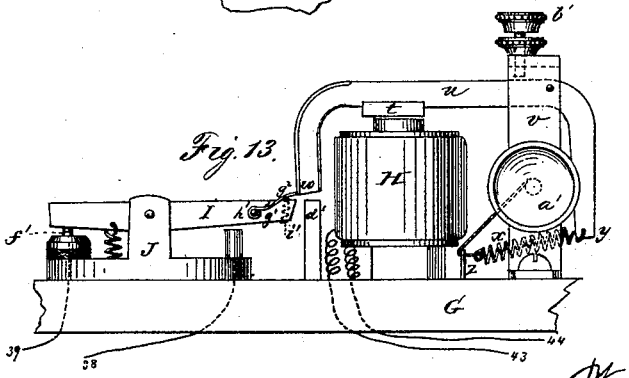


Fig. 13.



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5 Sheets—Sheet 5.

W. B. WATKINS.

Self Acting Fire Detecting and Locating Alarm Telegraph System.

No. 111,410. Patented Jan. 31, 1871.

Fig. 15.

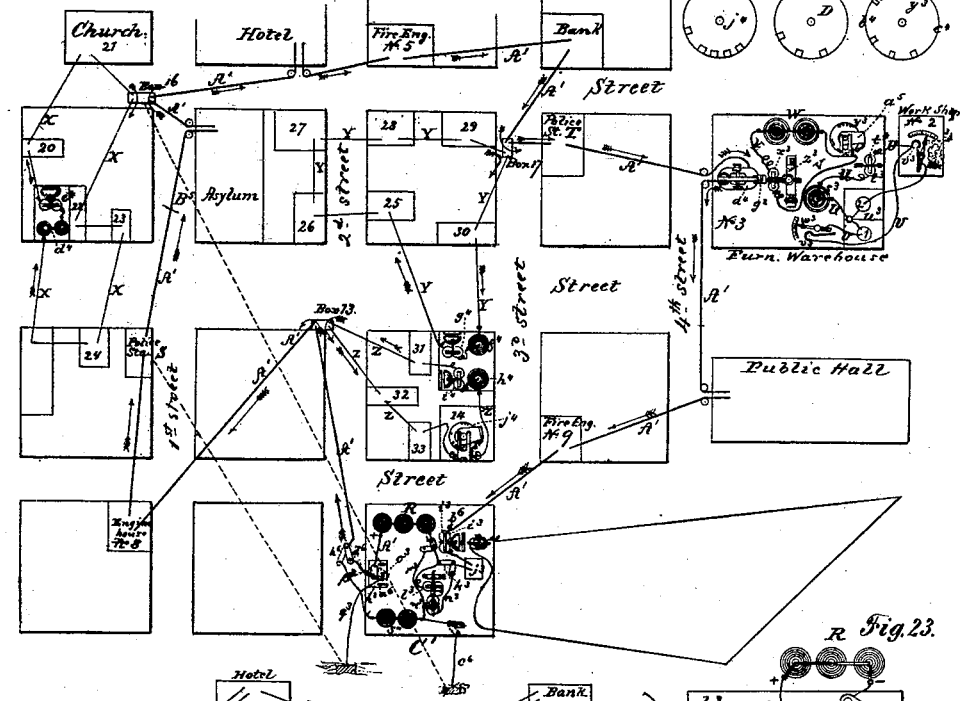


Fig. 19. Fig. 20. Fig. 18.

Fig. 23.

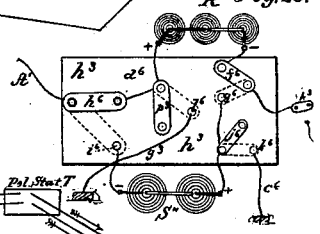
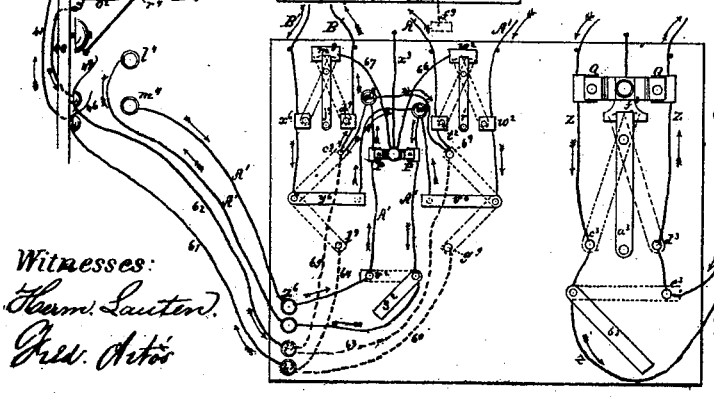


Fig. 16.

Fig. 17.



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William B. Watkins

UNITED STATES PATENT OFFICE.

WILLIAM B. WATKINS, OF JERSEY CITY, NEW JERSEY.

IMPROVEMENT IN FIRE-ALARM TELEGRAPHS.

Specification forming part of Letters Patent No. **111,410**, dated January 31, 1871.

To all whom it may concern:

Be it known that I, WILLIAM B. WATKINS, of Jersey City, in the county of Hudson and State of New Jersey, have invented a certain Improved Self-Acting Alarm-Telegraph System for detecting fires and signaling their location, of which the following is a specification:

The principal object of my invention is to provide a more perfect system for telegraphing alarms of fire automatically by means of the fire itself, so that the number of the street and the number of the building in the street, or any desired signal, may be sounded directly at the fire-department buildings, and at other points, at the very commencement of a fire in a building, so as to locate the fire with greater certainty before it can be seen from without, and by this means more effectually prevent the disastrous loss of life and property.

Another object of my invention is to combine, with a system of telegraph-lines, means which will prevent the derangement of the lines, and further means by which derangements or breaks when they occur may be more readily electrically repaired.

Another object is to so arrange and operate my system as to afford greater protection to the property on fire.

Another object is to so arrange the self-acting alarm mechanism for operating my system that it may be used by the public for giving alarms of fire in a more certain manner than has heretofore been done, and thus afford means which shall meet all the requirements of a perfect fire-alarm system.

In carrying out the above objects, my invention consists, first, in constructing mechanism and connecting the same with fire-alarm circuits, or other municipal telegraph-lines, or with any main telegraph-lines, in such a manner as to prevent the deragement of the main line by such connection, and so that buildings remote from each other may be connected through the mechanism with the main line, by which means, when a fire occurs in such buildings, the fire itself, at its very commencement, will set in motion the mechanism, which will then cause the number of the street and the number of the building to be telegraphed, and sounded or signaled through the main lines at the desired points, in such a manner that the peculiar signal shall not only indicate the exact spot, but also that the fire has just commenced to burn, thus saving the bringing out of machinery necessary to extinguish large fires, and the consequent wear and tear of the same; second, in so constructing the alarm mechanism that after one alarm has been sounded, as above described, it will without further attention be left in working order to sound another alarm through the main line by means of the fire, should one occur in any other building connecting with the mechanism; third, in so constructing the mechanism that when any line which connects the buildings with the mechanism is broken from any cause, an alarm will be sounded through the main line in such a peculiar manner as to give notice to the fire department that no fire has occurred, but that a connecting-line has broken, and also the point where it connects with the main line, thus insuring immediate attention to such derangements, and the most perfect protection to all connecting-lines; fourth, in so constructing the mechanism that, when such break occurs in any connecting line, the main line will not be broken thereby, but will, without attention, be left in working order for sounding alarms from all other connecting-lines; fifth, in so constructing the mechanism that when a fire has broken out in a building not connected with my system, the same mechanism used for the purposes above mentioned may be set in motion by any person by a single movement, by which means a different peculiar signal will be sounded through the main line, which will indicate, at different points, that a fire has broken out, and has been discovered, and may be of such an extent as to require apparatus necessary for extinguishing large fires; sixth, in so arranging a system of lines, and connecting and combining the alarm mechanism therewith, that both the fire and police departments will at the same instant be called for the protection of the property, and be directed to the very spot where the fire has occurred by means of the fire itself; seventh, in so constructing the main lines, and connecting them with the mechanism, that, when a break occurs in the same, the circuit may be instantly completed through all the instruments connected therewith by simply turning a single switch at the battery-office, and without the use of ground-wires, thus insuring the

constant working condition of the main line at all times.

