No. 824,804. PATENTED JULY 3, 1906.

G. F. MILLIKEN.

AUXILIARY FIRE ALARM SYSTEM.

APPLICATION FILED OCT. 20, 1905.

5 SHEETS—SHEET 1.

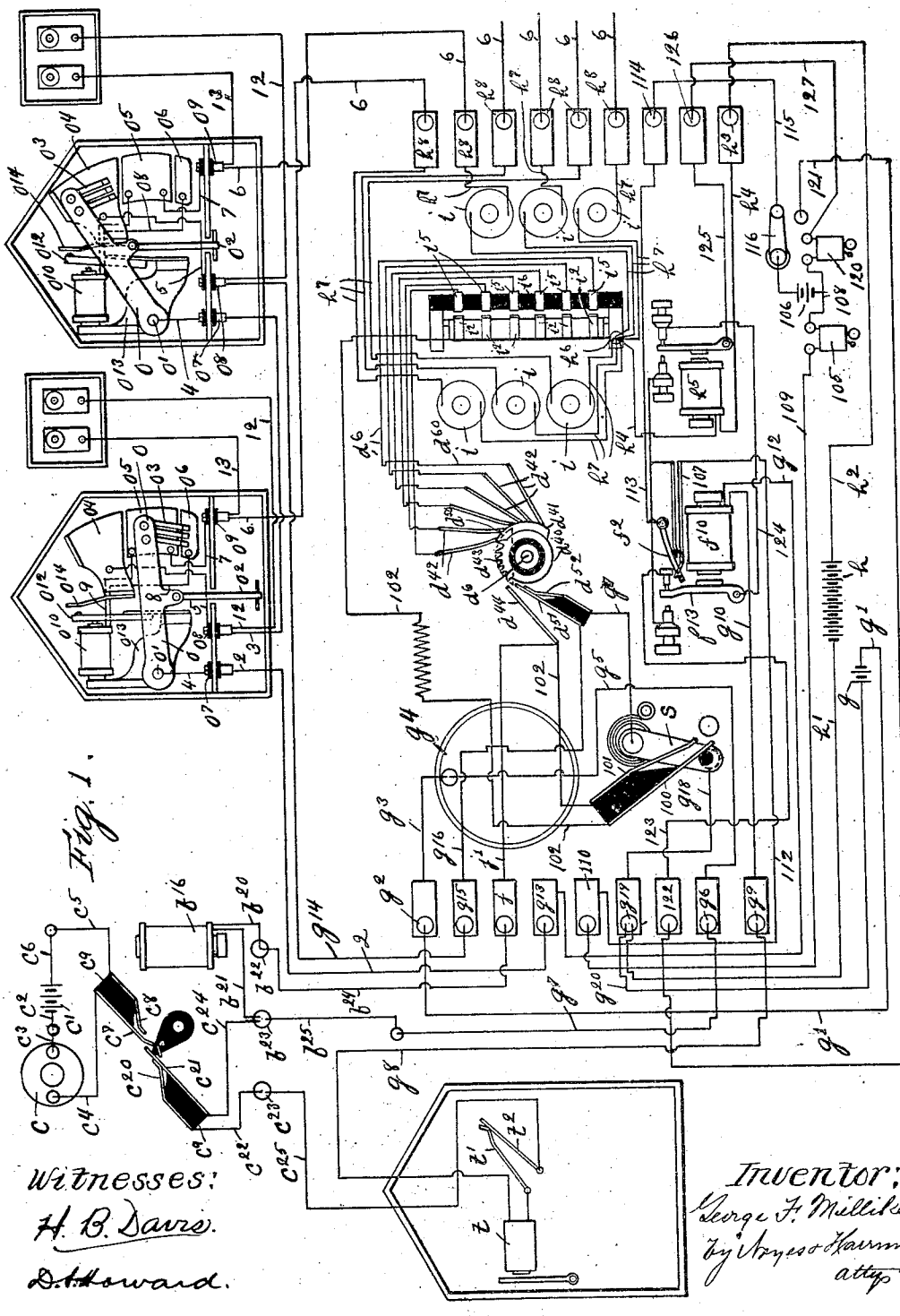

Fig. 1.

Witnesses:
H. B. Davis.
D. A. Howard.

Inventor:
George F. Milliken
by Noyes & Harriman
atty

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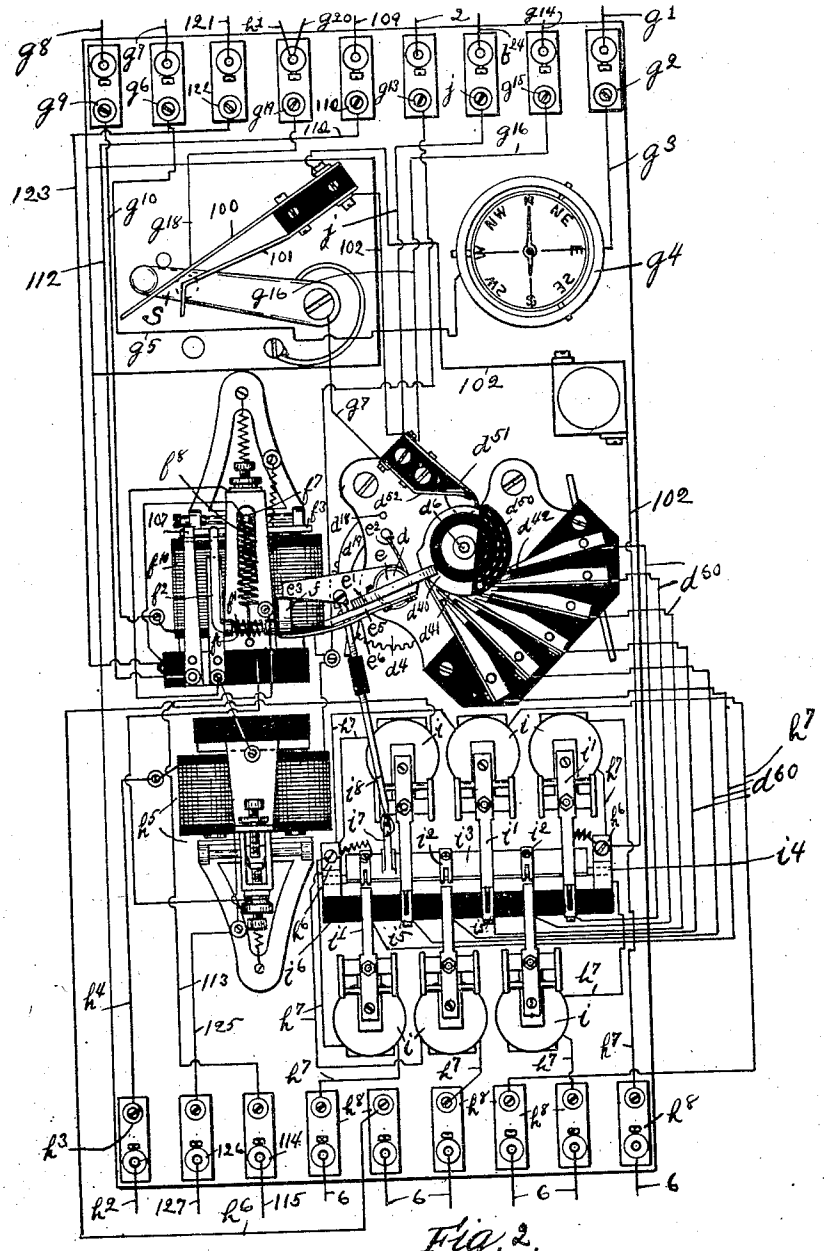

Fig. 2.

Witnesses:
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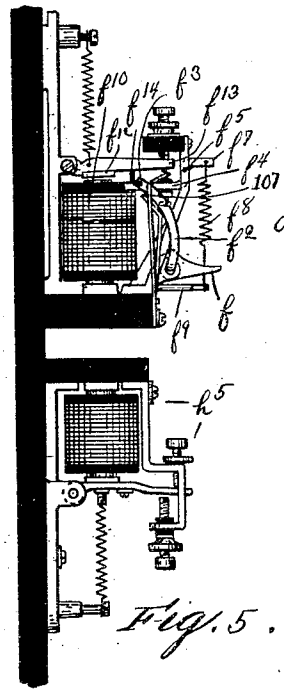

Fig. 5.

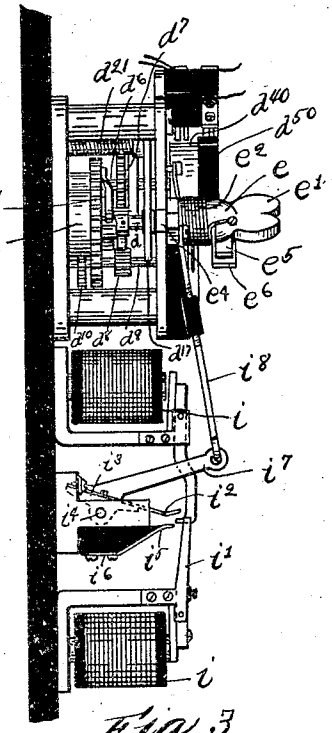

Fig. 3.

