(No Model.)

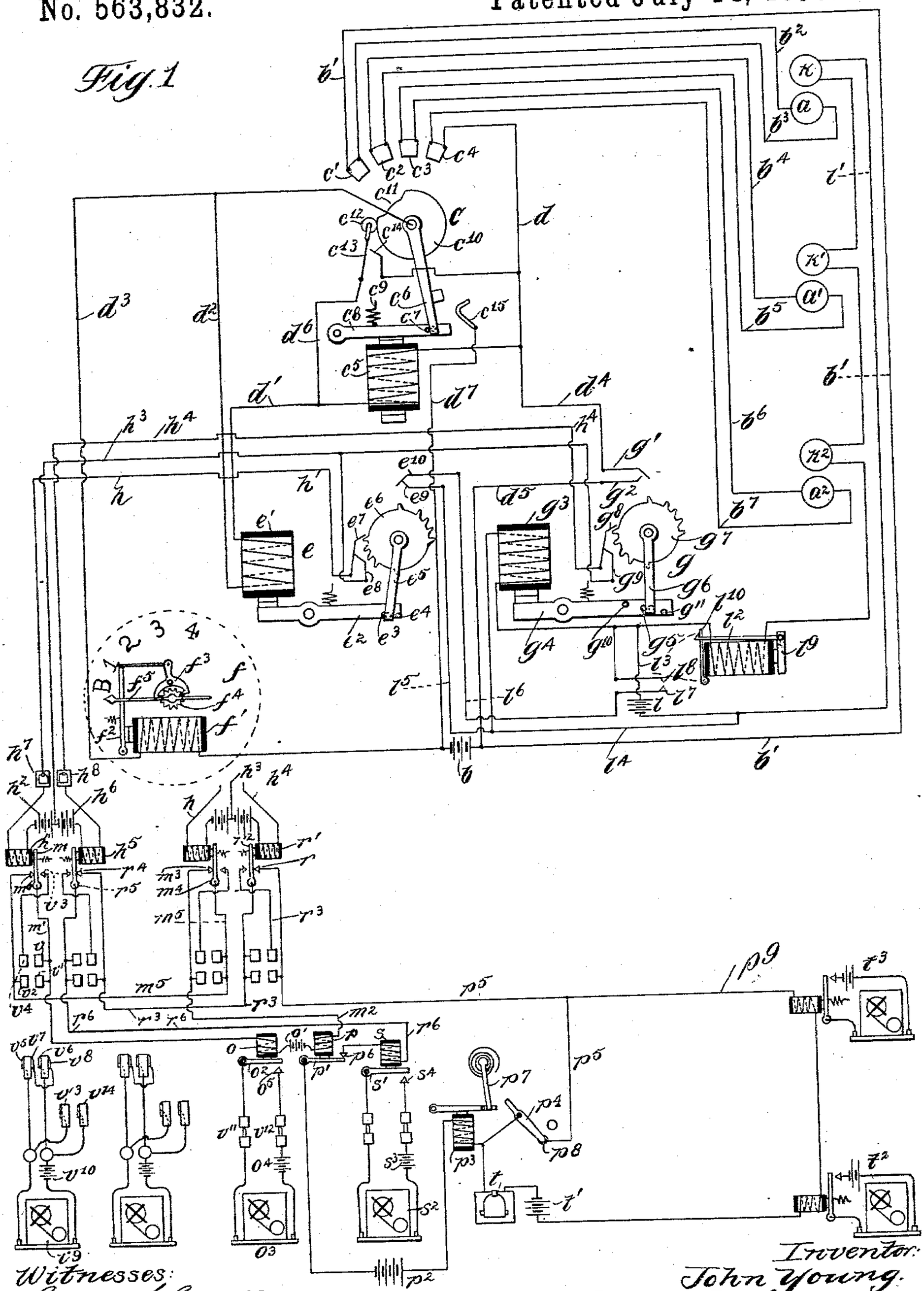
4 Sheets—Sheet 1.

J. YOUNG.

AUTOMATIC FIRE ALARM SYSTEM.

No. 563,832. Patented July 14, 1896.

Fig. 1



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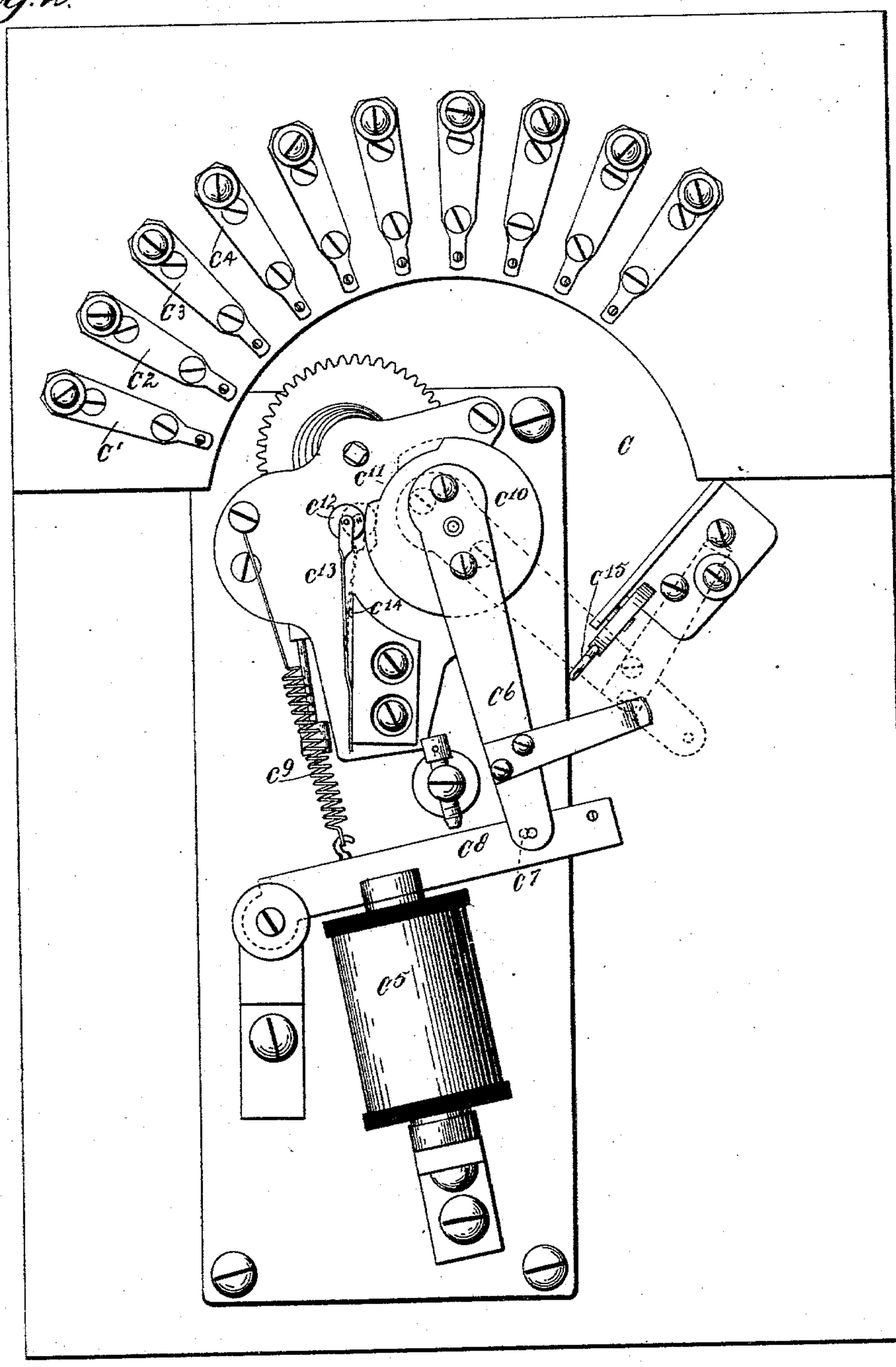
(No Model.) 4 Sheets—Sheet 2.