Figure 1, Sheet No. 1, is a front elevation of the operating mechanism, with the switch-board connected therewith arranged for connecting with any main or municipal line, and also arranged for connecting buildings with the mechanism by means of lines within the buildings or running therefrom. Fig. 2 is a perspective view of a revolving switch of the operating mechanism, showing the manner in which the lines may connect therewith, so that the electric current will pass through the same as it revolves. Figs. 3 and 4 are side views of the revolving switch, showing different positions of the same. Fig. 5 is a view of a section of the main shaft and the device connected therewith for limiting the winding up of the mechanism. (Shown also in Fig. 6.) Fig. 6, Sheet No. 2, is a top view of the operating mechanism and switch-board, showing the line-connections with both and with each other. Fig. 7 is a front view of the box in which the mechanism is placed, having an outer and inner door, showing the outer door closed. Fig. 8 is an elevation of the box, showing the inside door of the same. Fig. 9, Sheet No. 3, is a perspective view of a portion of the operating mechanism shown in Figs. 1 and 6, and showing more clearly the line-connections with the same. Figs. 10, 11, 12, 13, and 14, Sheet No. 4, are views of a hinged key, connecting with the main line, showing also an electro-magnet, connecting with, and operated by, the building-line with its armature and lever, illustrating the different positions of the key and vibrating lever when brought into operation; also shown in Figs. 1, 6, and 15. Figs. 15 and 16, Sheet No. 5, are diagrams and plans illustrating the application of my self-acting fire-alarm system to a town or city or section thereof, showing different points of connections of the different lines. Fig. 17 is a top view of a switch-board, arranged and used for connecting the lines with each of the boxes, and each of the alarm or operating instruments on the main line, and adapted to the working of my system, as illustrated in Fig. 16, for instantly completing the electric circuit through all the instruments in case of breaks in the main line. Figs. 18, 19, and 20 show one form of break-circuits which may be used in working my self-acting fire-alarm system. Fig. 21 represents another way in which the revolving switch B may be made. Fig. 22 shows the knob on the crank-handle for winding the mechanism. Fig. 23 is an enlarged view of the switch-board h^3, shown in the battery-office C^1 in Fig. 15. Fig. 24 represents one kind of heat-detecter for setting in motion the mechanism for sounding the number of the street and the number of the building through my system of lines. Fig. 25 represents one form of an automatic device for closing one telegraph-line by the breaking of another telegraph-line.

Upon a suitable frame, A, Figs. 1 and 2, is arranged a train of wheels in any convenient manner, mounted upon shafts *a b c d*. To the shafts *b c d* are fastened pinions. The pinion upon the shaft *b* is so arranged that while the shaft *a*, which carries the driver a^3, turns once around, the shaft *b*, which carries the wheel b^3, will turn twelve times.

The shaft *a* carries a ratchet, *e*, Fig. 6, into which takes a pawl, *f*, fastened to the driving cog-wheel a^3, which turns loosely on its shaft. The train may be carried by the force of a spring, *h*, or by a weight secured to the shaft *a* in the usual manner, and when wound up and released the train will be propelled by means of the ratchet *e* and pawl *f* in a well-known manner. The speed of the train may be regulated by a fly, *i*, secured to the shaft *d*, or by an escapement.

Upon the inside of the frame A, Fig. 6, is fastened a pawl, *j*, which fits into a recess or notch cut in the main shaft to limit the turning of the shaft in winding up the train. (Shown more clearly in Fig. 5, Sheet 1.) A spring, k^3, keeps the pawl on the shaft, but admits the lifting up of the pawl when desired to adjust the tension of the mainspring *h*.

A wheel, B, Fig. 2, of rubber or other non-conducting material, is mounted loosely upon the shaft *a*. Upon the outside or circumference of the wheel are secured sections of metal or other conducting material *k l m n*, in such a manner as to form alternate quarter-sections of the circumference or outside surface. The sections *k* and *m* are separated and insulated from each other, as are also the sections *l* and *n*, so that the electric current, when passing through one section, cannot pass to another section.

Upon one side or face of the wheel is fastened a ratchet, o^1, and upon the other side a similar ratchet, *p*, is fastened, as shown in Fig. 6. An arm, C, Fig. 1, is fitted to the shaft *a*, and turns with it; and to this arm is fastened a pawl, *q*, which takes into the ratchet *o*, so as to turn the wheel with the arm when the train is released.

A pawl, *r*, Fig. 6, fastened to the outside of the frame A, takes into the ratchet *p* and prevents the wheel from turning back when the main shaft is turned in winding up the train.

For the purpose of completing the circuit of the different lines and branches thereof through the different metallic sections of the wheel B, at different times, to be hereafter more fully described, three pairs of metallic figures or springs, 1, 2, 3, 4, 5, and 6, (shown in Fig. 2,) are secured at one end to the frame A, and are insulated from it. The free ends of each pair press upon the wheel constantly, and each spring is separated from the other. The electric current of the different lines or branches thereof passes alternately through these springs according to the position of the wheel B. The position shown in Fig. 2 is when the train is wound, and the arm C is then in the position shown in Fig. 1.

The circuit or branch thereof connecting with the springs 3 and 4 will now be completed through the metallic section *k*, and in like manner the circuit or branch connecting with springs 5 and 6 will be completed through the metallic section *m*. The electric current cannot pass through the springs 1 and 2 when the wheel is in the position shown in Fig. 2, as the ends of the springs rest upon the non-conducting portion of the wheel B.

Now, when the train is released, and the arm C has carried the wheel B a quarter-turn, the metallic sections *m* and *k* will then be in the position shown in Fig. 3, and the springs 3, 4, 5, and 6 will rest upon the non-conducting portion of the wheel, and the circuit of the different lines or branches connecting with these springs will then be broken. But at the same instant that the circuits are broken through the springs 3, 4, 5, and 6, the circuit of the line or branch connecting with the springs 1 and 2 will then be closed, as these springs will then rest upon the metallic section *k*, which will be in corresponding position to that of *m*, as shown in Fig. 3.

Another quarter-turn will bring the wheel in the position shown in Fig 4, in which position the circuit connecting with springs 1 and 2 will be broken, as these springs will then rest upon the non-conducting portion of the wheel, but the circuits of the lines connecting with springs 3, 4, 5, and 6 will then be again completed through the metallic sections *n* and *l*, upon which the springs will then rest. As the half-turn of the wheel is the limit desired for the purposes to be hereafter described, the train should now be wound, and the operation will be repeated when the train is again released.