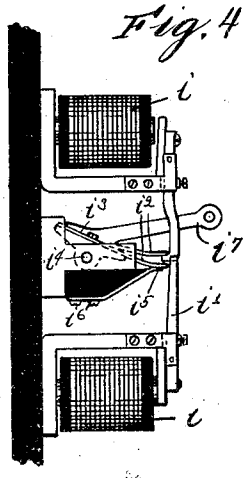

Fig. 4.

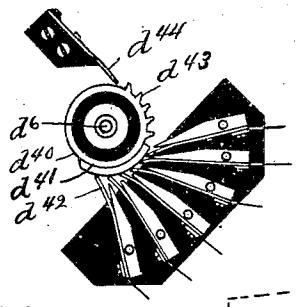

Fig. 7.

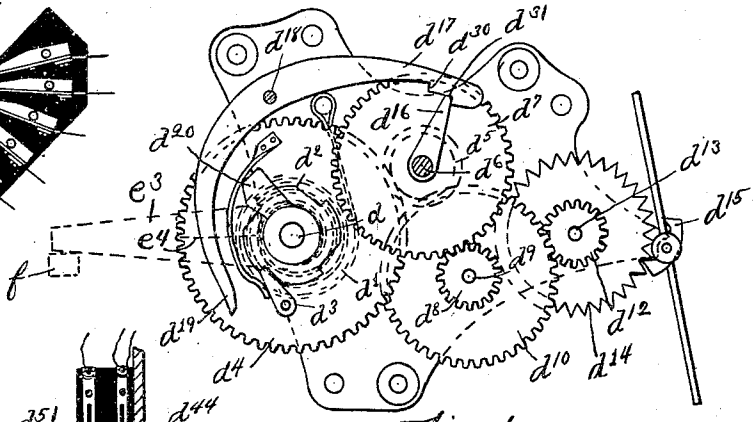

Fig. 6

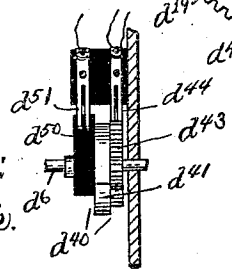

Fig. 8

Witnesses:
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No. 824,804. PATENTED JULY 3, 1906.

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AUXILIARY FIRE ALARM SYSTEM.

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5 SHEETS—SHEET 4.

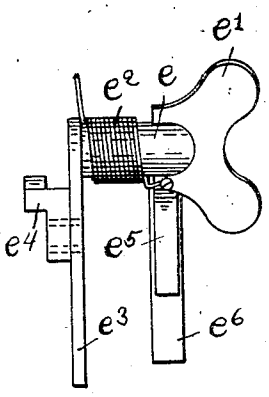


Fig. 9

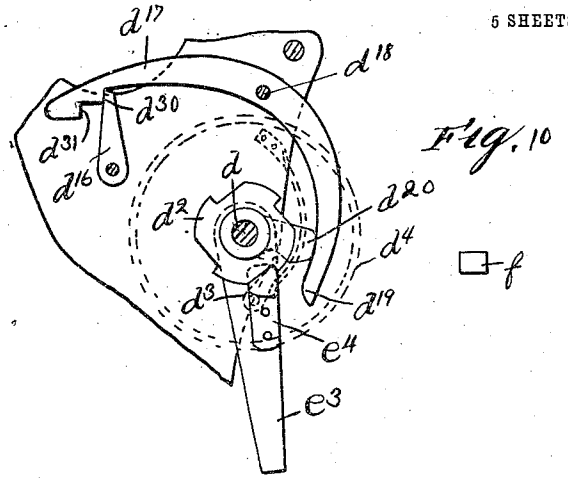


Fig. 10

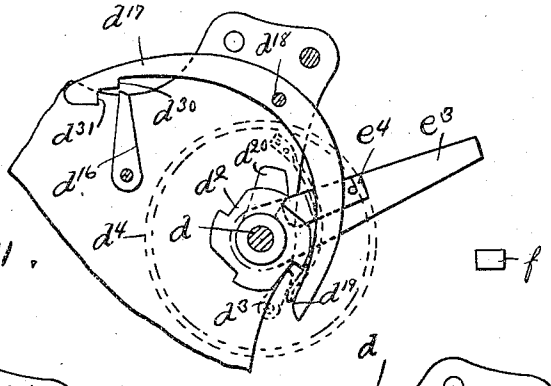


Fig. 11.

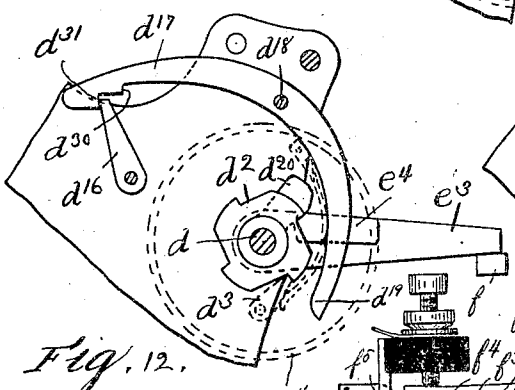


Fig. 12.

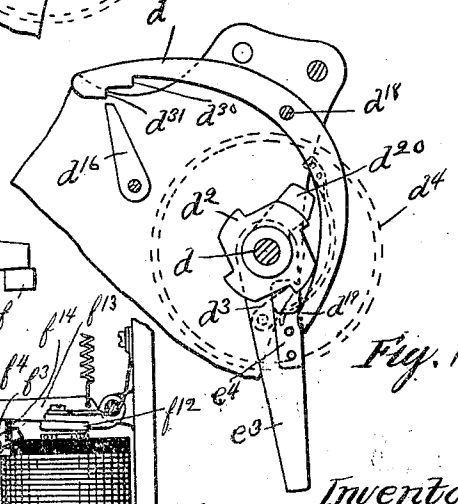


Fig. 13.

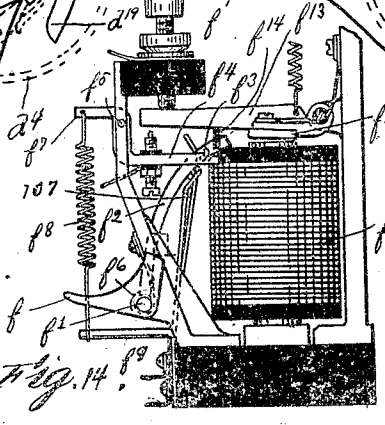


Fig. 14.

Witnesses:
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5 SHEETS—SHEET 5.

Fig. 15.

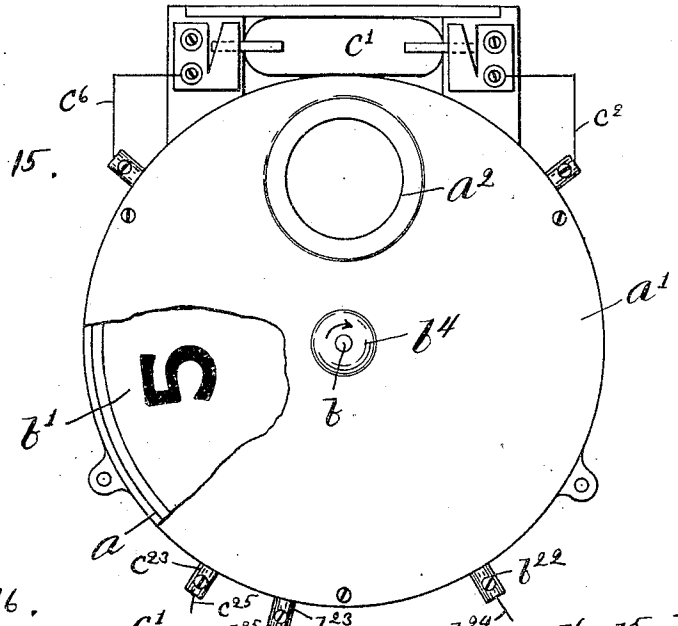



Fig. 16.