J. YOUNG.

AUTOMATIC FIRE ALARM SYSTEM.

No. 563,832. Patented July 14, 1896.

Fig. 2.



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AUTOMATIC FIRE ALARM SYSTEM.

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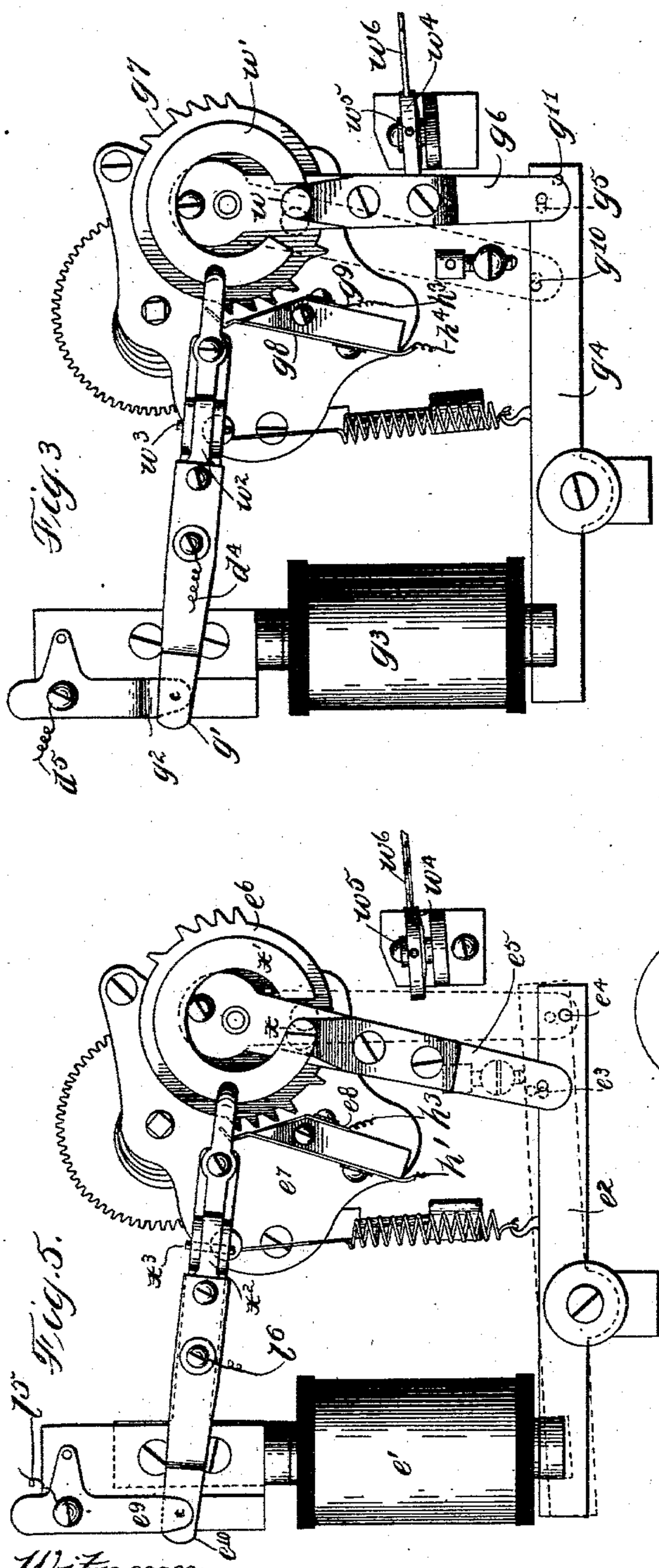

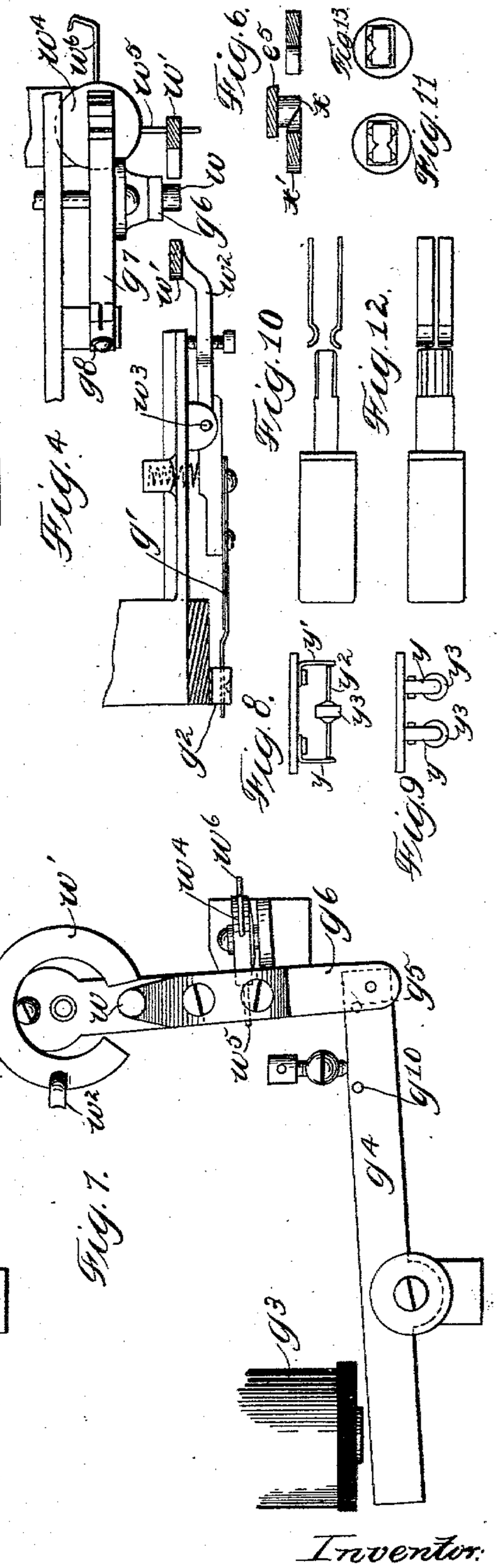

(No Model.) 4 Sheets—Sheet 4.