The wheel B I denominate a revolving switch, and one of its uses is to complete the circuit of the different lines alternately through its metallic sections, so as to sound different alarms alternately through the different lines, as will be hereafter more fully described. This revolving switch may be made in different forms, one of which is illustrated in Fig. 21, and which answers equally well in operating my system. In this instance the circumference of the wheel is divided into six equal sections of alternately conducting and non-conducting material, and it will be seen that with the springs 3 4 and 5 6 resting on the metallic sections *l''* and *m''*, and the springs 1 and 2 resting on the non-conducting portion of the wheel, if a one-third turn be given to the wheel in the direction of the arrow, the circuits of the lines connecting with the springs will be alternately completed and broken, as described, the only difference being the duration of the circuit, which will be during a sixth instead of during a quarter turn through each pair of springs; and it will be further seen that this wheel may be permanently secured to one of the shafts of the train, and be turned without the use of the ratchets and pawls. A circular metallic plate or disk, D, Figs. 1, 6, and 9, with non-conductors inserted in its edge, or with notches cut therein, and with an opening in the center, is fastened to the frame A and insulated from it. The shaft *b* extends through the opening, so as to revolve freely without touching the plate D.

An arm, E, is secured to the shaft, and is insulated from it, and one end of the arm is made to spring or press lightly against the edge or upon the periphery of the plate D, when the arm is made to revolve by releasing the train.

A metallic standard, F, Figs. 1 and 6, is fastened at one end to the base board G, and the other end presses against the arm E. A metallic strip or rod, *s*, is secured to the plate upon the back side thereof, and is also fastened to the frame or base board. The object of this arrangement, as will be hereafter shown, is to connect a line or branch of a line with the standard F and strip *s*, and to break the circuit of the same at intervals when the arm E is made to revolve.

An electro-magnet, H, is secured to the base-board; and when the electric circuit of a line is completed through the coils of the magnet, it will attract the armature *t*, which is fastened to the lever *u*. This lever works on a pivot in the frame *v*, and the end *w*, which carries the armature, is pulled back from the magnet by the force of the spiral spring *x*, Fig. 1, fastened to the end *y* of the lever when the circuit is broken. The tension of the spring *x* is regulated by the winding and unwinding of a cord which passes through a staple, *z*, and is fastened to the spring and also to the shaft of the winder a^1, Figs. 1 and 6. The upward movement of the lever *u* is regulated by the adjusting-screw b^1, which works in the frame *v*. The lever *u* carries a hook or stop, *c'*, for catching a detent or fly, *e'*, fastened to the shaft *d*. By this means the train may be held wound or be released by the movements of the armature. To the base-board G is secured a telegraph-key, I, Figs. 1 and 6, upon a frame, J, in such a manner that the operating end thereof will be worked by the lever *u*, when the armature *t* is attracted. The position of the key shown in Fig. 1 is after the armature has been attracted and has opened the key. The object of this arrangement is to repeat, automatically, through a main line embracing the key, any signal or message which may be transmitted through a primary or operating line. The key I of the main line is also so arranged that the breaking of the circuit of the operating line, which is completed through the coils of the magnet H, and which operates the armature *t*, will not break the circuit of the main line.

By reference to Figs. 10, 11, 12, 13, and 14, Sheet No. 4, the construction and operation of these parts will be more clearly seen. To the key I, Fig. 10, (seen also in Fig. 6,) is secured a pivot, *c''*, which works in the frame

J. The key is arranged for working a closed circuit, and is kept down upon the anvil f^1 by the light spring k^1. The circuit of the main line is completed through the frame J, key I, and anvil f^1. To the operating end g^1 is hinged an arm, g^2, which works freely on a pivot, h^1. The arm g^2 is kept down upon the key by a light spring, i. The key and frame are arranged upon the base-board, so that the end of the key or hinged arm will be operated by the lever u, when the armature is attracted by the magnet H, so as to raise the opposite end of the key from the anvil f^1, and to break the circuit of the main line or branch thereof, as shown in Fig. 11. In making the full downward movement, the end w of the lever u will open and pass the key, and both will then assume the position shown in Figs. 1 and 12. When the circuit of the operating line is broken the armature t will be released and the end w of the lever u in its upward movement will hit and raise the hinged arm g^2, as shown in Figs. 13 and 14, and without opening the key I, and, after passing it, the lever, hinged arm, and key will be in the position shown in Fig. 10. It will be seen that the lever u, in either of the positions, either after the armature has been attracted or released, leaves the key I free to be used by an operator, as in the ordinary manner.

Various modifications of the above-described combination will readily suggest themselves. I, therefore, do not confine myself to the particular arrangement described, as any form or construction of key which can be operated by the vibrating armature or lever of an electro-magnet in a manner similar to that described will answer equally well for the purpose. To the base-board G, Figs. 1 and 6, but shown more clearly in Fig. 9, is secured a switch, K, which turns on a pivot, L, and presses on a button, j^1, and is kept in this position by a spring, k'', also fastened to the base-board. Another switch, M, which may be also used as a key, is secured to the base-board by means of the pivot l^1 on which it turns. In the position shown the ends are in contact with the metallic buttons m^1 and n^1, and the spring o^1 keeps it in this position. Another spring, p^1, is fastened at one end to the base-board, and is bent in the center, so as to spring into the notch q^1 of the switch K when it is pushed inward and off the button j^1. When the switch K is pushed in in this manner it carries with it the switch M, and both switches will then be in the position shown by the dotted lines in Fig. 6, and the switch M will then be in contact with the buttons r^1 and s^1. The switches K and M are brought into this position by means of the sliding rod t^1 fastened to the inner door N, as seen in Fig. 6. The rod slides freely through an opening in the plate u^1, Fig. 8, which is secured to the door. A flat arm, v^5, fastened to the plate u^1, Fig. 6, extends through the door parallel with and underneath the rod, and is bent up at the end x^1. Through the bent part is an opening, through which the rod passes, and which serves as a guide to the rod. A light plate, v^1, which serves as a stop, is fastened to the rod upon the inside of the plate u^1, so as to prevent the rod from springing out or from being pulled out. Between the stop v^1 and the guide x^1 is a spiral spring, z^1, through the coils of which the rod passes. When the inner door is closed or locked, and the knob y^1, which is fastened to the rod is pushed in, it will turn the switches K and M in the position shown by the dotted lines, and they will be held in this position by the catch in the spring p^1. The springs k'' and o^1 will also be sprung back by the switches. When the rod t^1 is pushed in in the manner described the spiral spring z' will be compressed and will force the rod back when it is released. A stop, a^2, Fig. 9, arrests the switch K when it has been pushed in the required distance, and thus prevents the weakening or breaking of the springs k'' and o^1. Now, when the switches K and M are turned and are held by the spring p^1 in the position shown by the dotted lines in Fig. 6, and the arm C is in the position shown in Fig. 9, if the wound-up train be then released the arm C will turn with the shaft a, and when the arm has reached the positions shown by the dotted lines in Figs. 1 and 9, it will have pressed back the spring p^1, the switch K will then be released, and the springs k' and o^1 will then force both the switches K and M back to the positions shown in Fig. 9.