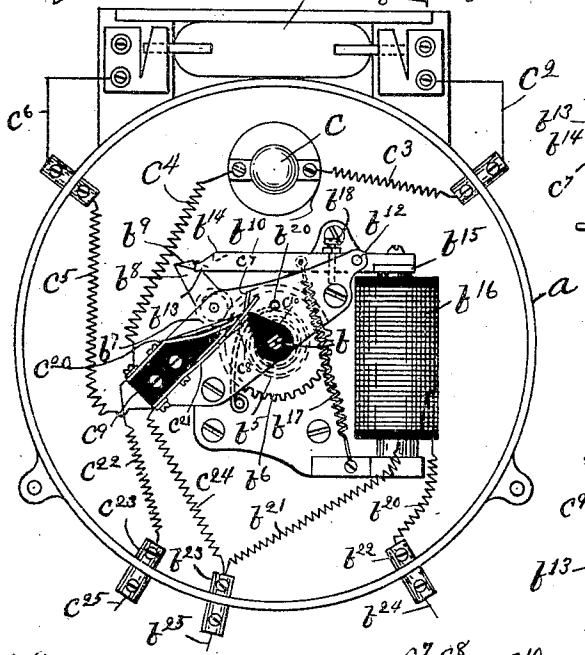
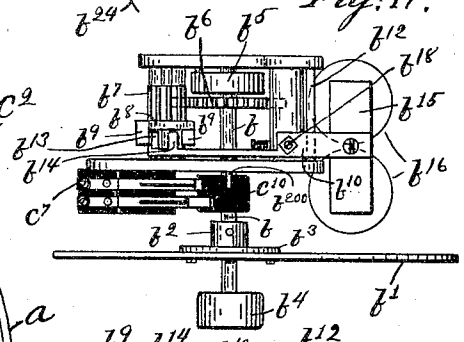



Fig. 17.



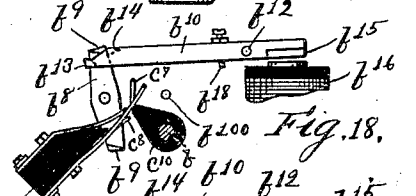




Fig. 18.

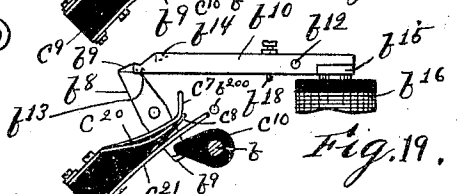



Fig. 19.

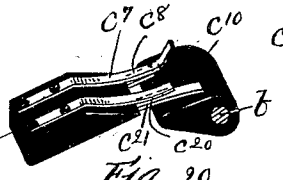



Fig. 20

Witnesses:

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Inventor:

George F. Milliken

by Noyes & Harriman

Attys

# UNITED STATES PATENT OFFICE.

GEORGE F. MILLIKEN, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO GAMEWELL FIRE-ALARM TELEGRAPH COMPANY, OF NEW YORK, N. Y.

## AUXILIARY FIRE-ALARM SYSTEM.

No. 824,804. Specification of Letters Patent. Patented July 3, 1906.

Application filed October 20, 1905. Serial No. 283,590.

*To all whom it may concern:*

Be it known that I, GEORGE F. MILLIKEN, of Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Auxiliary Fire-Alarm Systems, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention has for its object to provide an auxiliary fire-alarm system with an indicating device by which the number of the substation in the auxiliary circuit which has been operated to cause the street-box to send in the alarm will be indicated at a point to be observed conveniently by the firemen responding to the alarm.

As the fire apparatus responding to an alarm first goes to the fire-alarm box, or what is commonly called the "street-box," I prefer to locate the indicator on the pole or other support to which said box is attached, although said indicator may be placed anywhere in the vicinity of said street-box or elsewhere so far as my invention is concerned. The indicator which I employ is of the visual type in order that it may be observed quickly by the firemen, and while many forms of visual indicators are now well known which are suitable for the purpose, yet my invention also includes the general construction of a visual indicator which is especially devised for the purpose. The visual indicator herein shown consists, essentially, of a circular glass dial having numbers thereon and means for moving said dial step by step to bring the numbers successively back of a window or opening in the front of a suitable case containing the indicating apparatus. A miniature electric light, which is lighted when the indicator operates, is located back of said dial to illuminate it in order that the numbers on the dial may be observed at night. The indicator is provided with a telltale-switch, which is included in the auxiliary circuit and normally held closed by the indicating apparatus and adapted to be opened whenever the indicating apparatus is operated and to thereafter remain open, and thereby hold the auxiliary circuit open until the indicating apparatus has been reset, said switch thereby indicating whether or not the indicator is set in condition to operate. The street-box is provided with auxiliary actuating mechanism of any well-known or suitable construction adapted to be operated by the auxiliary circuit, and the auxiliary circuit, as usual, extends to and includes several buildings or several floors of a large building, or both, and has included in it several circuit-operating devices, one or more for each building or floor of a building, as may be required. These circuit-operating devices are, so far as the present invention is concerned, of any well-known or suitable construction and constitute substations, and the indicator is designed to indicate which substation has been operated to cause the street-box to send in the alarm, so that the firemen may quickly determine the exact location of the fire.

At some convenient location—as, for instance, in one of the buildings—an apparatus is located for operating the indicator. This apparatus is operated by any one of the substations, and when operated will cause the indicator to display the number of the particular substation, room, or building from which the alarm originated. The apparatus comprises, essentially, a multiple-signal transmitter adapted to operate the circuit of said indicator having selecting devices which determine or control its operation which are under the control of the several substations, there being one selecting device for each substation or group of substations in a room or building, as desired. The transmitter will operate the circuit of the indicator a number of times in succession, according to the particular selecting device which is operated by the substation, so that the indicator will set up or display the number of the substation.

While many forms of multiple-signal transmitters may be employed for carrying out my invention, yet the particular form herein shown possesses many advantages, and its general construction, therefore, forms a part of the present invention.

The transmitter herein shown is normally wound and is let off simultaneously with the release of the street-box by means controlled by the auxiliary circuit and is provided with a telltale-switch which is included in the auxiliary circuit and which is closed when the transmitter is wound and adapted to be opened whenever the transmitter is operated and to remain open until the transmitter has been rewound, thereby indicating whether or

not the transmitter has been reset. Testing devices are also provided for testing the several circuits.

Figure 1 shows a diagram of an auxiliary fire-alarm system having an indicating device embodying this invention. Fig. 2 is a front elevation of the means for operating the indicator, which is controlled by any of the substations, comprising, essentially, a multiple-signal transmitter and selecting devices therefor and a tripping-magnet. Fig. 3 is a side elevation of the multiple-signal transmitter and selecting devices. Fig. 4 is a side view of the selecting devices, the parts being in the position they will occupy when the signal is being transmitted to the indicator. Fig. 5 is a side view of the tripping-magnet and also of the cross-relay. Fig. 6 is a face view of the multiple-signal transmitter, the face-plate being removed and the transmitter at rest. Fig. 7 is a detail of the signal-wheel in its normal position. Fig. 8 is an edge view of the signal-wheel. Figs. 9 to 13, inclusive, are details of the winding device of the multiple-signal transmitter. Fig. 14 is an enlarged detail of the tripping-magnet. Fig. 15 is a front view of the indicator. Fig. 16 is a front view of the indicator with the face-plate and dial-plate removed. Fig. 17 is a plan view of the indicating mechanism. Figs. 18 to 20, inclusive, are details of the switches operated by the indicating mechanism to be referred to.

The visual indicator which I prefer to employ will first be described. (See Figs. 15 to 20.) $a$ represents the body of a shell or case of suitable size and shape to contain the operating parts, and $a'$ the front plate thereof, having a circular or other shaped opening $a^2$, back of which a numbered dial-plate $b'$ will be displayed. $b$ represents the main shaft of the indicating apparatus, upon which the numbered dial-plate $b'$ is rigidly mounted, having on its face the numbers of the several substations. The dial-plate $b'$ is secured to a flange $b^3$, extended from a collar or hub $b^2$, which is pinned or otherwise secured to the shaft. A knob $b^4$ is secured to the shaft $b$, which serves as a means for turning it by hand for the purpose of winding it. A spring $b^5$ is provided for turning the shaft, the inner end of which is attached to the shaft and the outer end to a fixed point. A toothed gear $b^6$ is secured to the main shaft, which engages a pinion $b^7$, journaled in the frame, and to the arbor bearing said pinion $b^7$ a detent-carrier is secured, which consists of a cross-bar $b^8$, secured to the arbor at a point intermediate its length and bearing at each end a detent $b^9$, formed as a laterally-extended lug. A let-off lever $b^{10}$, made as a double locking-lever, is pivoted at a point intermediate its length, as at $b^{12}$, to the frame, said lever bearing at one end two locking projections or let-offs $b^{13}$ $b^{14}$, located a short distance apart, and one occupying a plane above the other. These projections or let-offs $b^{13}$ $b^{14}$ are made as lugs extended laterally from one side of the lever, and each is formed with one beveled face, and they are designed to be successively engaged by the detents $b^9$. The armature $b^{15}$ of an electromagnet $b^{16}$ is attached to the opposite end of said lever $b^{10}$. A retractile spring $b^{17}$ is attached at one end to said lever $b^{10}$ and at the other end to a fixed point, the function of which is to move the armature into its retracted position. An adjusting-screw $b^{18}$ passes through the lever $b^{10}$, which by striking a fixed part of the frame or other stop limits the downward movement of the lever. Normally the armature $b^{15}$ occupies its retracted position, and the detent $b^9$ engages the locking projection $b^{14}$, as shown in Fig. 18, and thereby locks the main shaft bearing the dial-plate in its normal position.