J. YOUNG.

AUTOMATIC FIRE ALARM SYSTEM.

No. 563,832. Patented July 14, 1896.

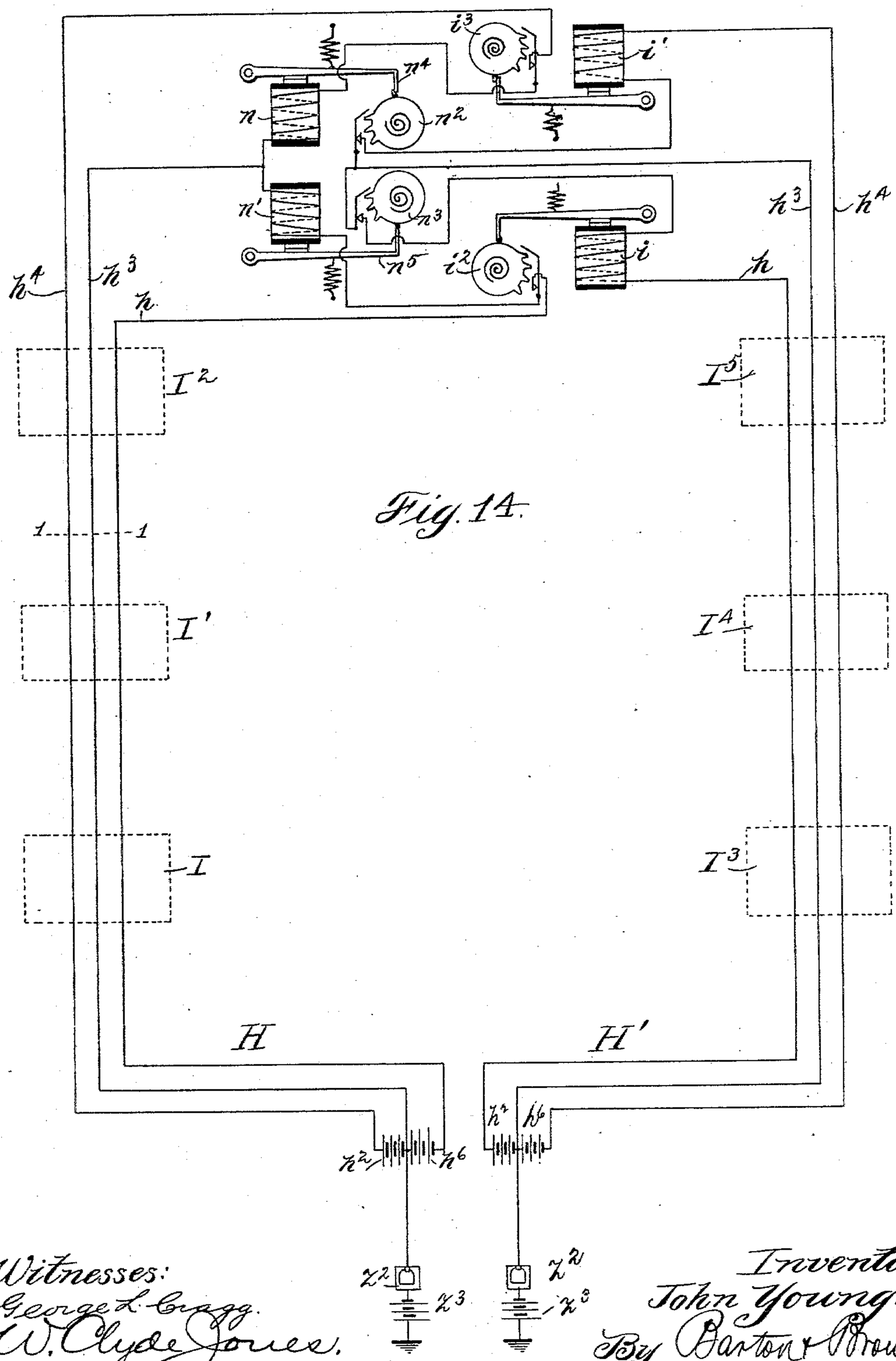

Fig. 14.

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UNITED STATES PATENT OFFICE.

JOHN YOUNG, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE WESTERN ELECTRIC COMPANY, OF SAME PLACE.

AUTOMATIC FIRE-ALARM SYSTEM.

SPECIFICATION forming part of Letters Patent No. 563,832, dated July 14, 1896.

Application filed August 8, 1895. Serial No. 558,601. (No model.)

To all whom it may concern:

Be it known that I, JOHN YOUNG, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Automatic Fire-Alarm Systems (Case No. 12,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to an automatic fire or heat alarm system, its object being to provide a system that shall effectively transmit all fire-alarms to the fire-alarm station while preventing the transmission of false signals.

In accordance with my invention two responsive circuits are provided, extending throughout the territory to be protected, thermostats being provided in each of the circuits, whereby the circuit may be opened when an abnormal degree of heat exists in the vicinity. The thermostats of one of the circuits, which will be designated the low or A side of the system, are adjusted to open the circuit at a lower temperature than the thermostats of the high or B side of the system, the thermostats of the A side being usually constructed to fuse at about 145° to 150°, while the thermostats of the high side fuse at 160° to 165°. In the low circuit is included an indicating or annunciating box placed on the outside of the building or in any other convenient position to indicate the floor upon which the fire exists. In each of the protective circuits is included a signal-transmitting instrument, the two instruments being connected in separate circuits which extend to the central station and are there connected through relays with receiving instruments or registers.

The registers at the city hall and at the fire-insurance patrol station are normally disconnected from the circuit, so that a single transmission from either of the transmitting instruments operated alone will not reach the registers at the city hall and at the patrol station. Each time either of the transmitting instruments is operated its signal-wheel makes one rotation, thus sending two signals to the central station, and an automatic switch is provided for cutting into circuit the registers at the city hall and at the patrol station, the automatic switch requiring a time of operation greater than that required for the transmission of the two signals by either of the transmitting instruments. When either of the transmitting instruments is operated alone, due to a false alarm, the signal is transmitted to the central station, but does not pass beyond it, since the double signal is completed before the automatic switch has operated to cut into circuit the registers at the city hall and at the patrol station. If the heat of the building from any cause be sufficient to actuate the thermostats of the low circuit alone, the transmitting instrument of that circuit will send a signal to the central office and this will not pass beyond the central office. Or if either of the circuits should be interrupted from any cause, the transmitting instrument of the particular circuit will send a signal to the central station, but it will not pass beyond it. When a fire exists and both circuits are interrupted by the action of the thermostats, the transmitting instrument of the A side immediately acts to transmit a double signal to the central station and throw into operation the automatic switch, which, by the termination of the double signal, has cut into circuit the registers at the city hall and at the patrol station.