By means of the knob b^2 the switch M may be turned so as to be in contact with the buttons r^1 and s^1, and it may be held in this position by turning the catch c^2 in the position shown by the dotted lines in Fig. 6. The switches k^2 and l^2, Figs. 1 and 9, are used in connection with the buttons m^2 and n^2, principally, for testing the lines connecting therewith, and also for telegraphing, as is also the magnet o^2 and bell p^2, and their use will be hereafter more fully described. The switch-key t^1 is used for a similar purpose, with the line which operates the magnet H and armature t. Upon the switch-board O is a switch, r^2, which is used in connection with the buttons t^2 u^2 and ground-wire plate w^2, for grounding the main line connecting therewith. The switch s^2 is used with the button v^2 for cutting out the mechanism from the main line, when necessary, in a manner to be hereafter shown. The ground-wire x^3 connects with the lightning-arrester P and the plate w^2, Figs. 1 and 6. The switch a^3, same figures, is used in connection with the buttons c^3, d^3, and the ground-wire plate f^3, and ground-wire s^4, for grounding the line z, when necessary. The switch b^3 is used with the button e^3 for switching out the magnet H, when necessary, as will be hereafter shown. The ground-wire s^4 connects with the lightning-arrester Q, and with the plate f^3, Fig. 6. The vibrating lever u, Fig. 6, carries an arm, d^2, to the end of which is fastened a plate or card, e^2, upon the

face of which may be printed or stamped characters, either figures or letters; or, it may be otherwise arranged by means of different colors, so as to indicate, at all times, the condition of the line or circuit which operates the magnet H and armature *t*. An opening is cut in the door N, Figs. 6 and 8, so that the face of the plate or card e^2, and the printing thereon, or the different colors, may be seen at a glance through the glass f^2, (seen, also, in Fig. 8,) which is secured in the opening. When the line which operates the armature *t* is closed, the plate e^2 will be lowered by the downward movement of the armature, and will indicate, as seen in Fig. 8, that the line is closed, and when the line or circuit is broken, the releasing of the armature *t* will raise the indicator, and it will be seen through the glass, at a glance, that the line or circuit is broken. This indicator will require no adjustment, as it will simply move down or up as the armature *t* is attracted or released by the closing or breaking of the circuit, and may be used upon all the instruments of the different lines, to indicate the condition thereof. This indicator may also be used for many other purposes. The train of wheels may be wound by the use of such a key or crank as is used for winding ordinary clocks; or, a crank, h^2, having a knob or handle, i^2, for the purpose, may be permanently fastened to the shaft *a*, and the knob may extend through a slot in the inner door, as seen by the dotted lines in Fig. 8, so as to allow the door to be opened and closed freely. The crank will be in the position shown by the dotted lines when the train is wound, and, if in this position the words "wound" and "unwound" be stamped or printed upon the knob i^2, (seen more clearly in Fig. 22,) the condition of the train will be indicated at a glance; for it will be evident that the word "wound" will be uppermost when the train is wound, and the word "unwound" will be apparent when the unwinding of the train has caused the crank to turn the limit described by the slot.

The object of this arrangement is to indicate the condition of the train, and by this means to prevent injury, which might result from attempting to turn the crank in the wrong direction, as different trains wind in different ways.

The mechanism should be kept wound, and is intended to be used principally to carry out, in a more perfect manner, (to be presently described), my self-acting system of sounding alarms of fire by means of the fire itself, so as to locate the fire at its very commencement. But, as the mechanism is also adapted for the use of the public, to sound an alarm when a fire has broken out in a building not connected with the system, the proper instructions as to how to give the alarm should be painted or secured to the inner door.

The following instructions may be sufficient, viz: "Push the knob in, then let it spring back, and lock the outer door. If no noise is heard inside, go to the next nearest box." Upon the outer door the number of the box is seen, and also instructions as to where the key may be found, as seen in Fig. 7. The box may be made of iron or of any suitable material. The train of wheels, together with the revolving switch and other running parts, should be inclosed and secured in an inner box, to exclude dust and moisture.

The points where the lines connect with the mechanism, and with the buildings, are shown in Figs. 15 and 16, Sheet No. 5.

The main line A^1, Fig. 15, is provided with a battery, of any desired construction, which may be kept in any suitable room or building, C^1, which I denominate the battery-office. In the battery-office is also a reserve-battery, s'', not connected with the lines, but kept in working order for cases of emergency, and is used principally for connecting with the main line A^1, while the battery R is being renewed or repaired. This is accomplished by turning the switch f^6 upon the button g^6, which connects with one pole of the battery s'', (shown more clearly in Fig. 23,) and by turning the switch h^6 upon the button i^6, which connects with the other pole of the battery, the battery R may then be removed for renewal. This reserve-battery may also be used for connecting part of the main line A^1 with the ground-wire c^6, in case of breaks, as will be hereafter shown.

The circuit of the main line A^1 runs from the positive pole of the battery R through the button d^6 and switch h^6 of the switch-board h^3, (seen more clearly in Fig. 23,) and in the direction of the arrow through box 13, with which it connects in a manner to be hereafter described. From the box it runs to engine-house No. 8, and is there connected with an ordinary electro-magnetic sounder or gong, and in like manner it is connected with police-station S. It is then connected with the asylum, box 16, hotel, engine-house No. 5, with the bank, with box 17, police-station T, with the furniture-warehouse, with the public hall, then with the engine-house No. 9; and returning to the battery-office C^1, the circuit is there completed through the coils of the electro-magnetic sounder or gong i^3, register inclosed in the box j^3, switches k^3 and f^6, thence returning to the negative pole of the battery R. In each engine-house and police-station an alarm gong or sounder is connected with the line. The sounder l^3 and key m^3 may be brought into the circuit for telegraphing by turning the switch k^3, as shown by the dotted lines, so as to connect with the branch n^3. The object of connecting the main line with a limited number of police-stations is to secure the immediate protection of the police-department in case of fire, so as to prevent the operation of thieves at such times. In the furniture-warehouse numbered 3, and represented as being on Fourth street, is a line, U, which I denominate a local fire-detecting

line. It is provided with a battery, s^3, and electro-magnet, t^3, having a lever and an armature, t^4, attached thereto, which the magnet operates when the local circuit is closed and broken. This line runs from one pole of the battery, and extends to the different rooms of the building, and also to the workshop, numbered room 2, and in each room the line may be connected with any suitable heat-detecter, which, when acted upon by heat, will close the local circuit and operate the armature t^4 of the magnet t^3. From the heat-detecter in each room the line may be brought to an indicator, u^3, which may be so arranged as to indicate in which room the fire has occurred, and at the indicator the lines may terminate in a single line which leads to the other pole of the battery.

In the instance shown the heat-detecter used is that patented by Alexander Ross, March 10, 1863, and now owned by the subscriber; and consists of a compound strip of two different metals, v^3, connecting with one pole of the battery, and an adjustable metallic index-arm, w^3, which connects with the other pole of the battery. It will be seen that the line U connects the different strips in the different rooms with one pole of the battery, while from the adjustable metallic index-arm in each room a line connects with the other pole of the battery, so that when the adjustable arm is set at any desired degree above the temperature of the room the arm and compound strip will be separated, as shown in room No. 3, Fig. 15; but when the compound strip is acted upon by heat, and the temperature in the room has reached the desired point, the arm and compound strip will be brought in contact, as seen in room No. 2, Fig. 15, which will close the local circuit and spring an alarm, as is more fully described in the patent above referred to. I utilize the force brought into operation by a heat-detecter to operate my self-acting fire-alarm system, as will be presently seen.

In the furniture-warehouse is another battery, W, from which runs a line, V, the circuit of which is completed through the coils of the magnet x^3 and break-circuit y^3. The magnet x^3 has an armature and a lever, z^3, arranged as shown in Figs. 10, 11, and 13, Sheet No. 4. The main line A^1 is brought into the building, and is connected with a key, a^4, which is constructed and arranged to be operated by the lever z^3, as described, and shown in Figs. 10, 11, 12, 13, and 14, Sheet 4. The break-circuit y^3 may be of any desired construction, and non-conductors may be inserted on its edge or surface, or it may have notches cut in it to correspond with the number of the street and the number of the building, or pins may be arranged upon a wheel at proper intervals, which, when made to revolve, will open a key at intervals, so as to sound the number of the street and the number of the building.

