No. 808,451. PATENTED DEC. 26, 1905.

M. W. HAMBLIN.

SIGNALING SYSTEM.

APPLICATION FILED MAY 31, 1904.

2 SHEETS—SHEET 1.

Fig. 1.

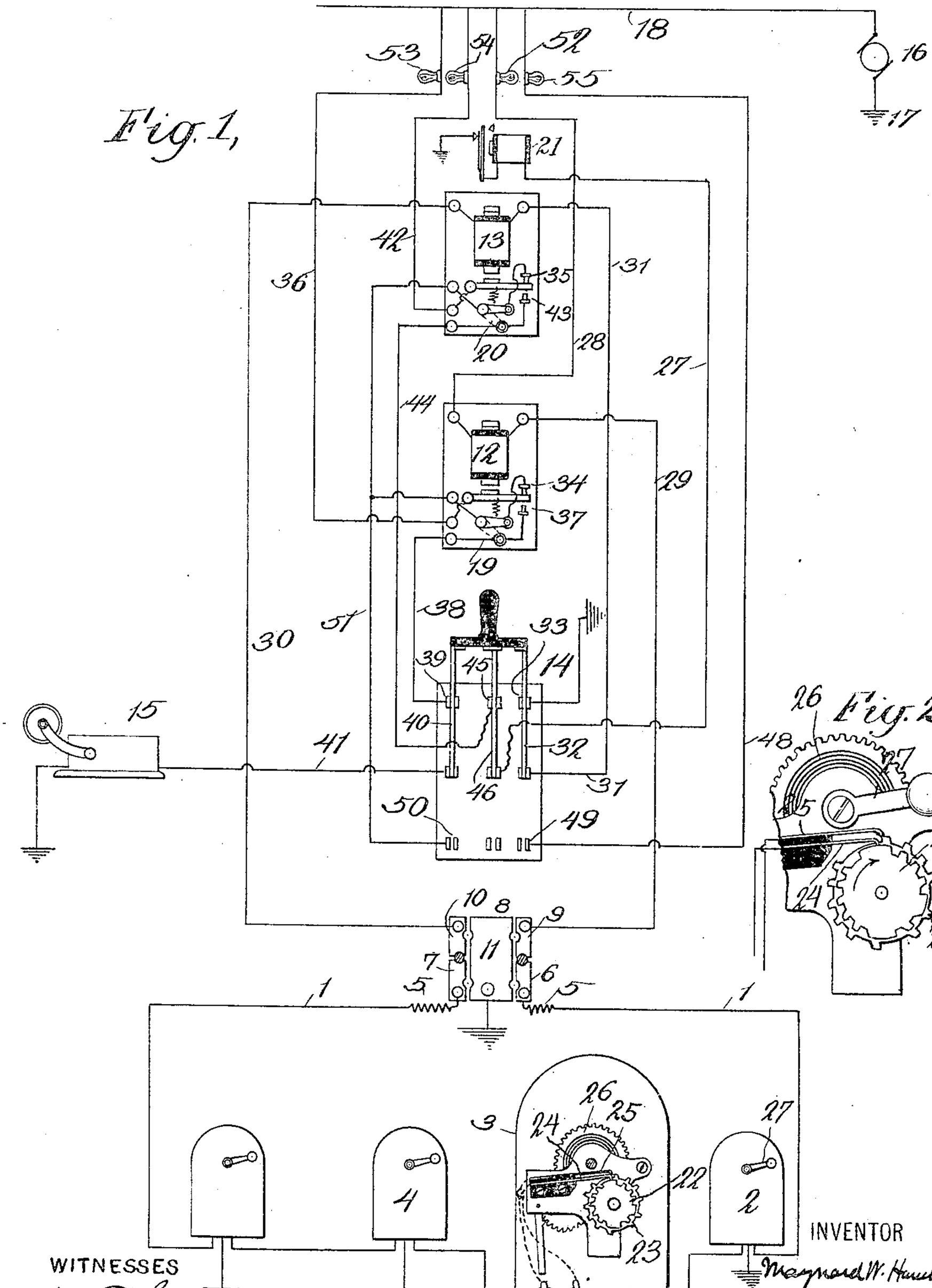

Fig. 2.