As soon as the transmitting instrument of the A side completes the transmission of the signal, it throws into operation the transmitting instrument of the B side, which in turn transmits a double signal and throws into operation the transmitting instrument of the A side, which sends in a double signal and again throws into operation the transmitting instrument of the B side, four double signals being thus transmitted to the central station, while only three double signals pass beyond the central station and are recorded upon the registers at the city hall and at the patrol station, the first double signal being intercepted at the central station.

By the employment of two circuits, one being adapted to open the circuit at a low temperature while the other responds only to a higher temperature, it is almost impossible to send in a false alarm. The breaking of a wire, the opening of one side of a circuit, or the failure of one of the local batteries transmits a double signal only and does not go be-

yond the central station, and should one circuit become disabled from any cause the other remains for the transmission of the signal.

I provide, in connection with the above-described system, a ground detector for determining the presence of a ground upon either of the circuits, and also devices for transmitting to the central station a signal when a break occurs upon either circuit.

I will describe my invention more in particular by reference to the accompanying drawings, in which—

Figure 1 is a diagrammatic view, illustrating the circuit arrangement of the fire-alarm system embodying my invention. Fig. 2 is a plan view showing the detailed construction of the circuit-controlling device that operates the annunciator or indicator. Fig. 3 is a plan view of a transmitting instrument on the B side of the system. Fig. 4 is an end view thereof. Fig. 5 is a plan view of the transmitting instrument of the A side of the system. Fig. 6 is a detached view of a portion of the mechanism shown in Fig. 5. Fig. 7 is a view illustrating some of the parts of Fig. 5 shown in their alternative positions. Fig. 8 is a view in elevation of the thermostat which I preferably employ. Fig. 9 is an end view thereof. Fig. 10 is a view in elevation of a spring-jack and plug employed in my system. Fig. 11 is an end view of the plug. Fig. 12 is a plan view of another form of plug and spring-jack. Fig. 13 is an end view of the plug. Fig. 14 is a diagrammatical view illustrating the ground-detecting device and the instruments for transmitting a signal to the central office when a short circuit occurs.

Like letters refer to like parts in the several figures.

A series of thermostats a a' a^2 are provided upon the different floors and in the different localities to be protected, and are connected in the A side of the system, the circuit being traced from the battery b through the conductor b' to the contact c' of the circuit-controlling device c, the contact c' being connected by conductor b^2 with the thermostats a provided upon the first floor, circuit then extending by conductor b^3 to contact c^2, thence by conductor b^4 to the thermostats a' provided upon the second floor, thence by the conductor b^5 to contact-terminal c^3 and by conductor b^6 to the thermostats a^2 provided upon the third floor, and by the conductor b^7 to the contact-terminal c^4, as many floors or localities being thus connected with terminals upon the controlling device c as may be required. Circuit extends from the last terminal c^4 by conductor d through the electromagnet c^5 and by conductor d' to the electromagnet e' of the transmitting instrument e; thence by conductors d^2 d^3 through the electromagnet f' of the indicating device f and back to the opposite pole of the battery b. A conductor d^4 joins conductor d with contact-spring g' normally resting out of contact with a spring g^2, which is connected by a conductor d^5 with the pole of the battery b.

The indicator f comprises an armature-lever f^2, pivoted in front of the pole of the electromagnet f', the end of the lever being connected with a rocking pawl or detent f^3, the prongs of which are adapted to engage the teeth of a ratchet-wheel f^4, upon which is carried an index-finger f^5 adapted to move over a plate upon which are provided characters indicating the different localities which the system protects. When a signal is sent in, the indicator f is actuated to move the index-finger f^5 opposite the character designating the floor or locality at which the fire exists.

The circuit-controlling device c comprises an arm c^6 adapted in its rotation to engage and make electrical contact with the contact-terminals c' c^2, &c., the arm c^6 being normally maintained from rotation by engagement with a pin c^7 carried upon the armature-lever c^8 pivoted in front of the electromagnet c^5. When the electromagnet c^5 is deënergized, the lever c^8 is drawn back by means of a coiled spring c^9 and the pin c^7 removed from in front of the pin on the arm c^6, and the arm is free to be rotated by means of a spring or clock mechanism. Mounted to rotate with the arm c^6 is a disk or wheel c^{10}, having a portion of the periphery cut away at c^{11}. Upon the periphery of the wheel c^{10} rests a roller c^{12} carried upon the end of a pivoted arm c^{13}, the arm being connected with the conductor d' by a conductor d^6. The arm c^{13} is normally held out of engagement with the back contact c^{14}, which is connected with the conductor d. When the arm c^6 is released and has passed over the terminal contacts c' c^2, &c., it comes into engagement with the hook c^{15}, and when in this position the roller c^{12} enters the recess c^{11} and permits the lever c^{13} to come in contact with the back contact c^{14}, thus completing a short circuit about the electromagnet c^5. The hook c^{15} is connected by a conductor d^7 with the pole of the battery b.

Normally the circuit of battery b may be traced through conductor b' to contact c', thence by conductor b^2 through the thermostats a, conductor b^3, contact c^2, conductor b^4, thermostats a', conductor b^5, contact c^3, conductor b^6, thermostats a^2, conductor b^7, contact c^4, conductor d, electromagnet c^5, electromagnet e', conductors d^2 d^3, electromagnet f' back to the battery b. When the circuit is opened from any cause, as by the operation of one of the thermostats, the electromagnets c^5, e', and f' are deënergized. The deënergizing of the electromagnet e' of the transmitter e results in sending a signal to the central station, as will be hereinafter described.