In the instance shown the break-circuit y^3 is arranged with four breaks at short intervals to open and close the line V when the arm a^5 is made to revolve, so as to sound the number of the street, and three breaks are arranged at longer intervals, so as to sound the number of the building. The arrangement of the breaks is more clearly seen in Fig. 18. It will also be seen that there is a metallic interval, b^4, between each group, to separate one from the other, and a longer metallic interval, c^4, between the beginning and ending of the series.

As different ways in which the break-circuit y^3 may be operated has been fully described in patents granted to me, and bearing even date herewith, further description here is deemed unnecessary, except to state that upon the commencement of a fire in the building, as shown in room No. 2, the local line U will be closed, the armature t^4 will be operated, and may be made to set in motion the break-circuit, either by releasing a wound-up train of wheels or by working an electro-magnetic motor, so as to revolve a break-wheel, or revolve an arm, a^5, around a brake-wheel, as has been fully described in the patents above referred to.

When the break-circuit is set in motion, or the arm a^5 is made to revolve by the effect of the fire, it will operate the lever z^3 at intervals corresponding to the breaks in the disk y^3, and the lever will, at the same intervals, operate the key a^4 in the manner shown and described in Figs. 10, 11, 12, 13, and 14, Sheet No. 4, and will open and close the line A^1 so as to sound the number of the street and the number of the building directly at all the engine-houses and police-stations connected with the line A^1 immediately upon the breaking out of a fire in the building.

It will be evident that, instead of using the compound strips v^3 and index-arm w^3 to close the local circuit by the effect of the heat, I can use a series of ordinary mercury thermometers, x^7, Fig. 24, in which the mercury answers the purpose of the compound strip, the line U connecting the mercury in each of the bulbs with one pole of the battery s^3, and, in place of the adjustable arm w^3, adjustable metallic wires y^7 are inserted in the opening of the glass tube which leads to the mercury. By setting these wires y^7 at any desired degree above the temperature of the room, when a fire commences in the room the mercury will expand and come in contact with the metallic wires y^7, and by this means the local circuit will be closed and will operate the armature t^4, and by this means the break-circuit y^3 of the line V may be operated, either by releasing a train of wheels or by operating an electro-magnetic motor for the purpose of sounding the number of the street and that of the building in the engine-houses. In a similar manner various other heat-detecters may be used to set in motion the break-circuit by the effect of the fire. Now, if the line V in the building No. 3, Fig. 15, should be broken from any cause, the lever z^3

would simply raise and pass the hinged arm g^3, (shown more clearly in Figs. 13 and 14, Sheet No. 4,) leaving the main line A^1 unbroken. In this manner the public hall, asylum, hotel, and bank (represented in Fig. 15) may be connected with the main line, and without perceptibly increasing the resistance of the line, as no additional magnets are brought into the circuit, and by this means it will be seen that valuable buildings distant from each other in towns or cities may be connected with a main line, so as to give an alarm at all the fire-department buildings and police-stations, and instantly locate a fire at its very commencement and without any liability of deranging the main line by such connections. But, to make the system more general and to secure additional advantages in working it, as will be hereafter seen, I construct independent lines X Y Z in different parts of a town or city, as shown in Fig. 15. Each line is provided with a battery, kept in a convenient place, and connects with different buildings, and in each building the line connects with a break-circuit of any desired construction, arranged to open and close the circuit so as to sound the number of the street and the number of the building, or any desired signal, in case of fire, so as to locate the building. Each building is provided with any suitable local fire-alarm or heat-detecter, which, when acted upon by the fire as described, will set in motion the break-circuit. The circuit of the line X is from one pole of the battery d^4 through the coils of the magnet which operates the alarm-bell e^4, building 20, church 21, alarm-box 16, buildings 22, 23, and 24, to the other pole of the battery.

The circuit of the line Y is from one pole of its battery f^4, alarm-bell g^4, buildings 25, 26, 27, 28, and 29, alarm-box 17, and building 30, to the other pole of the battery.

The circuit of the line Z is from one pole of its battery h^4 through the magnets of the alarm-bell i^4, building 31, alarm-box 13, buildings 32, 33, and 14, to the other pole of the battery.

One form of a break-circuit, j^4, with which the line Z connects, is shown in building 14, which is represented as being on Third street. The break-circuit j^4, shown also in Fig. 19, is arranged with three breaks at short intervals so as to open the line Z to sound the street-number 3, and with the breaks at longer intervals to sound the number of the building 14, and the circuit will be broken at the intervals shown in Fig. 19, when the arm k^4 is made to revolve by closing the local circuit by means of a heat-detecter, as described.

The connections of the main line A′ and the building-lines Z with the alarm mechanism are shown in Figs. 1, 6, and 9, the connections being the same in all the boxes.

The main line A^1, Fig. 6, enters the box, and, passing through the lightning-arrester and metallic buttons upon the switch-board O, runs in the direction of the arrows to the screw-post l^4. A branch wire, 34, (seen more clearly in Fig. 9,) runs to the strip 2, and when the wheel B, Fig. 1, is turned in the position shown in Fig. 3, the metallic fingers or strips will rest on the metallic section k, (seen more clearly in Fig. 2,) and the circuit will be completed through the metallic section k, strip 1, wire 35, standard F, arm E, plate D, strip s, and through wire 36 to the screw-post m^4. From the post m^4 the line returns to the switch-board O, and, passing through the connections thereon, leaves the box for other points. From the screw-post l^4, Figs. 6 and 9, another branch, 37, runs to the spring 3, and the circuit is completed when the wheel B is in the position shown through the section k, spring 4, wire 38, metallic frame J, Fig. 6, key I, wire 39, button n^1, switch M, button m^1, and wire 40, to the screw-post m^4, part of the connections being shown more clearly in Fig. 9.

The building-line Z, Fig. 6, enters the box and passes in the direction of the arrows through the lightning-arrester Q upon the switch-board O to the screw-post n^4, and the circuit is completed through wire 41, spring 5, metallic section m of the wheel B, (shown more clearly in Fig. 9,) spring 6, wire 42, button j, switch K, wire 43, coils of magnet H, Fig. 6, wire 44, to the screw-post o^4, and in the direction of the arrows, back to and through the connections on the switch-board off to other connections shown in Fig. 15.

Now, if the mechanisms in the boxes 13, 16, and 17, Fig. 15, are wound, in which condition they should be kept, and the circuit of the main line A^1 is closed, and the lines X Y Z are also closed, upon the commencement of a fire in a building, arranged with local fire-alarms or heat-detecters, and connected, as described, with either of the lines, the operation of the alarm mechanism in the box will be as follows, viz: Presuming a fire to have commenced in a building, number 14, in street number 3, Fig. 15, the break-circuit j^4, connecting with the line Z in the building, will be brought into operation by a local fire-alarm or heat-detecter, which may be arranged therein for that purpose, in a manner similar to that shown in rooms Nos. 2 and 3, Fig. 15. The line Z will then be opened and closed at intervals corresponding to the number of the street and the number of the building, which will operate the armature t and lever u, and release the train in box 13, Figs. 1 and 6, at corresponding intervals.