When the armature is attracted, the locking projection $b^{14}$ disengages the detent $b^9$, and the arbor bearing the detent-carrier revolves until the other detent $b^9$ is brought into engagement with the locking projection $b^{13}$, (see Fig. 19,) making half a revolution. During this half-revolution of the arbor the main shaft $b$ will be revolved by the spring $b^5$ far enough to bring the first number on the dial into position back of the opening $a^2$. Subsequently the armature will be retracted and the locking projection $b^{13}$ will disengage the detent $b^9$, and the latter will move into engagement with the locking projection $b^{14}$ preparatory to being released when the armature is again attracted. This operation will be repeated to successively operate the dial-plate $b'$ step by step and bring the numbers into position back of the opening $a^2$. To restore the dial-plate to its normal position and wind the spring $b^5$, the operator will turn the knob $b^4$ in the direction of the arrow, Fig. 15, and when doing so the toothed gear $b^6$ will revolve the pinion and detent-carrier and the detents $b^9$ will engage the bevel-faces of and pass by the locking projections $b^{14}$ $b^{13}$ until a cam-block $c^{10}$, which is secured to the main shaft, strikes against a fixed pin $b^{200}$, projecting from the frame.

The dial-plate $b'$ is preferably made of transparent material, and a miniature electric lamp $c$ is contained in the shell or case back of the dial-plate for the purpose of illuminating it when the indicator is operated, and said lamp is contained in a suitable socket, which is connected in a lamp-circuit especially provided for it, said circuit consisting of the circuit-wires $c^2$, $c^3$, $c^4$, $c^5$, and $c^6$, connected to the battery $c'$, and said lamp-circuit contains a switch which normally holds said circuit open, but which closes it whenever the indicating apparatus is operated. The switch herein shown for operating the lamp-circuit consists of a pair of spring-acting contact-pens $c^7$ $c^8$, mounted upon a

block of insulating material $c^9$ and having a normal tendency to close together, and means for separating them consisting of a cam $c^{10}$, composed of a block of insulating material, which is secured to the main shaft $b$. The circuit-wires $c^4$ $c^5$ are respectively connected to the pens $c^7$ $c^8$.

Normally the cam $c^{10}$ engages the uppermost contact-pen $c^7$ and lifts it free from the contact-pen $c^8$, so as to hold the lamp-circuit open, but whenever the main shaft $b$ is turned by its retracting-spring, as it will be whenever the indicator operates, said cam will disengage said contact-pen $c^7$, and thereby permit it to close onto the contact-pen $c^8$, and thus close the lamp-circuit and cause the lamp to glow. The electromagnet $b^{16}$ of the indicating apparatus is included in a circuit which is adapted to be operated by a multiple-signal-transmitting apparatus and which is herein referred to as the "indicator-circuit." The indicator-circuit when established is normally open at the multiple-signal transmitter.

A telltale-switch is also included in the box containing the visual indicator, which is connected with the auxiliary circuit and is normally closed, but is adapted to be opened when the indicator is first operated and to be subsequently closed by hand when the indicator is wound. This switch is provided for the purpose of showing whether or not the indicator has been wound or reset, which it does by holding the auxiliary circuit open until such act has been performed. The switch is represented as two contact-pens $c^{20}$ $c^{21}$, attached to the opposite sides of the block $c^9$, the ends of which project beyond the block and have a normal tendency to spring apart, and the ends of said pens project into the path of movement of the cam $c^{10}$ and are held by said cam in engagement with each other when said cam is in its normal position, being the position which it occupies when the indicator is wound. Upon the first operation of the indicator the cam $c^{10}$ is turned, permitting said contact-pens $c^{20}$ $c^{21}$ to spring apart and open the auxiliary circuit, and at or about the same time the contact-pens $c^7$ $c^8$ close together and close the lamp-circuit.

Circuit-wires $b^{20}$ $b^{21}$ lead from the electromagnet $b^{16}$, respectively, to the binding-posts $b^{22}$ $b^{23}$, and a circuit-wire $b^{24}$ is connected to the binding-post $b^{22}$, which forms a part of the indicator-circuit which is operated by the multiple-signal transmitter, and a circuit-wire $b^{25}$ is connected to the binding-post $b^{23}$, which forms a part of the auxiliary circuit, but which is adapted to form a part of the indicator-circuit when the auxiliary circuit is open. A circuit-wire $c^{22}$ leads from the contact-pen $c^{20}$ to the binding-post $c^{23}$, and a circuit-wire $c^{24}$ leads from the contact-pen $c^{21}$ to the binding-post $b^{23}$. A circuit-wire $c^{25}$ leads from the binding-post $c^{23}$ to the street-box, which forms a part of the auxiliary circuit. As the switch $c^{20}$ $c^{21}$ is normally closed the path for the current through the indicating apparatus is as follows: $b^{25}$, $b^{23}$, $c^{24}$, $c^{21}$, $c^{20}$, $c^{22}$, $c^{25}$, it being understood that the indicator-circuit containing the electromagnet $b^{16}$ is open.

When the switch $c^{20}$ $c^{21}$ is open and the indicator-circuit closed at a distant point, the path for the current through the indicating apparatus will be as follows: $b^{25}$, $b^{23}$, $b^{21}$, $b^{16}$, $b^{20}$, $b^{22}$, $b^{24}$.

The apparatus for operating the indicating device, and which is adapted to be controlled and operated by the circuit-operating device of any one of the substations, consists of a multiple-signal transmitter comprising, essentially, a motor mechanism, a circuit-operating device operated by it for the indicator-circuit, and selecting devices which determine the number of times the circuit-operating device shall operate the indicator-circuit to thereby move the indicating-dial step by step and display a number corresponding to the particular selecting device which has been operated. The motor mechanism is normally wound and is released by a tripping-magnet which is operated by the auxiliary circuit.

$d$ represents the winding-shaft of the motor mechanism, (see Figs. 2, 6 and 9 to 13,) having attached to it a mainspring $d'$ (see dotted lines, Fig. 6) and bearing a ratchet-wheel $d^2$, which engages a spring-pressed pawl $d^3$, pivoted to the face of a toothed gear $d^4$, which is mounted loosely on the shaft $d$ and which engages a pinion $d^5$, secured to the signal-wheel shaft $d^6$, to which is secured a toothed gear $d^7$, which engages a pinion $d^8$, secured to a shaft $d^9$, bearing a toothed gear $d^{10}$, which engages a pinion $d^{12}$ secured to a shaft $d^{13}$, bearing an escape-wheel $d^{14}$, which is engaged by a suitable pallet $d^{15}$.

$d^{40}$ represents the signal-wheel, which is secured to the shaft $d^6$, and said wheel has a pen-engaging portion $d^{41}$, upon which the several contact-pens $d^{42}$ of the selecting devices bear, and also a toothed portion $d^{43}$, adapted to engage the contact-pen $d^{44}$, which is connected with the indicator-circuit. On the face of the signal-wheel a segmental block $d^{50}$ (see Fig. 8) of insulating material is secured, which is adapted to engage and lift the member $d^{51}$ of a switch free from engagement with the member $d^{52}$ thereof. The switch $d^{51}$ $d^{52}$ is connected with the auxiliary circuit, and its members are normally held closed by their inherent spring action when disengaged—as, for instance, when the multiple-signal transmitter is wound and set in condition to operate; but whenever the transmitter is operated said switch will be engaged by the segmental block $d^{50}$, which serves as an actuating device therefor, and will be opened just before the signal has been