The deënergizing of the electromagnet f' releases the armature-lever f^2 and causes the rotation of the index-finger f^5 to a position opposite the letter B, which stands for battery, thus indicating that the circuit is open. Deënergizing electromagnet c^5 releases the

arm c^6 and the arm begins to rotate. When the arm c^6 comes in contact with the first contact-terminal c', the circuit of battery b is closed through conductor b', contact-terminal c', contact-arm c^6, conductor d^3, and electromagnet f' back to the battery, thus actuating the electromagnet f', which attracts its armature and causes the rotation of the pinion f^4 through a distance equal to the pitch of one of its teeth, the index-finger being thus moved to a position midway between the letter b and the numeral 1. As the arm c continues its motion it breaks contact with the terminal c', and this opens the circuit just traced and deenergizes the electromagnet f', thus permitting the armature-lever f^2 to move back, rotating the pinion f^4 another tooth, the index-finger being thus brought opposite the numeral 1. The contact-arm c^6 next comes in contact with terminal c^2, and the circuit may be traced from battery b over conductor b' to contact c', conductor b^2, thermostats a on the first floor, terminal c^2, arm c^6, conductor d^3, electromagnet f' to battery. The index-finger f^5 is thus moved to a position midway between the numerals 1 and 2. As the contact-arm c^6 breaks contact with terminal c^2 the circuit just traced is opened and the index-finger f^5 is moved up to a position opposite the numeral 2.

Supposing, now, that the circuit is open upon the second floor, that is, that the circuit is open at one of the thermostats a', the circuit will remain open when contact-arm c^6 engages terminal c^3, and the contact-arm will continue its motion without again energizing the electromagnet f'. The index-finger f^5 will thus remain opposite the numeral 2, thus indicating that the disturbance is upon the second floor. As the arm c^6 continues its rotation it is engaged by the hook c^{15}, and the electromagnet of the indicating device is thus short-circuited by the circuit which may be traced from the conductor d^2 to the contact-arm c^6, hook c^{15}, and conductor d^7 back to the battery, so that subsequent closures of the circuit-battery b will not energize the electromagnet f' to disturb the indication of the indicator f. With the arm c^6 in engagement with the hook c^{15} the roller c^{12} rotates in the recess c^{11} and the arm c^{13} thus comes in contact with the anvil c^{14}, thus short-circuiting the electromagnet c^{15}. The transmitting instrument e comprises an electromagnet e', opposite which is pivoted an armature-lever e^2, upon which are provided pins e^3 e^4. An arm e^5 mounted upon the signal-wheel e^6 normally engages the pin e^3, the signal-wheel being thus maintained against rotation. Upon the periphery of the signal-wheel are provided teeth adapted as the wheel rotates to engage the spring e^7 and move same out of contact with the spring e^8, two series of teeth being provided upon the wheel whereby a double or treble signal is transmitted upon each rotation of the signal-wheel. The spring e^7 is connected by a conductor h through a relay h' with a battery h^2 at the central station, the return circuit being by conductor h^3 to the spring e^8. When the circuit is opened from any cause, the electromagnet e' is dëenergized and the armature-lever e^2 released to move the pin e^3 out of engagement with the arm e^5 and permit the signal-wheel to rotate, thus transmitting a double signal to the central station.

I will now describe the B or low side of the system. A series of thermostats k k' k^2 is provided upon the several floors in close proximity to the thermostats of the A side, the thermostats being included in a circuit which may be traced from battery l by conductor l' through the series of thermostats k k' k^2 thrcugh the electromagnet l^2 and back to the battery by conductor l^3. The electromagnet g^3 of the signaling instrument g is included in circuit with the battery l, the circuit being traced from the battery by the conductor l^4 to the electromagnet g^3 and thence to the conductor l^3 and back to the battery. From conductor l^4 a conductor l^5 extends to a spring e^9, normally resting in contact with a spring e^{10}, the spring e^{10} being connected by the conductor l^6 with a contact-point l^7 normally out of engagement with a contact-point l^8, which is connected with the battery through the conductor l^3. Opposite the pole of the electromagnet g^3 is pivoted armature-lever g^4, which carries a pin g^5, against which normally rests the arm g^6 mounted upon the signal-wheel g^7 of the indicator. The teeth of the signal-wheel g^7 are adapted, when the wheel rotates, to engage the spring g^8 and move same out of contact with the spring g^9. The spring g^8 is connected with the conductor h^4, which extends to the central station and with a relay h^5 and battery h^6, return being through the conductor h^3 to the spring g^9.

When from any cause the B side of the circuit is opened, the electromagnet l^2 is dëenergized and releases its armature l^9, thus releasing the drop l^{10}, which falls upon the contact l^8, closing the same against contact l^7. The electromagnet g^3 is thus short-circuited, the short circuit being traced from the battery l through conductor l^4, conductor l^5 contacts e^9 e^{10}, conductor l^6 contacts l^7 l^8, conductor l^3 to battery. Electromagnet g^3 being thus dëenergized, the pin g^5 is moved out of engagement with arm g^6 and the signal-wheel is permitted to rotate, thus successively separating the springs g^8 and g^9 and transmitting the signal to the central station.

When either of the circuits is opened alone, the particular transmitting instrument belonging thereto is actuated to send a signal to the central station. Such a signal is a false signal, and means are provided at the central station for preventing its passage beyond the central station, as will be hereinafter described. When, however, a fire occurs, both circuits are opened and both instruments transmit their signals to the central office, means, which I will now describe, being pro-

vided for causing the transmitting instrument to act successively, each instrument being thus caused to transmit its signal as often as may be desired. In practice each instrument transmits two duplicate signals to the central station, the first duplicate signal of the first instrument to operate being intercepted at the central station, while the three subsequent double signals are transmitted to the city hall and patrol station and constitute the fire-alarm signal.

When a fire occurs, the thermostats of the A or low side will operate first, since these thermostats are adjusted to operate at about fifteen degrees below those of the other side. This will deënergize the electromagnet e' and permit the rotation of the signal-wheel e^6, a double signal being thus transmitted to the central station. Immediately after or simultaneously with the opening of the circuit through the A side, the circuit is opened through the B side, thus deënergizing the electromagnet l^2 and effecting the closing of the contacts l^7 and l^8, thus short-circuiting and deënergizing the electromagnet g^3, which starts the signal-wheel g^7; but immediately that the signal-wheel e^6 starts to rotate, the springs e^9 e^{10} are separated in a manner hereinafter to be described, thus opening the short circuit of the electromagnet g^3 and energizing said electromagnet, which attracts its armature and moves the pin g^{10} into position to engage and check the movement of the contact-arm g^6, the rotation of the signal-wheel g^7 being thus prevented. When the signal-wheel e^6 has completed a rotation, the arm e^5 comes in contact with the pin e^4, carried upon the armature-lever, and the rotation of the signal-wheel is stopped. The contacts e^9 e^{10} are again closed together and the electromagnet g^3 thus shunted and deënergized, the armature-lever g^4 being released to move the pin g^{10} out of engagement with the arm g^6 and permit the signal-wheel g^7 to rotate, a double signal being thus transmitted from the transmitting instrument g. During the rotation of the signal-wheel g^7 the contacts g' g^2 are closed together, thus completing the circuit of the battery b through electromagnet e' by conductors d^4 and d to contact c^{14}, lever c^{13}, conductors d^6 and d', electromagnet e', conductor d^2, arm c^6, hook c^{15}, conductor d^7 to the opposite side of the battery. The armature-lever e^2 is thus attracted, moving pin e^4 out of engagement with arm e^5 and permitting the arm to move into engagement with pin e^3, which is now in position to check the movement of the arm. The signal-wheel e^6 is thus checked against rotation during the rotation of the signal-wheel g^7.