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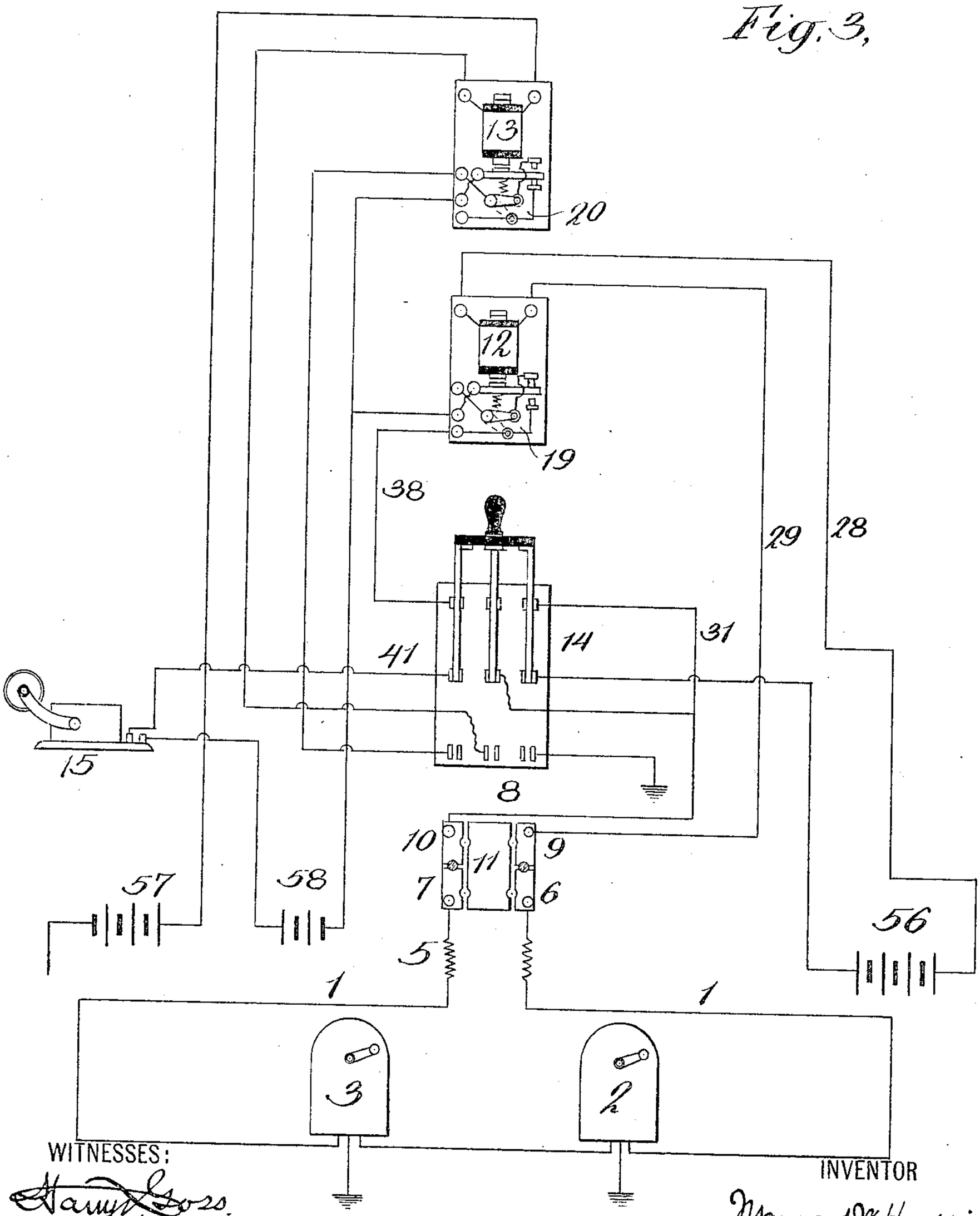
2 SHEETS—SHEET 2.

Fig. 3.



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SIGNALING SYSTEM.

No. 808,451. Specification of Letters Patent. Patented Dec. 26, 1905.

Application filed May 31, 1904. Serial No. 210,373.

To all whom it may concern:

Be it known that I, MAYNARD W. HAMBLIN, a citizen of the United States, residing in the city of New York, borough of Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Signaling Systems; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in electric signaling systems, and particularly to call-box, fire-alarm, and similar systems comprising a plurality of boxes or the like normally connected with a central station by a closed line-circuit. My invention consists in means whereby in case of grounding or interruption of such circuit the boxes or instruments on both sides of the break or ground may be placed quickly in operative connection with the central-station instruments.