The lever u, by this means, will open the key I at the same intervals, and while the fingers or strips 3 and 4 are on the metallic section k of the wheel B, Fig. 2, the circuit of the main line A^1 will be completed through the key I by the connections shown in Figs. 6 and 9, and by this means the number of the street and the number of the building will be sounded at all the engine-houses and police-stations, through the line A^1, at the very commencement of the fire; and this alarm will continue to be sounded until the unwinding

of the train has brought the wheel B in the position shown in Fig. 3. In this position of the wheel the fingers or strips 3 4 and 5 6 will be on the non-conducting section of the wheel, and the strips 1 and 2 will be upon the metallic section k, which will divert the current of the main line A^1 through the break-plate D by the connections hereintofore described. This break-plate is arranged with four breaks, (seen more clearly in Fig. 20,) to open the line A^1, so as to sound the number of the box 13, through the main line; and for this purpose the breaks upon the plate D are at longer intervals than those upon the break-plate j^1 in the building, as shown in Figs. 1 and 20. As the strips 5 and 6 will be resting upon the non-conducting portion of the wheel in the position last described, the circuit of the building-line Z will be broken. The armature t will therefore be released, the lever u will assume the position shown in Fig. 10, in which position the catch c^1 (seen in Figs. 1 and 6) will be released from the detent or fly e^1, by which means the train will run uninterruptedly during the next quarter turn of the wheel B, during which interval the arm E will revolve three times around the plate D, and each revolution will open and close the circuit of the main line A^1, so as to cause the number of the box 13 to be sounded at all the engine-houses and police-stations on the main line. When the full half turn of the arm C is completed, the wheel B will have been turned in the position shown in Fig. 4, and the circuit of the line Z will then be completed through the strips 5 and 6, which will then rest upon the metallic section n, and the current passing through the coils of the magnet H will attract the armature t, and bring down the catch c' so as to stop the train.

At the same instant that the circuit of the line Z is closed through the strips 5 and 6, the circuit of the main line A^1 will be closed through the strips 3 and 4 and metallic section l, upon which the strips will rest, as the wheel, in the position shown in Fig. 4, brings the section l in a corresponding position to that of n. The circuit of the main line will now be broken through the plate D, as the strips 1 and 2, connecting with the plate, will, in the position of the wheel last described, be left resting upon the non-conducting section of the wheel B. The circuit of the main line will now be completed through the key I by means of the branches connecting with strips 3 and 4. If the arm C be short enough to pass the base-board G unobstructedly upon the commencement of another fire in any of the buildings connected with the line Z, or upon the continuance of the fire in building 14, the alternate alarms will be repeated and sounded, as above described, until the train runs down; but if the arm C is long enough to enter the socket p^4, as shown in Figs. 1, 6, and 9, when the arm has made the half turn, it will be held in the position shown by the dotted lines in Figs. 1 and 9; and upon the commencement of another fire, and without further attention to the train, an alarm will be sounded through the main line by means of the lever u and the key I, giving the number of the street and the number of the building at all the engine-houses and police-stations until the fire is extinguished.

Now, if the train is wound and the mechanism and parts thereof are in the position shown in Figs. 1, 6, and 9, and the circuit of the line Z is broken either by design or accident, or by the running down of the battery h^4, Fig. 15, the armature t will be released and remain so until the line is repaired. In its upward movement it will lift and pass the hinged arm and release the train, as described, which will run uninterruptedly, carrying with it the wheel B. When the wheel has turned in the position shown in Fig. 3, so that the fingers or strips 1 and 2 are upon the metallic section k or l, the circuit of the main line will then be through the break-plate D, and an alarm through the main line will be given, sounding the number of the box three times by the same number of revolutions of the arm E, as described. Upon the completion of the half turn of the wheel B the arm C will enter the socket p^4, and the train will be arrested, and the circuit of the main line will now be completed through the fingers 3 and 4 and the key I. By this means, the signal given being different from either of the fire-signals, it will be known that a fire-detective line has broken, and also the point where it connects with the main line, thus insuring the most perfect protection to the connecting-lines and the constant working condition of the main line. The line Z having been repaired, the train is again wound. Now, when a fire has broken out and has been discovered in a building not connected with the system, the person discovering the fire goes to the nearest box—in this instance supposed to be box 13—procures the key, unlocks and opens the outer door, pushes in the knob y^1, Figs. 6 and 8, and lets it fly back. This operation turns and fastens the switches K and M in the positions shown by the dotted lines, Fig. 6; and they will be held in this position by the spring p^1 until the spring is forced back by the arm C, as described. The turning of the switch K, as described, off the button j breaks the circuit of the line Z, which releases the armature t and the train, and the circuit of the main line having also been broken through the key I by turning the switch M with the switch K, the circuit will now be completed through the break-plate D, during the whole half-turn of the wheel B, in the following manner, viz: During the first quarter-turn the circuit will be completed from the screw-post l^4, Figs. 6 and 9, through the wire 37, springs 3 and 4, wires 45, 46, 47, coils of the magnet q^4, wires 48, 49, 50, button r^1, switch M, button s^1, wire 51, standard F, revolving arm E, plate D, spring s, and wire 36, to the screw-post m^4. During the last quarter turn the cir-

cuit will be completed through the branches leading from the springs 1 and 2 in the manner already described. The arm E during the entire interval will revolve six times around the plate D, and during each revolution the number of the box in which the mechanism is placed will be sounded at all the engine-houses and police-stations, bringing the firemen and policemen to the box, who will there be informed where the fire has broken out. The arm C, in the meantime, as shown by the dotted lines in Fig. 9, will have released the switches K and M by forcing back the spring p^1, which will leave both lines closed, as at the commencement, as the wheel B will be in the position shown either in Fig. 2 or 4, whether the train be wound or unwound. The train should now be wound to be ready for operating in either manner described.

It will thus be seen that, by the use of the same mechanism, four different alarms may be given, from different causes, in a manner to indicate the particular cause of the alarm: first, when the mechanism has been left wound and a fire has but just commenced in a building; second, when the mechanism has run down, and a fire has but just commenced; third, when the train has been left wound and a connecting-line has broken; fourth, when the train has been left wound, and is released by an operator upon the discovery or breaking out of a fire, thus affording the most perfect protection against fire.

The switch-key M may be used in telegraphing by turning it in the position shown by the dotted lines, so as to complete the circuit through the coils of the magnet q^4, which operates the armature r^4 when the line is opened and closed by means of the switch-key. By this means messages may be transmitted through the line and received at any of the boxes.

When a break occurs in the main line the switch h^6 in the battery-office C^1, Fig. 15, (seen more clearly in Fig. 23,) is turned upon the button, i^6, and the switch j^6 is turned on the button k^6, which connects the line on the left side with battery s'' and the ground-wire c^6. The switch p^3 is then turned on the button l^6, which connects the line on the right side with the ground-wire g^3. Now, suppose the break to have occurred at the point B^5, Fig. 15. If the ground-wires are connected with the line at the police-station s and at box 16, the circuit of the line will be completed through the ground on each side of the break, as shown by the dotted lines, and all parts of the line will be in working order except that part between the police-station and the box. In testing for breaks in the main line the ground-wires in the battery-office are connected with the line in the manner described, or by means of the arrangements commonly used in telegraph-stations for grounding the lines. The switch-key M in the boxes is then turned, as above described, for telegraphing, and the switch r^2, which connects with the ground-wire x^3 through the plate w^2 upon the switch-board O, Fig. 6, is now turned upon the button u^2 or t^2, to find upon which side of the box or in which direction to look for the break.