When the wheel g^7 has completed its rotation, the contacts g' g^2 are separated again and the electromagnet e' deënergized, thus permitting the rotation of the wheel e^6 to again send a signal from the A transmitter, the contacts e^9 e^{10} being meanwhile opened to effect the energization of electromagnet g^3 and prevent the rotation of signal-wheel g^7. When signal-wheel e^6 has completed its rotation, contacts e^9 e^{10} are closed together again, thus effecting the deënergization of electromagnet g^3 and permitting the signal-wheel g^7 to make its second rotation. After the second rotations of the two signal-wheels they are locked in position by the mechanism which will be hereinafter described. It is evident that, instead of having each wheel complete two rotations, any number of rotations may be made.

Referring now to the apparatus at the central station, the lever m of the relay h is connected by a conductor m' through relay o, battery o', and relay p, conductor m^2 to back contact m^3 of a second relay against which lever m^4 normally rests; thence by conductor m^5 to back contact m^6, against which lever m normally rests. The armature-lever o^2 of relay o is connected through the register o^3 and battery o^4 with back contact o^5. The armature-lever p' of relay p is connected through battery p^2, electromagnet p^3, switch-arm p^4, conductor p^5, with the back contact r of the relay r', against which normally rests the armature-lever r^2, which is connected by conductor r^3 with back contact r^4 of the relay h^5, against which rests armature-lever r^5, which is connected by conductor r^6 with relay-magnet s and back-contact anvil p^6, against which the lever p' normally rests. The armature-lever s' of relay s is connected with the register s^2 and battery s^3 through the contact s^4. When a signal is transmitted by the instrument e of the A side, the relay h' is successively operated, thus successively opening the circuit between lever m and contact m^6, thus successively deënergizing the relay-magnets o and p and moving the levers o^2 and p' successively to close the local circuits containing the registers o^3 and s^2, the signal being thus recorded upon each of the registers o^3 and s^2. The closing of the local circuit containing the battery p^2 energizes the electromagnet p^3, which releases the arm p^7, which is adapted to be rotated about a spring or clock mechanism, the mechanism being so adjusted that after the first double signal has been transmitted to the central station and recorded upon the registers thereof, the arm p^7 comes in contact with the arm p^4 and moves the same off of the terminal p^8. The short circuit through arm p^4 is thus interrupted and current is allowed to pass through the indicator t and battery t' to the register t^2 at the patrol station and the register t^3 at the city hall, the current returning by the conductor p^9. The circuit through the registers t^2 and t^3 being thus completed, any subsequent signals transmitted to the central station will also be registered at the patrol station and at the city hall.

When a signal is sent from the instrument g of the B side, the relay h^5 is operated to successively open the circuit between the contact r^4 and the lever r^5, the circuit through

relay s being thus successively operated to produce a record upon the register s^2 and also upon the registers i^2 and t^3, the circuit being traced from lever r^5 through conductor r^6, relay s, contact p^6, lever p', battery p^2, electromagnet p^3, indicator t, battery t', registers t^2 t^3, conductors p^9 p^5, contact r, lever r^2, conductor r^3, to contact r^4. The battery t' is employed to assist the local battery p^2 in energizing the circuit extending to the distant patrol station and city hall. It will thus appear that all signals sent from the A side are recorded upon both the registers o^3 and s^2, while signals sent from the B side are recorded upon the register s^2 but not upon the register o^3, while all signals except the first duplicate signal sent are recorded upon the registers t^2 t^3. Since all fire-signals result from the successive operation of the transmitters e and g, the fire-signals are forwarded to the patrol station and the city hall, while all false alarms that may arise upon either circuit send but a single duplicate signal to the central station, which is intercepted and does not pass to the patrol station or the city hall.

The line springs v v' of a spring-jack are connected with the conductor m', and a line-spring v^2 is connected with the conductor m^5, and back contact v^3 is provided for the relay-lever m, and is connected with line-spring v^4. A double plug is adapted to be inserted into the spring-jacks, the plug comprising contacts v^5 v^6, adapted to make contact respectively with springs v^4 v and with contacts v^7 v^8, adapted to make contact respectively with line-springs v^2 v'. The detailed structure of the plug and spring-jack is shown in Figs. 10 and 11. An auxiliary register v^9 and a battery v^{10} are included in circuit between the contacts v^5 and v^6, so that when the plug is inserted in the spring-jacks the register and battery are included in a local circuit which may be traced from the battery to contact v^6, line-spring v, relay-lever m, back contact v^3, line-spring v^4, contact v^5, through the register v^9 to the battery. When it is desired to cut out the regular register, the double plug may be inserted in the spring-jack and the register v^9 substituted in place of the regular register. Since all calls coming to the central station are recorded upon the registers o^3 and s^2, some provision should be made for taking care of two signals that might be simultaneously sent to the central station, and for this purpose shutters h^7 h^8 are provided in the A and B circuits respectively adapted to indicate when a signal is sent over the line. If the operator notes the indicators of two different systems fall at the same time, a double plug is inserted in the spring-jack of one of the systems, and the signal coming over that system will be recorded upon the auxiliary register v^9, the relay acting through the local circuit above traced.

In the local circuit containing the register o^3 are provided spring-jacks v^{11} v^{12}, into which plugs v^{13} v^{14} may be inserted to cut out the register o^3 and cut the register v^9 into circuit, when for any reason it is desirable to disconnect the register o^3. Spring-jacks are likewise provided in the local circuit containing the register s^2 for a similar purpose.

In Figs. 3 and 4 is illustrated in detail the mechanism of the transmitting instrument of the B side of the circuit, the instrument comprising a pivoted arm g^6 adapted to be rotated by a clock mechanism, a pin w being provided upon the arm adapted when the arm rotates to engage the under surface of the ring w', which is carried upon the end of an arm w^2 pivoted at w^3. Upon the arm w^2 is mounted a contact-spring g', which is connected with the conductor d^4 of Fig. 1. When the pin w engages the under side of the ring w', the lever w^2 is rotated and the spring g' is brought into engagement with the contact g^2, which is connected with the conductor d^5 of Fig. 1. The signal-wheel g^7 is mounted to rotate with the arm g^6 and is provided with teeth extending from its periphery, which are adapted to engage spring g^8 and successively move the same out of contact with the spring or contact g^9 when the wheel rotates. The spring g^8 is connected with the conductor h^4 of Fig. 1, while spring g^9 is connected with the conductor h^3 of Fig. 1. Opposite the pole of the electromagnet g^3 rests the armature-lever g^4 carrying the pins g^5, g^{10}, g^{11}. Upon a rotating wheel w^4 is provided a pin w^5 adapted to be engaged by the arm g^6, as the arm makes its first rotation, to rotate the wheel through such a distance as to bring the hook w^6 into position to be engaged by the arm g^6 upon its second rotation, the arm being thus held against further rotation by means of the hook w^6.