transmitted, thereby opening the auxiliary circuit at this point, and the auxiliary circuit thus opened will remain inoperative until said switch has been manually closed. The switch is adapted to be closed by means operated or controlled by the winding device or means employed to wind and reset the multiple-signal transmitter, and hence said switch serves as a telltale to indicate whether or not the multiple-signal transmitter has been wound and reset. To accomplish this result, the signal-wheel shaft $d^6$ is designed to make one complete rotation to first transmit the signal and then to open and subsequently close the telltale-switch, and the motor mechanism or train is arranged to turn the signal-wheel shaft a predetermined part of a cycle to first transmit the signal and then open the telltale-switch and then cease and subsequently when wound and reset to complete the rotation of said signal-wheel shaft and close said telltale-switch. The motor mechanism thus has two successive periods of operation or two successive operations to completely turn the signal-wheel shaft. To provide for thus successively operating the motor mechanism, a locking device is employed consisting of a lever $d^{17}$, pivoted to the frame at $d^{18}$ and provided near one end with two teeth $d^{30}$ $d^{31}$, adapted to be sucessively engaged by a detent $d^{16}$, which is secured to one of the shafts of the train—as, for instance, to the signal-wheel shaft $d^6$. The locking-lever $d^{17}$ is moved out of engagement with the detent $d^{16}$ by a spring $d^{21}$ whenever said spring is permitted to act, and its position relative to the detent is controlled by the winding device and by a member driven by the train. The winding device consists of a sleeve $e$, mounted loosely on the projecting end of the winding-shaft $d$, having a finger-piece $e'$ for turning it and a spring $e^2$ encircling it, one end of which is connected to the frame and the other end to the sleeve, which is adapted to turn the sleeve in a direction opposite to that employed for winding the shaft. The shaft has a short arm $e^3$ projecting from it, which engages the tripping-dog of a tripping device to be described, and said arm $e^3$ has on its rear side a lug $e^4$, which when the sleeve is turned by the finger-piece in a direction to wind the shaft will engage and lift a short arm $d^{20}$, which is connected to the winding-shaft to thereby turn said winding-shaft until the next tooth of the ratchet-wheel engages the pawl. The lug $e^4$ on the winding device normally occupies a position at one side of an extension $d^{19}$ on the locking-lever, and thus holds said lever with its second tooth $d^{31}$ in engagement with the detent $d^{16}$, the motor mechanism at such time being wound up and at rest. Whenever the tripping device disengages the arm $e^3$ of the winding device, the spring $e^2$ turns the winding device in the direction opposite to that which it was moved to wind the motor, and the lug $e^4$ is removed from engagement with the extension $d^{19}$, and the locking-lever is then free to be moved by its actuating-spring to disengage the detent $d^{16}$ and release the train. As the train runs the short arm $d^{20}$ on the winding-shaft is driven backward in a direction opposite to that which it was moved when winding the motor, and said arm engages the extension $d^{19}$ on the locking-lever and moves said locking-lever into position to be engaged by the detent $d^{16}$, so that when the train has run and turned the signal-wheel shaft bearing the detent $d^{16}$ a predetermined part of a cycle said detent will engage the first tooth $d^{30}$ of the locking-lever, and thereby stop the train. During the time the train has thus run the signal has been transmitted and the telltale-switch opened; but at the moment the train stops the actuating device $d^{50}$ of the telltale-switch is still in engagemnt with said switch, and the switch is consequently still held open. This constitutes the first period of operation of the train. The winding device is then operated to rewind the motor, and the lug $e^4$ while engaging and lifting the short arm $d^{20}$ to accomplish this result moves along adjacent to the extension $d^{19}$ of the locking-lever, and as the arm $d^{20}$ disengages said extension the latter moves into engagement with the lug $e^4$, and such movement is sufficient for the first tooth of the locking-lever to disengage the detent $d^{16}$ and for the second tooth thereof to be brought into position to be engaged by said detent whenever said detent is moved by the train into engagement therein. The motor mechanism is thus rewound; but during the winding movement the arm $e^3$ is moved a short distance beyond the tripping-dog before the next tooth of the ratchet-wheel engages the pawl, and the locking-lever moves out of engagement with the detent $d^{16}$, so that when the operator disengages the winding device the motor is free to start up and run until the arm $e^3$ is moved backward into engagement with the tripping-dog and the detent $d^{16}$ moves into engagement with the second tooth of the locking-lever. This second movement or period of operation of the train is very short; but during the period of operation the segmental block or actuating device for the telltale-switch is moved out of engagement therewith and the telltale-switch thereupon closed. It will therefore be seen that the first period of operation of the motor mechanism is controlled by any one of the substations, and its second period of operation is controlled by the winding device, and that the telltale-switch is opened by the transmitting mechanism when operating to transmit its signal and is subsequently closed whenever the motor is rewound, and not until.

A short arm $e^5$ projects from the sleeve $e$ toward the tripping-dog, to which a flat

spring $e^6$ is attached, the free end of which extends beyond the outer end of the arm bearing it and serves as a yielding arm for engaging and restoring the tripping-dog.

$f$ represents the tripping-dog of the tripping device, which is made as a small bell-crank lever, one arm of which is adapted to be engaged by the yielding arm $e^6$ of the winding device when the latter is operated to wind the motor mechanism and the other arm of which is adapted to serve as a prop to hold the arm $e^3$, with the lug $e^4$, back of the extension of the locking-lever to thereby hold said locking-lever in engagement with the detent $d^{16}$. The tripping-dog $f$ is secured to the rock-shaft $f'$, having its bearing in the frame, and said rock-shaft has a curved arm $f^2$ extended from it, bearing at its extremity a cross-bar $f^3$, which is adapted to engage the notched or shouldered end portion of a pivoted arm $f^4$ to thereby hold the tripping-dog in position to hold the arm $e^3$. A spring $f^6$ encircles the rock-shaft $f'$, which is connected to it at one end, the action of which is to turn said shaft in a direction to move the tripping-dog so as to release the arm $e^3$. The arm $f^4$ is pivoted at $f^5$ to the frame and has an extension $f^7$, to which one end of a spring $f^8$ is connected, the opposite end of said spring being connected to a fixed pin $f^9$ on the frame, and said spring acts to hold the arm $f^4$ with its notched end in engagement with the cross-bar $f^3$. The arm $f^4$ is moved on its pivot to disengage the cross-bar $f^3$ by an electromagnet $f^{10}$, herein referred to as the "tripping-magnet," the armature $f^{12}$ of which is attached to a lever $f^{13}$, pivoted to the frame and bearing a downwardly-extending lug $f^{14}$, which whenever the armature is retracted will engage the arm $f^4$ and depress it, and thereby cause it to disengage the cross-bar and permit the spring $f^6$ to rock the shaft and move the tripping-dog to release the arm $e^3$, and thereby release the motor mechanism.

The selecting devices of the multiple-signal transmitter comprise a plurality of electromagnets $i$, located at the transmitter and corresponding in number to the number of substations, rooms, or buildings to be indicated and respectively included in branch wires $h^7$ $h^8$ 6, leading from the heavy battery-circuit, respectively, to the several substations, which circuits are normally open at the last substation in a section to be indicated, as at $o^6$, and a corresponding number of switches at the transmitter respectively controlled by said selecting-magnets for respectively closing branch wires $d^{60}$, leading from the heavy battery-circuit to contact-pens $d^{42}$, which engage the conducting portion $d^{41}$ of the signal-wheel $d^{40}$, which is employed for operating the indicator-circuit.

The switches comprise movable members, (shown as contact-pens $i^2$,) several of which may be attached to a signal-plate $i^3$, which is pivoted at $i^4$ to the frame, and stationary members, (shown as contact-pens $i^5$,) several of which may be attached to a single block $i^6$ of insulating material, the pens $i^2$ being so disposed as to be movable into and out of engagement with the pens $i^5$ to close and open their respective branch wires. The selecting-magnets $i$ determine which switch shall be operated, and to accomplish this result said magnets are arranged in a row, and their armature-levers $i'$ are independently pivoted and are formed with hooked ends adapted when in retracted position to engage the movable members $i^2$ of the switches and hold them disengaged from the fixed members, and as said magnets are included in normally open branch wires their armatures are normally retracted. Whenever one of the branch wires is closed at the substation, the armature of the selecting-magnet therein will be attracted, and the movable member of the particular switch controlled by it will be disengaged, while the corresponding members of all the other switches will be held by the remaining magnets.

The movable members of all the switches are adapted to be moved toward the stationary members, and the movable member which is disengaged to be moved into engagement with its fellow member by positively moving the plate to which all said movable members are attached, and when said plate is moved the engaged members will yield and will not engage their fellow members, and the disengaged member will engage its fellow member. The plate $i^3$ has an arm $i^7$ attached to it, which is connected by a link $i^8$ with the arm $e^3$ of the winding device of the motor mechanism, and whenever said motor mechanism is released and the arm $e^3$ moved by its actuating-spring the plate $i^3$, bearing the movable members of the switches, will be moved and the disengaged switch will be closed, the other switches being held open by the engagement of their movable members with the armature-levers of the remaining selecting-magnets. If a large number of substations are employed, two rows of selecting-magnets will be provided, as herein shown, located at opposite sides of the row of selecting-switches, and in such event the armature-levers of the second row of magnets will be formed with flat ends against which the movable members of the switches abut.

To operate the indicator, the multiple-signal transmitter is designed to successively close the indicator-circuit a number of times corresponding to the number of or groups of substations, and to accomplish this result, as herein shown, a single circuit-wheel $d^{40}$ is employed, having a conducting portion $d^{41}$ for engagement with the several contact-pens $d^{42}$, which are connected with the selecting-switches and having a toothed portion $d^{43}$ for engagement with a contact-pen $d^{44}$.

The location of the conducting portion $d^{41}$ relative to the toothed portion is important. Normally all of the contact-pens $d^{42}$ bear upon the conducting portion $d^{41}$, and the contact-pen $d^{42}$ is disengaged from the toothed portion of the wheel, so that the circuit is open at this point. Whenever the transmitter is released, one of the selecting-switches $i^2$ $i^5$ will be operated to close one of the branch wires $d^{60}$, and the signal-wheel will revolve, and first the conducting portion $d^{41}$ will pass out of engagement with all of the contact-pens $d^{42}$ *seriatim*. Then as the wheel continues its revolution said conducting portion $d^{41}$ will move into engagement with the several contact-pens *seriatim*, until all of them again bear upon said conducting portion, and just after said conducting portion engages the first pen of the group the first tooth of the toothed portion $d^{43}$ arrives in position to engage the contact-pen $d^{44}$, and the remaining teeth of said toothed portion will successively engage said pen $d^{44}$ as the conducting portion $d^{41}$ engages the several pens $d^{42}$.