If the circuit is completed through the ground upon either side, so as to operate the armature r^4, the test is continued upon that side in the same manner until the break is located, similar switch-boards O being arranged in all the buildings connecting with the line for this purpose. The break having been located, the line is connected with the ground-wires upon each side of the break, as described, until the line is repaired. But, if no circuit is obtained by turning the switch r^2, as described, on both sides, the fault may then be looked for in the connections with the mechanism, which may be detected in the following manner, viz: The switches k^2 and l^2, Figs. 1, 6, and 9, are turned on the buttons m^2 and n^2, and the circuit will be completed from the screw-post l^4 through the wire 52, button n^2, switch l^2 wires 46, 47, 48, 49, (which lead to and from the coils of the magnet q^4,) switch k^2, button m^2, and wire 53 to the screw-post m^4, thus cutting out all connections with the mechanism. If, now, the ground-wire be connected with either side of the line, by turning the switch r^2 on the button u^2 or t^2, and the armature r^4 is operated thereby, the break will have been detected in the mechanism, and if it cannot be repaired in the box, the switch s^2, Fig. 6, may be turned on the button v^2, and the switch b^3 may be turned on the button e^3, which will keep both lines closed, and cut out the entire mechanism, which may now be removed and replaced by a duplicate, or be repaired.

The building-line Z, may have its batteries and switches connecting therewith, arranged in a manner similar to that described for the main line A^1, and in each building connecting with the line Z there should be a lightning-arrester and ground-wire, and switch connecting therewith similar to that described for the main line and shown upon the switch-board O. When the breaks occur in the line Z, the ground-wires in the battery-room should first be put on. The break is then tested for at different points by turning the switch a^3 either upon the button c^3 or d^3, Fig. 6, by which the line will be connected with the ground-wire s^4. In testing in the box, if no circuit is obtained on either side, the switch-key t^4 is turned on the button u^4, as seen by the dotted lines in Fig. 6. The circuit will now be completed through the wire 54, switch t^4, coils of the magnet H, and wire 44. If the armature t is now operated by connecting either side with the ground-wire, the fault may be found in the connections with the mechanism, which may be repaired in the box, or the mechanism may be removed, as described, by turning the switches b^3 and s^2 in the position shown by the dotted lines.

The above description illustrates the appli-

cation and working of the mechanism as applied to my fire-detective and alarm-system, when combined with a single main line A^1, and it is evident that the mechanism can be applied to any main fire-alarm circuit, or other main line, and be worked in the same manner. But my complete system, arranged to instantly complete the circuit through all the instruments and boxes when breaks occur in the main line, is illustrated in Figs. 16 and 17, by which arrangement the delays incident to obtaining a circuit at such times through all the boxes and instruments is entirely obviated.

As breaks in telegraph-lines are most liable to occur during high winds, and as conflagrations are most disastrous and more difficult to control at such times, it is of the highest importance that a fire-alarm system should be so constructed that derangements in the lines may be instantly remedied. For this purpose I run two main lines, A^1 and B^1, from the battery-office C^1, Fig. 16, and connect both lines with the switch-board in each box, and in each fire-department building and police-station, in a manner to be presently described. The line A^1, Fig. 16, runs from one pole of the battery R, in the direction of the arrow, through the switch m^6, and the circuit is completed through all the boxes and buildings, and returns to the battery through the switch n^6 and coils of the magnet o^6, which works the sounder or gong-bell p^6. The circuit of the line B^1 is from the battery D^1 through the switch q^6, and embraces in its circuit the same instruments as the line A^1, and returns to the battery-office, where it connects with the button r^6. The connections of both lines with the mechanism in the boxes and with the instruments in the different buildings are such that, if a break should occur in the line A^1, as at B^5, Fig. 16, the circuit will be immediately completed through all the instruments and boxes without testing for the break, and without connecting with any ground-wires by simply turning the switch s^6 upon button r^6, which closes the line B^1 and brings into the circuit the magnet t^6, for operating the sounder or bell connected therewith. The switch s^6 may be turned on the button r^6 by an operator, or by the battery attendant, or when the attendant is not present devices may be arranged in the battery-office so that the breaking of one line will cause the other to be closed automatically. One way of accomplishing this object is shown in Fig. 25, Sheet No. 3. The switch A^2, when turned on the button B^2, diverts the current of the main line A^1 through the coils of the magnet C^2, which will then operate an armature, D^2, and an arm, E^2, fastened thereto, so as to catch the fly F^2, or any detent arranged for the purpose of holding a train of wheels wound up. Screw-threads are cut upon one of the shafts, G^2, of the train, and a traveling-nut, H^2, having threads corresponding with the screw, is mounted on the shaft. The nut moves freely upon guide-rods J^2, which are secured to the frame K^2. These rods prevent the nut from turning, so that it may be moved forward when the shaft G^2 is turned.

Now, when a break occurs in the line A^1 the armature D^2 and the train will be released, the shaft G^2 will revolve and cause the nut H^2 to be carried forward to the position shown by the dotted lines, where it will be stopped by the head L^2 on the end of the shaft G^2, and in moving forward the nut may be made to turn the switch s^6 upon the button r^6 in the position shown by the dotted lines, so as to close the line B^1 automatically when a break occurs in the line A^1. Another way of accomplishing this is to secure an arm to one of the shafts of the train, so that, when turned by releasing the train, it will pass over and come in contact with the switch s^6, and press it down upon a button, r^6, and in this case the switch should be a spring-switch, arranged over the button.

The arrangement of the switches upon the switch-board O for connecting both lines with the same instrument or mechanism, so that they may be operated by either line, is seen in Fig. 17. The line A^1 enters the box in the direction of the arrows, and runs, through the button w^2, switch v^6, to the button w^6. The line B^1 enters in the direction of the arrow, passes through the button x^6, switch y^6, and forms a junction with the line A^1 at the button w^6. If the line A^1 is closed and the line B^1 is open, as shown in Fig. 16, the circuit will be completed from the button w^6 through the line connecting it with the screw-post l^4, from which the circuit is completed through the mechanism, as shown in Figs. 6 and 9, returning to the screw-post m^4, from which, as shown in Fig. 17, the line runs, in the direction of the arrow, through the button z^6, lightning-arrester P, buttons a^9, b^9, and t^2, from which it leaves the box in the direction of the arrow. Now, if the line A^1 is broken, as at B^5, Fig. 16, and the switch s^6 is turned upon the button r^6, the circuit will be immediately closed through the line B^1, and the circuit will be completed in the box through the switch-board, Fig. 17, and will pass, in the direction of the arrow, through the connections shown to the junction-button w^6, from which it will be completed through the connections in the mechanism above described for line A^1, returning to junction-button a^9, from which the circuit of the line B^1 is completed through the button c^9 and button d^9, leaving the box in the direction of the arrow. The circuit now being completed through the line B^1 and through the operating mechanism in all the boxes, and through the alarm instruments, the break in line A^1 is tested for in the following manner, and without interfering with the line B^1, viz: the switch n^6 in the battery-office, Fig. 16, is first turned on the button e^9, which connects the line A^1, upon the left side, with the ground-wire f^9. In each box and building in turn, upon the left side of the battery-office, the switch v^6 is turned on the button g^9, Fig. 16.

Commencing at the box 13, or engine-house No. 8, the line A^1 will be connected with the ground when the switch r^2 is turned on the button t^2, Fig. 17, and if the line is not broken between the battery-office and the point where the test is made the circuit will be completed through the switch v^6 when turned, as shown by the dotted lines, on the button g^9, thence through the wire 60, the button h^9, wire 61, wire 47, coils of the magnet q^4, wires 48, 62, and 63, switch r^2, ground-wire plate w^2, and wire 66, which connects with the ground-wire x^3, by which means a current will be obtained which will operate the armature r^4. The test is continued in this manner until the break is detected, and, when repaired, the switch n^6, Fig. 16, is turned in the position shown by the dotted lines, off the button e^9, and the switch v^6 is turned in the position shown by the black lines, as at the commencement, so that if a break should occur in the line B^1, the circuit may be completed through the line A^1 by turning the switch n^6 on the button w^6. In testing for breaks in the line A^1, upon the right side of the battery-office, the switch m^6 Fig. 16, is turned on the button o^9, which connects with the ground-wire f^9, and the switch r^2, Fig. 17, is turned on the button w^2 at the different stations and boxes, until the break is detected. Should a break occur in the line B^1 it may be detected in the manner as already described for line A^1, by means of the switches s^6 or q^6, Fig. 16, which connect the line on either side with the ground-wire f^9 at the battery-office, and the switch j^9, Fig. 17, which, at the boxes or buildings, will connect the line with the ground-wire x^3 when turned on the button x^6 or d^9, by which means a current may be obtained which will operate the armature r^4 when the switch y^6 is turned on the button l^9.