In Figs. 5, 6, and 7 is illustrated the transmitting instrument of the A side, the apparatus being of the same general construction as that of the B side. Upon the rotating arm e^5 is carried a pin x adapted to engage the under side of a ring x' carried upon the end of an arm x^2, pivoted at x^3. Upon the end of the arm x^2 is carried a contact-spring e^{10}, normally in engagement with the under side of a contact spring e^9, but adapted to be moved out of engagement therewith when the pin x engages the ring x'. The springs e^{10} and e^9 are connected respectively with the conductors l^6 and l^5 of Fig. 1. The signal-wheel e^6 is mounted to rotate with the arm e^5 and carries teeth upon its periphery adapted to successively separate springs e^7 e^8, which are connected respectively with the conductors h' h^3 of Fig. 1. Opposite the electromagnet e' is mounted the armature-lever e^2, which carries the pins e^3 and e^4. The arm e^5 normally occupies the position illustrated in full lines in Fig. 5, being checked against rotation by the pin e^3, while the arm g^6 normally occupies the position illustrated in full lines, being maintained

against rotation by the pin g^5. When the A side of the system is opened, the magnet e' is deënergized and the armature-lever e^2 moves to the position indicated in dotted lines, thus moving the pin e^3 out of engagement with arm e^5 and permitting the arm to rotate, the arm engaging and rotating the wheel w^4 in its travel and being checked against further rotation by the engagement with the pin e^4, which, when the armature e^2 is unattracted, rests in position to engage the arm.

When the B side of the circuit is opened alone, the pin g^5 is moved out of engagement with the arm g^6 and the arm makes a rotation, moving the wheel w^4 and being checked by the pin g^{11}, which is in position to engage the arm when the lever g^4 is unattracted. The attendant observing that the wheel w^4 in either case has been rotated through half its travel will know that the transmitting instruments have responded to a disturbing call, as otherwise the instruments would have made two rotations, and when the magnet e' is energized, the arm e^5 is released by the pin e^4 and engaged by the pin e^3, while the arm g^6 is released by the pin g^{11} and engaged by the pin g^5. When a true alarm-signal is sent in and both magnets e' and g^3 are deënergized at the same time or in close succession, both transmitting instruments would send in their signals, were not some means provided for locking one of the instruments. It will be observed that the pin x in Fig. 5 has but a short distance to travel before engaging the ring x', as compared with the distance which the pin w must travel before engaging the ring w', so that when both instruments are actuated simultaneously, the lever x^2 is first rotated to separate the contacts e^9 e^{10}, which effects the energization of the electromagnet g^3, as explained in connection with Fig. 1. The armature-lever g^4 is thus moved to bring the pin g^{10} into engagement with the arm g^6 and check its further rotation. The pin x passes from beneath the ring x', thus closing together the contacts e^9 e^{10} and effecting the deënergization of electromagnet g^3, which releases its armature and withdraws the pin g^{10} from engagement with the arm g^6, which begins its rotation. Immediately thereafter the pin w comes in contact with ring w' and closes together contacts g' g^2, thus energizing electromagnet e' and bringing pin e^3 into position to check the rotation of arm e^5.

In Figs. 8 and 9, I have illustrated the form of thermostat which I preferably employ, but which in its individual capacity forms no part of the present invention. Upon the ends of standards or supports y y' is soldered by means of fusible metal, a wire y^2 carrying a weight y^3. When the temperature reaches the predetermined degree, the solder is fused and the weight withdraws the wire from engagement with the supports, thus opening the circuit, which is normally maintained through the supports and wire in series. By making the supports y y' of different sizes the solder may be caused to fuse at the desired degree, the rate of conduction of the heat to the fusible solder being thus adjusted. By making the supports of the A side smaller in cross-section than the supports of the B side, the thermostats of the A side may be caused to operate in advance of those of the B side.

In Fig. 14 I have illustrated diagrammatically the devices for detecting grounds and short circuits. The central-station apparatus, except the batteries h^2 h^6, is omitted for clearness. The conductors h h^3 h^4 of the circuit H extending through a number of buildings I I' I², likewise conductors h h^3 h^4 of a second circuit H' extend through a number of buildings I³ I⁴ I⁵. A conductor extends to the ground from each of the conductors h^3 of the circuits H H', and in the ground-conductor is included an indicator z^2 and a battery z^3, so that should a ground occur upon either of the circuits H or H' the circuit of battery z^3 will be closed to actuate the indicator z^2.

Should a short circuit occur across the conductors h h^3 h^4 at any point, as, for instance, along the line 1 1, shown in connection with circuit H, the current from the batteries h^2 h^6 would pass through the short circuit 1 1, thus preventing the passage of any current to the buildings or protective circuits beyond the short circuit, as, for instance, to building I². It is necessary, therefore, to provide means for indicating at the central station when such a short circuit exists upon the line. At the extreme end of the circuit H is provided an electromagnet n included in circuit between the conductors h^3 h^4, and an electromagnet n' is included in the circuit between the conductors h and h^3. The extremity of a second circuit H' is extended to a position near the extremity of the circuit H and in the circuit H' are provided signal-wheels n^2 n^3, one in circuit between the conductors h^3 and h^4 and the other between the conductors h and h^3 of the circuit H'. The signal-wheels are normally prevented from rotating by the attraction of the electromagnets n and n' upon their respective armature-levers n^4 n^5. Should a short circuit occur upon the circuit H one or both of the electromagnets n n' would be deënergized, thus releasing one or both of the signal-wheels n^2 n^3 and transmitting a signal to the central station over the circuit H' to indicate that the circuit H is short-circuited. Electromagnets i and i' are likewise included in the circuit H', while signal-wheels i^2 i^3, controlled thereby, are included in circuit H, whereby a short circuit upon the circuit H' may transmit a signal to the central station over the circuit H.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a fire-alarm system, the combination with two circuits extending throughout the district to be protected, of thermostats or responsive instruments in each of said circuits, the thermostats of one of said circuits being constructed to change the electrical condition

of the circuit at a lower temperature than the thermostats of the other circuit, a signal-transmitting device included in each of said circuits, and means for intercepting the signal when but one of said signal-transmitting devices is operated; whereby, when both signal-transmitting devices are operated in succession, the signal is transmitted to its destination, while, when but one is operated, the signal is intercepted; substantially as described.