If the switch of the circuit containing the first contact-pen $d^{42}$ of the group is closed, then all of the teeth of the toothed portion will be effective in closing the circuit and thereby transmitting the signal; but if said circuit is open then the first tooth of said toothed portion will not be effective, and so on. Therefore no impulse will be transmitted until the conducting portion has engaged a contact-pen the circuit of which is closed, after which the remaining teeth of the toothed portion on will be effective to operate the indicator-circuit. Each substation contains a circuit-operating device adapted to be operated by hand, first, to open the normally closed auxiliary circuit which contains a very light battery *g*, then to connect a heavy battery *h* in said auxiliary circuit, preferably in series with the light battery, and then to also connect an answer-back-signal magnet in circuit with the heavy-battery circuit thus formed. These three operations will take place in rapid succession upon pulling down the circuit-operating lever at the substation. This answer-back signal is contained in the substation and is adapted to operate when the street-box has been released and opens a pair of contacts in the auxiliary circuit; but as it is not introduced into circuit when the circuit-operating device at the substation first connects the heavy battery with the auxiliary circuit the full strength of both batteries will be utilized in operating the auxiliary actuating mechanism of the street-box and in releasing the multiple-signal transmitter.

*o* represents the circuit-operating lever in one of the substations, which is pivoted at *o'* and has suspended from it a finger-piece $o^2$, by which it may be pulled down. The lever *o* bears at its extremity a plurality of contact pens or brushes $o^3$, which are adapted to engage any one of a series of plates $o^4$ $o^5$ $o^6$, arranged close together in the arc of a circle about the pivot *o'* as a center. The two auxiliary-circuit wires 2 3, which lead to the box, are connected, respectively, to the binding-posts $o^7$ $o^8$. A wire 4 leads from the binding-post $o^7$ to the pivot *o'* of the circuit-operating lever, and a wire 5 leads from the binding-post $o^8$ to the plate $o^4$. The circuit-operating lever *o* normally occupies its elevated position, with the contact-pens borne by it engaging the plate $o^4$, and the normal path for the current through the substation is as follows: 2, $o^7$, 4, *o'*, *o*, $o^3$, $o^4$, 5, $o^8$, 3.

The circuit-wire 6, which leads from each substation to the transmitting-station and which is connected to the heavy-battery circuit, is connected to the binding-post $o^9$, and a wire 7 leads from said post to the plate $o^5$, and when the circuit-operating device *o* is pulled down the auxiliary circuit is broken as the contact-pens leave the plate $o^4$, and while said pens engage the plate $o^5$ the path for current through the substation is as follows: 2, $o^7$, 4, *o'*, *o*, $o^3$, $o^5$, 7, $o^9$, 6.

In pulling down the circuit-operating lever the contact-pens $o^3$ will engage the plate $o^5$ only for a very short period of time, as by the same downward movement of said lever they quickly pass off of said plate and into engagement with the plate $o^6$. The plate $o^6$ is connected by a wire 8 with the electromagnet $o^{10}$ of the answer-back signal, and a wire 9 leads from said electromagnet to the plate $o^5$, so that when the contact-pens $o^3$ are in engagement with the plate $o^6$ the path for the current through the substation is as follows: 2, $o^7$, 4, *o'*, *o*, $o^3$, $o^6$, 8, $o^{10}$, 9, $o^5$, 7, $o^9$, 6.

The operating electromagnet of the answer-back signal is thus included in the circuit. The armature $o^{12}$ of said electromagnet $o^{10}$ is connected to a plate $o^{13}$, to which the lever *o* is pivoted, and said armature bears a contact-point which when the armature is fully retracted engages a spring-acting arm $o^{14}$, attached to the plate $o^4$. When the contact-pens $o^3$ engage the plate $o^6$ and include the electromagnet $o^{10}$ in circuit, the armature $o^{12}$, which normally occupies an intermediate position between the electromagnet and the spring-arm, will be immediately attracted; but the circuit thus established is immediately broken at the street-box by the operation of the auxiliary actuating mechanism thereat, opening a switch $t'$ $t^2$, and said armature $o^{12}$ then immediately retracts to extreme position and engages the spring-arm $o^{14}$, closing a circuit the path of which through the substation is as follows: 3, $o^8$, 5, $o^{14}$, $o^{12}$, $o^{13}$, *o'*, *o*, $o^3$, $o^6$, 8, $o^{10}$, 9, $o^5$, 7, $o^9$, 6, and the circuit thus established, including the electromagnet $o^{10}$, causes the latter to again attract its armature $o^{12}$, and thereby disengage

the arm $o^{14}$. While this circuit is maintained the armature $o^{12}$ will rapidly vibrate, and thus indicate that the auxiliary actuating mechanism at the street-box has been operated to cause said box to send in the alarm. As soon as the answer-back signal has been received the operator will release the circuit-operating lever, which will at once resume its normal elevated position, and the normal path for the current through the substation will be reëstablished; but it will be understood that the auxiliary circuit is at such time open at the street-box.

A branch wire 12 leads from the binding-post $o^8$, and a branch wire 13 leads from the binding-post $o^9$, and said branch wires 12 13 are designed to include a high-resistance telephone-receiver (not shown) to be used for testing purposes. Whenever said branch circuit is closed, a cross is formed between the open wire 6 and the closed wire 3 to thereby include the open wire 6 and the heavy battery-circuit wire, and the high resistance of the telephone-receiver allows but a small portion of the current to pass, so that an alarm from any substation during such test would not be interrupted or affected thereby. In making this test by the telephone-receiver an intermittent tapping is sufficient to show the condition of the open wire.

The electromagnet $f^{10}$ of the tripping device of the multiple-signal transmitter is included in the normally closed auxiliary circuit; but its armature is normally retracted by reason of the auxiliary circuit including a light battery and the retractile spring, which is connected to said armature, being adjusted to overcome the attractive force of the magnet.

$g$ represents the light battery, which is included in the auxiliary circuit, and with all the parts of the system in their normal position the auxiliary circuit is represented as follows: light battery $g$, wire $g'$, binding-post $g^2$, wire $g^3$, galvanometer $g^4$, wire $g^5$, binding-post $g^6$, wires $g^7$, $b^{25}$, binding-post $b^{23}$ at the indicator, wire $c^{24}$, telltale-switch $c^{21}$, wire $c^{22}$, binding-post $c^{23}$, wire $c^{25}$ to street-box, answer-back switch $t^2$, $t'$, electromagnet $t$ of the auxiliary actuating mechanism of the street-box, wire $g^8$, binding-post $g^9$, wire $g^{10}$, tripping-magnet $f^{10}$, wire $g^{12}$, binding-post $g^{13}$, wire 2 to substation, thence through the substation by $o^7$, 4, $o'$, $o$, $o^3$, $o^4$, 5, $o^8$, 3, thence through the other substations which are connected in the circuit in the same manner, then wire $g^{14}$, binding-post $g^{15}$, wire $g^{16}$, telltale-switch $d^{51}$, $d^{52}$, wire $g^{17}$, switch $s$, wire $g^{18}$, binding-post $g^{19}$, wire $g^{20}$ to battery $g$.

$h$ represents the heavy battery, which is included in a normally open branch circuit, consisting of the wire $h'$, which leads from one side of the battery to the binding-post $g^{19}$, where it connects with the auxiliary circuit, and a wire $h^2$, which leads from the other side of the battery to a binding-post $h^3$, from which a wire $h^4$, including a cross-relay $h^5$, leads to a binding-post $h^6$, from which the several substation-wires $h^7$, including the selecting-magnets $i$, lead to the binding-posts $h^8$, from which wires 6 lead to the binding-post $o^9$ of the several substations.