The entire mechanism, or the instrument connected with the switch-board, Fig. 17, may be cut out, and either line will remain closed when the switch s^2 is turned on the button v^2. When the switch v^6 is turned on the button b^9 the current of the line A^1 will pass through the switch and off through the line without passing through any other connections, and in like manner the current of the line B^1 will enter and pass out when the switch y^6 is turned on the button c^9. When the above arrangement of switches for the main line, as shown in Fig. 17, is used in the boxes, the arrangement of switches for the building-line Z in the boxes is the same as shown in Fig. 6, (shown also in Fig. 17.)

It will be understood that the arrangement of switches for the main line A^1 and B^1 in the fire-department buildings, police-stations, and other buildings, will correspond with the arrangement upon the switch-boards in the boxes, as shown in Fig. 17; but in the buildings the lines leading to and from the switch-boards will pass directly to and from the coils of the magnets which operate the alarm-sounders, gong-bells, or other instruments.

It will be evident that relays, such as are ordinarily used in telegraphing, may be embraced in the main line A^1 for the purpose of closing and opening a local circuit in the fire-department and police-buildings to work the sounders or gongs in such buildings.

Instead of fastening the boxes containing the alarm mechanism to the outside of buildings or to telegraph-poles, they may be kept in hotels or other public places indoors, where access may be had to them at all times, and by this means injury to the works from outdoor exposure and false alarms may, in a great measure, be prevented. If they are connected with the lines in this manner signs may be placed on the street-corners at different points, directing the public to places where the alarm-boxes may be found.

Having described my invention, I claim—

1. The combination of any fire-alarm circuit or main telegraph-line, A^1, with the alarm-operating mechanism in the boxes, substantially as described, and a secondary operating or building line, Z, also connecting with the mechanism and with break-circuits in different buildings, which have local circuits and heat-detecters arranged therein for operating said break-circuits, substantially as described, the whole arranged to be brought into operation so as to sound a different alarm from different causes through the main line under the different conditions, essentially as described.

2. The combination of the sliding or operating rod t^1, with the switch K, catch-spring p^1, stop a^2, switch M, buttons r^1 and s^1, all arranged and connected with the different lines and with the operating mechanism, as described, for the purpose of releasing the train by turning the switch K by means of an operator, as described, and by this means diverting the circuit of the main line through a break-circuit, D, and its connections, so as to sound a different peculiar signal through the main line, as described, which will indicate that a fire has broken out in a building not connected with the fire-detecting lines.

3. The combination of the arm C and spring p^1 for releasing the switch K, so as to allow the springs k'' and o^1 to force back the switches K and M to their original position after they have been turned by an operator, so as to automatically close both lines after an alarm has been sounded, as described.

4. A self-acting indicator, consisting of the combination of a magnet, H, vibrating armature t, and lever u, adjustable spring x, stop-screw b^1, frame v, arm d^2, plate-card or indicator e^2, opening or glass f^2, arranged and operating essentially as described.

5. The combination of a telegraph-key, I, hinged spring-arm g^2, the anvil f^1, spring k^1, with a vibrating armature, t, and a magnet, H, for the purpose described.

6. The combination of the following elements, viz: a fire-alarm circuit or other main line, A^1, embracing a hinged key, a^4, a second-

ary or operating line or circuit, V, with its battery W, magnet x^3, and armature and lever z^3, and embracing a break-circuit, y^3, a local fire-alarm circuit, U, or a series of local fire-alarm circuits combined with heat-detecters, all operated as described, so that upon the commencement of a fire in a building the local circuit therein will be closed, a break-circuit, y^3, will be operated, so that a signal, or a series of signals, which will locate the fire will be sounded by means of the fire itself through the main line without the liability of deranging the main line by the breaking or derangement of any of the connecting-lines.

7. The combination, with a train of wheels, of one or more revolving switches, B, having alternate conducting and non-conducting sections thereon, springs 1 2, 3 4, and 5 6, which connect with the revolving switch and also with the main line A^1 and building-line Z, and with the break-circuit D, key I, and magnet H, by means of the branch wires and other connections described, for the purpose of diverting the current of the main line alternately through the key I and plate D, or through either alone, when operated as described.

8. The combination and arrangement of the switch M, buttons r^1 and s^1, with the branch wires leading therefrom, and the catch C^2 for holding the switch M in the desired position for bringing into the circuit of the main line the coils of the magnet q^4 by means of the branches leading to and from the same for the purpose of operating the armature r^4 in telegraphing and testing for breaks, as described.

9. The combination of the switch k^2, button m^2, switch l^2, button n^2, and branches connecting the same with the screw-posts l^4, m^4, and coils of the magnet q^4 for cutting out all other branches and connections of the main line with the mechanism, and for the purpose of detecting faults or breaks in the line when they occur in the mechanism, as described.

10. The combination of the switch r^2, buttons t^2 u^2 w^2, and ground-wire x^3 with the main line A^1 for grounding the line on either side, as described.

11. The combination of the switch s^2, button v^2, switch b^3, and button e^3 for closing both lines A′ and Z and for cutting out all connections of the same with the operating mechanism, so that the mechanism may be removed when desired, as described.

12. The combination of the spring-switch t^4, button w^4, branches 43 44, coils of the magnet H, and branch 54 for cutting out from the line Z the branches leading through the mechanism, and for telegraphing when desired, as described.

13. The arrangement of words or characters upon the knob or handle i^2 in such manner as to indicate the condition of a train or mechanism in the boxes, as described—that is to say, whether the train is wound or unwound.

14. The combination of a telegraph-line, A^1, and switches h^6 and f^6 with the battery R and the battery s'', for the purpose of renewing or repairing either battery when desired, as described.

15. The combination of the switches h^6, button i^6, battery s'', switch j^6, button k^6, and ground-wire c^6, and the switch f^6, battery R, switch p^3, button l^6, and ground-wire g^3 for dividing the line A^1 into two circuits when the ground-wires are put on in the boxes or buildings, as described.

16. The combination of two main lines, A^1 and B′, the line A^1 closed and the line B open, or vice versa, and each having its own independent battery, both lines arranged substantially as described, so as to connect with the same operating mechanism and alarm instruments in the different boxes and buildings, and in such a manner that when a break occurs in the closed line A^1, for instance, the circuit may be instantly restored through all the instruments in the buildings and boxes by turning the switch s^6 of the open line B′ upon the button r^6, at the battery-office C^1, as described.

17. The combination and arrangement of the switches and buttons of the lines A^1 and B′ upon the switch-board (shown in Fig. 17) and the branches connecting therewith for the purpose of testing for breaks in either line, or for switching out either line, or both, when desired, essentially as described.

18. The devices herein described for automatically closing one line by the breaking of another, and consisting of a train of wheels, traveling-nut H^2, screw G^2, switch s^6, magnet C^2, and vibrating armature D^2, as described.

In testimony whereof I have hereunto set my hand.

WILLIAM B. WATKINS.

Witnesses:
T. H. UPPERMAN,
A. E. H. JOHNSON.