2. In a fire-alarm system, the combination with two circuits extending throughout the district to be protected, of a signal-transmitting instrument in each of said circuits, each of said signaling instruments being constructed to transmit a signal of a definite duration when its own circuit alone is opened, means for causing the signaling instruments to operate successively when both circuits are opened, to transmit a signal of longer duration, a registering device at the central station, a registering device at a distant fire-alarm station and means for preventing the passage to the distant fire-alarm station of the shorter signal transmitted when one of the signaling instruments alone is operated, whereby a false signal is intercepted at the central station; substantially as described.

3. In a fire-alarm system, the combination with two circuits extending throughout the district to be protected, and a signal-transmitting device in each of said circuits, means for operating said signaling devices successively when both circuits are opened, registering devices at the central station and at a distant fire-alarm station, a switch normally disconnecting the register at the distant station from the circuit, said switch being constructed to cut the distant register into circuit by the transmission of a signal and having a predetermined duration of operation greater than the duration of a signal transmitted by either of said signaling instruments when acting alone.

4. In a fire-alarm system, the combination with a circuit extending in series throughout a number of localities to be protected, of a series of terminals included in said circuit, one terminal being included in circuit in advance of each of the localities to be protected, a contact-arm adapted to be moved over said terminals to successively open and close the electric circuit including the terminals and the localities to be protected, an electromagnet normally energized to lock said contact-arm in position, an indicator-needle adapted to be moved over a dial, a second electromagnet normally energized to maintain said indicator-needle at the zero-point, and an electric circuit including said second electromagnet, the contact-arm and one or more of said terminals and the localities connected therewith as the contact-arm rotates; whereby the circuit through the second electromagnet is successively opened and closed to move the needle step by step; substantially as described.

5. In a fire-alarm system, the combination with the circuit extending throughout the localities to be protected, of a circuit-controlling device comprising the terminals c' c^2, and so forth, interposed in the circuit between the several localities, the contact-arm c^6 adapted to be moved over said terminals, and the electromagnet c^5 normally energized to maintain said arm c^6 against rotation, the indicating device comprising the electromagnet f' and the index-finger adapted to be moved by the successive energization and de-energization of the electromagnet f', the hook c^{15} adapted to be engaged by the arm c^6 to short-circuit the electromagnet f' and the lever c^{13} adapted to engage the contact c^{14} to short-circuit the electromagnet c^5, substantially as described.

6. In a fire-alarm system, the combination with two circuits extending throughout the district to be protected, of a signal-transmitting instrument included in each of said circuits, electromagnets normally energized to prevent the operation of said signaling devices and contacts controlled by each of said signaling instruments for reciprocally maintaining the electromagnet of the other instrument energized during the operation of one of the instruments, whereby the instruments are caused to transmit their signals successively; substantially as described.

7. In a fire-alarm system, the combination with the signaling instruments e and g of the contacts g' g^2 adapted to be closed together by the operation of the instrument g to maintain a closed circuit through electromagnet e' of instrument e and contacts e^9 e^{10} adapted to be separated by the operation of instrument e to open the short circuit about the electromagnet g^3 of instrument g and permit the energization of the same; substantially as described.

8. In a fire-alarm system, the combination with the two circuits extending throughout the district to be protected, of the circuit-controlling instrument c, indicating device f and signaling instrument e included in one of said circuits, the signaling instrument g and electromagnet l^2 included in the other of said circuits, the normally open short circuit about the electromagnet of instrument g adapted to be closed by the energization of the electromagnet l^2, contacts e^9 e^{10} adapted to be separated during the operation of the instrument e to open said short circuit, and the contacts g' g^2 adapted to be closed together during the operation of instrument g to complete circuit through the magnet e' of instrument e; substantially as described.

9. In a fire-alarm system, the combination with two circuits extending throughout the district to be protected, of a signal-transmitting instrument in each of said circuits, a relay included in each of said circuits at the central station, two registers at the central station, and means for operating both of said registers by one of said signal-transmitting

instruments and for operating a particular one of said registers by the other of said signal-transmitting instruments; substantially as described.

10. In a fire-alarm system, the combination with two circuits extending throughout the district to be protected, of a signal-transmitting instrument in each of said circuits, relays h' h^5 at the central station one included in each of said circuits, a local circuit for said relay h' including the contacts of said relay and the electromagnets of two other relays o and p, a register included in circuit with the contacts of relay o, a local circuit for the relay h^5 including the contacts thereof, the electromagnet of a relay s, the contacts of relay p and a registering device; whereby both of the registers are operated by the relay h', while but one of the registers is operated by the relay h^5; substantially as described.

11. In a signal-transmitting instrument, the combination with an electromagnet, of an armature-lever thereof, a rotating arm normally engaged by said armature-lever and adapted to rotate when free, a pin or cam-surface carried upon said arm and a cam-ring adapted to be engaged thereby and mounted upon the end of a pivoted lever, and contact-points controlled by the rotation of said lever; substantially as described.

12. In a signal-transmitting instrument, the combination with the rotating arm of the wheel w^4 carrying the pin w^5 adapted to be engaged by the arm during the first rotation, a hook w^6 adapted to be engaged by the arm to check the rotation of the same during the second rotation; substantially as described.

13. The combination with the rotating arm g^6 carrying the pin w, of the pivoted arm w^2 carrying the cam-ring w', and the contacts g' g^2, the arm e^5 carrying the pin x, pivoted lever x^2 carrying cam-ring x, and contacts e^9 e^{10}, said pin x being arranged to engage ring x' before the pin w engages the ring w'; substantially as and for the purpose set forth.

14. In a fire-alarm system, the combination with three conductors extending to the central station, of a signal-transmitting instrument at the substation in circuit between one of said conductors and the second conductor, a signal-transmitting instrument at the substation in circuit between one of the first-mentioned conductors and the third conductor, a relay and a battery in circuit with each of said signal-transmitting instruments and situated at the central station, a ground branch at the central station extending from the conductor common to the two circuits and an indicator and a battery in said ground-branch, whereby when a ground occurs upon any of the three conductors the indicator is actuated, substantially as described.

15. In a fire-alarm system, the combination with two separate circuits extending from the central station to the district to be protected, of a signal-transmitting device in each of said circuits in the vicinity of the district to be protected a responsive device in each of said circuits at the central station, an electromagnet in one of said circuits at the signal-transmitting end, and a signal-wheel controlled thereby and included in the other circuit; whereby, when the circuit containing the electromagnet is short-circuited, the signal-wheel is operated to transmit a signal to the central station over the opposite circuit; substantially as described.

In witness whereof I hereunto subscribe my name this 12th day of July, A. D. 1895.

JOHN YOUNG.

Witnesses:
JOHN W. SINCLAIR,
W. CLYDE JONES.