When any one of the substations is operated, the normally closed auxiliary circuit is broken by the pens leaving plate $o^4$, and the heavy-battery circuit, together with one of the substation-wires 6, is connected into the auxiliary circuit in such manner that the heavy battery $h$ is included in series with the light battery $g$. The complete circuit first established at such time is as follows: $g$, $g'$, $g^2$, $g^3$, $g^4$, $g^5$, $g^6$, $g^7$, $b^{25}$, $c^{24}$, $c^{21}$, $c^{20}$, $c^{22}$, $c^{23}$, $c^{25}$, $t^2$, $t'$, auxiliary magnet $t$, $g^8$, $g^9$, $g^{10}$, tripping-magnet $f^{10}$, $g^{12}$, $g^{13}$, 2, $o^7$, 4, $o'$, $o$, $o^3$, $o^5$, 7, $o^9$, 6, $h^8$, $h^7$, including selecting-magnet $i$, $h^6$, $h^4$, including $h^5$, $h^3$, $h^2$, $h$, $h'$, $g^{19}$, $g^{20}$ to $g$. The heavy-battery circuit being thus momentarily established, the electromagnet $t$ operates to release the auxiliary actuating mechanism at the street-box, and the electromagnet $i$ operates to disengage one of the switches $i^2$ $i^5$ and the tripping-magnet $f^{10}$ operates to release the multiple-signal transmitter and to close the disengaged switch $i^2$ $i^5$. The switch $o$ at the substation when pulled way down finally introduces the answer-back-signal magnet into the circuit, the connection being from switch $o$, plate $o^6$ wire 8, answer-back magnet $o^{10}$, wire 9, plate $o^3$, and then on, as previously described. The operator will then receive the answer-back signal upon the opening of the switch $t'$ $t^2$ at the street-box, and sufficient time is allowed before the multiple transmitter takes possession of the circuit for the answer-back signal to be received at the substation, the street-box being released before the answer-back signal is sent. The multiple-signal transmitter is at such times, however, run and after a proper length of time has elapsed for the answer back to be sent the pen-engaging portion $d^{41}$ will first pass from beneath the pens $d^{42}$, and thereafter the insulated segmental block $d^{50}$ will separate switch-pens $d^{51}$ $d^{52}$, thus opening the auxiliary circuit leading via $g^{16}$, $g^{15}$, and $g^{14}$ to the substations, so that thereafter no manipulation of the switch $o$ at the substation can have any effect on the auxiliary circuit. The pen-engaging portion $d^{41}$ of the signal-wheel will next arrive in engagement with the first one of the series of pens $d^{42}$ simultaneously with the arrival of the first tooth of the signal-wheel to its contact-pen $d^{44}$, and thereafter said pen $d^{44}$ will be engaged by successive teeth of the signal-wheel as the conducting portion $d^{41}$ engages with the successive pens $d^{42}$, and the circuit to these pens $d^{42}$ is controlled, as described, by the selecting-switches controlled by the electromagnets $i$, before described. When

the engaging portion $d^{41}$ arrives at the pen $d^{42}$, connected to a closed selecting-switch, then the circuit to the indicator will be closed through the light and heavy batteries in series and may be traced as follows: $g$, $g'$, $g^2$, $g^3$, $g^4$, $g^5$, $g^6$, $g^7$, $g^{25}$, $b^{23}$, $b^{21}$, $b^{16}$, $b^{20}$, $b^{22}$, $b^{24}$, binding-post $j$, wire $j'$, pen $d^{44}$, signal-wheel $d^{40}$, pens $d^{42}$, wire $d^{60}$, switch $i^5$, $i^2$, binding-post $h^6$, $h^4$, $h^3$, $h^2$, $h$, $h'$, $g^{19}$, $g^{20}$ to $g$. Upon the successive closures of this circuit by the revolving signal-wheel the electromagnet $b^{16}$ will operate and set up the indicator according to the number of teeth of the signal-wheel to come in contact with the pen $d^{44}$ after this circuit was first closed.

When the signal has been transmitted to the indicator, the signal-wheel ceases to revolve, and the auxiliary circuit is left open. As the different substations are operated different selecting-magnets $i$ will be included and rendered operative, and consequently a different number of impulses will be transmitted by the multiple-signal transmitter, according to the selecting-switch operated. The indicator-circuit is normally open, and the heavy-battery circuit is likewise normally open, and to test these circuits a switch $s$ is provided in the auxiliary circuit, and the arm of said switch, in addition to performing its regular functions, is adapted to close another switch composed of two members 100 and 101, included in a branch circuit 102, leading from the heavy-battery-circuit-wire at $h$ to the contact-pen $d^{44}$, and whenever said switch $s$ is operated to close said switch 100-101 the auxiliary circuit is opened by the switch $s$, and said branch circuit is closed, and the circuit established through the galvanometer $g^4$ includes both batteries, as follows: $h$, $h^2$, $h^3$, $h^4$, $h^6$, 102, $j'$, $j$, $b^{24}$, $b^{22}$, $b^{20}$, $b^{66}$, $b^{21}$, $b^{25}$, $g^6$, $g^5$, $g^2$, $g'$, $g$, $g^{20}$, $g^{19}$, $h'$, to $h$.

At the transmitting-station a vibrating bell 105 is included in a local circuit containing a battery 106, and said circuit contains a circuit-operating device by which it is closed whenever the tripping-magnet is operated, thereby causing the bell to respond. The circuit-operating device in said local circuit consists of a contact-pen 107, adapted to be engaged by a cross-bar $f^3$ on the arm $f^2$, which is connected with the tripping-dog, and whenever the tripping-dog is disengaged said arm $f^2$ is moved, and the cross-bar engages the pen 107 and closes the circuit. The circuit is herein represented as follows: battery 106, circuit-wire 108, bell 105, circuit-wire 109, binding-post 110, circuit-wire 112, contact-pen 107, arm $f^2$, circuit-wire 113, binding-post 114, circuit 115 to battery. This local circuit includes a hand-switch 116, which may be operated whenever desired to open the circuit. Another local circuit contains a vibrating bell 120, which is adapted to respond whenever the local circuit containing it is closed by the opening of the trip-relay armature or whenever the cross-relay operates by a cross. This local circuit is as follows: battery 106, switch 116, circuit-wire 121, binding-post 122, circuit-wire 123, armature-lever of the tripping-magnet $f^{10}$, circuit-wire 124, armature-lever of the cross-relay $h^5$, circuit-wire 125, binding-post 126, circuit-wire 127, bell 120 to battery.

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

1. The combination with the auxiliary actuating mechanism of a signal-box, a circuit therefor, and substations, each substation having means for operating said circuit, of an indicating device, a circuit therefor, and means for operating the indicator-circuit controlled by any one of said substations, substantially as described.

2. The combination with the auxiliary actuating mechanism of a signal-box, a circuit therefor, and substations, each substation having means for operating said circuit, of an indicating device, a circuit therefor, a multiple-signal transmitter for operating the indicator-circuit, the operation of which is controlled by any one of said substations, substantially as described.

3. The combination with the auxiliary actuating mechanism of a signal-box, auxiliary circuit, and substations, each substation having means for operating said auxiliary circuit, of an indicating device, indicator-circuit, a multiple-signal transmitter for operating said indicator-circuit, controlled by any one of the substations, and a tripping-magnet in said auxiliary circuit, substantially as described.

4. The combination with the auxiliary actuating mechanism of a signal-box, a circuit therefor, and substations, each substation having means for operating said circuit, of an indicating device, a circuit therefor, a multiple-signal transmitter for operating the indicator-circuit having a plurality of selecting devices corresponding in number to the number of substations, which are electrically connected with said substations, and a tripping-magnet for said transmitter, the circuit of which is operated at any one of said substations, substantially as described.

5. The combination with the auxiliary actuating mechanism of a signal-box, a circuit therefor, and substations, each substation having means for operating said circuit, of an indicating device, a circuit therefor, a multiple-signal transmitter for operating the indicator-circuit, having a plurality of selecting-switches, corresponding in number to the number of substations, which determine the signals which shall be transmitted, and a plurality of electromagnets for controlling the operation of said switches, and circuits for said magnets leading to the several substations, substantially as described.

6. The combination with the auxiliary actuating mechanism of a signal-box, a circuit therefor, and substations, each substation having means for operating said circuit, of an indicating device, a circuit therefor, a multiple-signal transmitter for operating the indicator-circuit, having a releasing device, a plurality of selecting-switches corresponding in number to the number of substations, a corresponding number of electromagnets for controlling the operation of said switches, circuits for said magnets leading to the several substations, and means for operating said switches connected with said releasing device, substantially as described.

7. The combination with the auxiliary actuating mechanism of a signal-box, a circuit therefor, and substations, each substation having means for operating said circuit, of an indicating device, a circuit therefor, a multiple-signal transmitter for operating the indicator-circuit, a tripping-magnet for said transmitter, the circuit of which is operated by any one of the substations, a plurality of selecting-switches, corresponding in number to the number of substations, a corresponding number of electromagnets for controlling the operation of said switches, circuits for said magnets leading to the several substations, and means for operating said switches controlled by said tripping-magnet, substantially as described.

8. The combination with the auxiliary actuating mechanism of a signal-box, a circuit therefor, and substations, each substation having means for operating said circuit, of an indicating device, a circuit therefor, a multiple-signal transmitter for operating the indicator-circuit, having a releasing device, a plurality of selecting-switches, corresponding in number to the number of substations, a pivoted plate, to which the movable members of said switches are attached, a corresponding number of electromagnets for controlling the operation of said switches, circuits for said magnets leading to the several substations, and means for connecting said pivoting-plate with said releasing device, whereby the former is operated by the latter, substantially as described.

9. The combination with the auxiliary actuating mechanism of a signal-box, a circuit therefor, and substations, each substation having means for operating said circuit, of an indicating device, a circuit therefor, a multiple-signal transmitter for operating the indicator-circuit having a releasing device, a plurality of selecting-switches, corresponding in number to the number of substations, a pivoted plate bearing the movable members of said switches, a corresponding number of electromagnets for controlling the operation of said switches, the armature-levers of which engage the movable members of said switches, and means for connecting said pivoted plate with the releasing device of the transmitter, and circuits for said magnets leading to the several substations, substantially as described.

10. The combination with the auxiliary actuating mechanism of a signal-box, a circuit therefor, and substations, each substation having means for operating said circuit, of an indicating device, a circuit therefor, a multiple-signal transmitter for operating the indicator-circuit having a winding device, a tripping-dog for engaging it, a tripping-magnet for said tripping-dog, adapted to be operated by the auxiliary circuit, a plurality of selecting-switches, corresponding in number to the number of substations, a corresponding number of electromagnets for controlling the operation of said switches, circuits for said magnets leading to the several substations, and means for operating said switches controlled by said tripping-magnets, substantially as described.

11. The combination with the auxiliary actuating mechanism of a signal-box, a circuit therefor, and substations, each substation having means for operating said circuit, of an indicating device, a circuit therefor, a multiple-signal transmitter for operating the indicator-circuit having a winding device, a tripping-dog for engaging it, a tripping-magnet for said tripping-dog, adapted to be operated by the auxiliary circuit, a plurality of selecting-switches, corresponding in number to the number of substations, a corresponding number of electromagnets for controlling the operation of said switches, circuits for said magnets leading to the several substations, and means connected with the winding device for operating said switches, substantially as described.

12. The combination with the auxiliary actuating mechanism, of a signal-box, an auxiliary circuit, and substations therein, each substation having means for operating said auxiliary circuit, of an indicating device and circuit therefor, a multiple-signal transmitter for operating the indicator-circuit, a winding device for said transmitter having a tripping-arm, a tripping-dog into engagement with which said arm is moved by the winding device, and a tripping-magnet for said tripping-dog operated by the auxiliary circuit, substantially as described.

13. The combination with the auxiliary actuating mechanism of a signal-box, an auxiliary circuit, and substations therein, each substation having means for operating said auxiliary circuit, of an indicating device and circuit therefor, a multiple-signal transmitter for operating the indicator-circuit, a detent borne by one of the shafts of the transmitting-train, a locking-lever adapted to engage said detent, a winding device for the transmitting-train having means for controlling the position of said locking-lever, and

having a tripping-arm, a tripping-dog into engagement with which said arm is moved by the winding device, and a tripping-magnet for said dog, operated by the auxiliary circuit, substantially as described.

14. The combination with the auxiliary actuating mechanism of a signal-box, an auxiliary circuit, and substations therein, each substation having means for operating said auxiliary circuit, of an indicating device and circuit therefor, a multiple-signal transmitter for operating the indicator-circuit controlled by any one of the substations, a detent borne by one of the shafts of the transmitting-train, a locking-lever adapted to engage said detent, means for moving said locking-lever out of engagement therewith, to release the train; a member driven by the train for moving said locking-lever into position to engage the detent, and a winding device for the transmitting-train, which also controls the position of said locking device, substantially as described.

15. The combination with the auxiliary actuating mechanism of a signal-box, an auxiliary circuit, and substations therein, each substation having means for operating said auxiliary circuit, of an indicating device and circuit therefor, a multiple-signal transmitter for operating the indicator-circuit, controlled by any one of the substations, a detent borne by one of the shafts of the transmitting-train, a locking-lever adapted to engage said detent, means for moving said locking-lever out of engagement therewith to release the train, a member driven by the train for moving said locking-lever into position to engage the detent, and a winding device for the transmitting-train, which also controls the position of the locking-lever, having a tripping-arm, a tripping-dog into engagement with which said arm is moved by the winding device, and a tripping-magnet for said dog, operated by the auxiliary circuit, substantially as described.

16. The combination with the auxiliary actuating mechanism of a signal-box, an auxiliary circuit, and substations therein, each substation having means for operating said auxiliary circuit, of an indicating device and a circuit therefor, a multiple-signal transmitter for operating the indicator-circuit, controlled by any of the substations, a winding device for said transmitter having a tripping-arm, a tripping-dog into engagement with which said arm is moved by the winding device, and a tripping-magnet for said tripping-dog, operated by the auxiliary circuit, and means operated by the winding device for restoring the tripping-dog, substantially as described.

17. The combination with the auxiliary actuating mechanism of a signal-box, auxiliary circuit, and substations, each substation having means for operating said auxiliary circuit, of an indicating device, indicator-circuit, a multiple-signal transmitter for operating said indicator-circuit controlled by any one of the substations, a tripping-dog for releasing said transmitter, an engaging device for holding said tripping-dog in position to hold the transmitter, and a tripping-magnet for operating said engaging device to release tne tripping-dog, substantially as described.

18. The combination with the auxiliary actuating mechanism of a signal-box, auxiliary circuit, and substations, each substation having means for operating said auxiliary circuit, of an indicating device, indicator-circuit, a multiple-signal transmitter for operating said indicator-circuit, controlled by any one of the substations, having a tripping-arm, a tripping-dog for engaging said arm, a rock-shaft to which it is secured, having a latch-engaging arm, a pivoted latch for engaging said arm, and a tripping-magnet having means for moving said latch to disengage the arm, substantially as described.

19. The combination with the auxiliary actuating mechanism of a signal-box, an auxiliary circuit, and substations, each substation having means for operating said circuit, of an indicating device, a circuit therefor, and means for operating said indicator-circuit, controlled by any one of said substations, a normally closed telltale-switch in said auxiliary circuit at the indicator, means for opening it when the indicator is operated, and means for closing it when the indicator is reset, substantially as described.

20. The combination with the auxiliary actuating mechanism of a signal-box, an auxiliary circuit, and substations, each substation having means for operating said circuit, of an indicating device, a circuit therefor, and means for operating said circuit controlled by any one of said substations, a normally closed telltale-switch in said auxiliary circuit at the indicator, means operated by the indicating mechanism for opening said switch, and by the resetting device for subsequently closing it, substantially as described.

21. The combination with the auxiliary actuating mechanism of a signal-box, an auxiliary circuit, and substations, each substation having means for operating said circuit, of an indicating device, a circuit therefor, a multiple-signal transmitter for operating the indicator-circuit, the operation of which is controlled by any one of said substations, a winding device for said transmitter, and a telltale-switch in the auxiliary circuit at the transmitter, the operation of which is controlled by the winding device of the transmitter, substantially as described.

22. The combination with the auxiliary actuating mechanism of a signal-box, an aux-

iliary circuit and substations, each substation having means for operating said circuit, of an indicating device, a circuit therefor, a multiple-signal transmitter for operating the indicator-circuit, the operation of which is controlled by any one of said substations, a winding device for said transmitter, a telltale-switch in the auxiliary circuit at the transmitter, means for opening it when the transmitter operates to transmit its signal, and means for closing it when the transmitter is wound, substantially as described.

23. The combination with the auxiliary actuating mechanism of a signal-box, an auxiliary circuit, and substations therein, each substation having means for operating said circuit, of an indicating device and circuit therefor, and multiple-signal transmitter for operating the indicator-circuit, having two successive periods of operation, the first controlled by any one of the substations, and the second controlled by the winding device, a telltale-switch in the auxiliary circuit at the transmitter, means operated by the transmitter, during its first period of operation, for opening said switch, and during its second period of operation for closing it, substantially as described.

24. The combination with the auxiliary actuating mechanism of a signal-box, an auxiliary circuit, and substations therein, each substation having means for operating said circuit, of an indicating device, and circuit therefor, a multiple-signal transmitter for operating the indicator-circuit having two successive periods of operation, the first controlled by any one of the substations, and the second controlled by the winding device, a telltale-switch in the auxiliary circuit at the transmitter, a segmental block on one of the shafts of the transmitter, which is operated during its first period of operation to open said switch and during its second period of operation to close it, substantially as described.

25. The combination with the auxiliary actuating mechanism of a signal-box, an auxiliary circuit containing a light battery, a circuit containing a heavy battery, substations in said auxiliary circuit, each substation having a circuit-operating device adapted to connect the heavy battery in series with the light battery, an indicator, a circuit therefor, which, when established, includes said batteries, and means for operating said indicator-circuit controlled by any of said substations, substantially as described.

26. The combination with the auxiliary actuating mechanism of a signal-box, an auxiliary circuit containing a light battery, a circuit containing a heavy battery, substations in said auxiliary circuit, each substation having a circuit-operating device adapted to connect the heavy battery in series with the light battery, an indicator, a circuit therefor, which, when established, includes said batteries, a multiple-signal transmitter for operating said indicator-circuit controlled by any one of said substations, and a tripping-magnet for said transmitter, included in the auxiliary circuit, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GEORGE F. MILLIKEN.

Witnesses:

B. J. NOYES,

H. B. DAVIS.