The objects of my invention are to facilitate the operative connection of the call-boxes or circuit-breaking instruments to the central-station instruments in the event of the interruption or grounding of the line-circuit, to enable the necessary changes in circuit to be made very quickly, to avoid the possibility of making false connections during such change, to employ in the system a minimum number of relays, switches, and the like, and generally to make the system simple, compact, and reliable.

I will now proceed to describe my invention with reference to the accompanying drawings and will then point out the novel features in claims.

In the said drawings, Figure 1 is a diagram showing one arrangement of circuits and instruments in a call-box signaling system embodying my invention, the contact mechanism of one of the call-boxes being shown diagrammatically. Fig. 2 is a detail view, on a larger scale, showing the contact wheels and brushes of this contact mechanism. Fig. 3 is a view similar to Fig. 1 of an alternative arrangement of circuits and instruments in a call-box system.

In the drawings I show a line-circuit 1, comprising call-boxes 2, 3, and 4, both ends of said circuit being connected normally through fuses 5 with terminal-plates 6 and 7 of a combined lightning-arrester and testing-switch-board 8, located at the central station. Other terminal-plates 9 and 10 of this switchboard serve to connect with the terminals of a dynamo or other generator of electric energy, and plates 6 and 9 are customarily connected by a contact-plug, as shown, as are plates 7 and 10. The lightning-arrester and testing-board 8 customarily comprises a ground-plate 11, connected to ground, and this ground-plate may be connected to any of the plates 6, 7, 9, and 10 by the insertion of suitable plugs, but ordinarily is not connected to any of these plates, means for connecting it with the plates 6, 7, 9, and 10 being provided for facilitating testing.

The central-station equipment comprises two relays 12 and 13 of similar construction, a double-throw three-pole switch 14, which is usually a knife-switch, as shown, and a signal-receiving device 15 at the central station, which device is usually a self-starting register, and also comprises a dynamo 16 or other suitable source of electric energy, one terminal of which dynamo is usually connected to ground at 17 and the other terminal to a current-lead 18.

Each of the relays 12 and 13 is, in effect, an ordinary relay having both front and back contact-stops; but these relays in addition have two-point hand-switches 19 and 20, the function of which will appear hereinafter. A call-bell or buzzer 21 or other suitable signaling device is usually provided.

In the drawings the relay-armatures and switch-arms are shown in their normal positions—viz., the positions which they should occupy when the circuit is intact and ungrounded.

The call-boxes 2, 3, and 4 are of a type employing two correspondingly-toothed contact-wheels and brushes therefor, one for closed-circuit and the other for open-circuit operation, suitable spring mechanism or the like being provided for rotating the contact-wheels. In construction these boxes may be alike and may be of a type well known and in common use, and hence the mechanism of only one box—viz., box 3—is shown, and this mechanism is shown to a large extent diagrammatically, and it is not deemed necessary to show all the parts of this box in detail. Numerals 22 and 23 indicate, respectively, the normally

closed circuit and the normally open circuit contact-wheels of this box, and numerals 24 and 25 the brushes of said wheels, respectively. The frame of the call-box is connected to one side of the line-circuit 1 and the closed-circuit brush to the other side of said circuit, the open-circuit brush 25 being connected to ground. The spring mechanism 26, provided for rotating these wheels, is of ordinary construction, and therefore requires no detail description. It is arranged, when operated by the movement of the lever 27, to cause the contact-wheels to make one complete revolution in the direction indicated by the arrow. It will be seen that the line-circuit is normally complete through contact-wheel 22 and brush 24 and that the ground connection through wheel 23 and brush 25 is normally broken, but that when the wheels rotate the line-circuit is successively broken and completed according to the predetermined signal to be transmitted by the box and that the ground connection is completed and broken a corresponding number of times.

Considering now the operation of this system when in its normal condition, it will be seen that normally the line-circuit is complete from the dynamo-lead 18 at the central station through wire 28 to the magnet-coils of relay 12 and thence through wire 29 to contact-plate 9 of terminal switchboard 8 and thence through line-circuit 1 and the call-boxes therein to contact-plate 10 of switchboard 8, through wire 30 to the magnet-coils of relay 13, and through wire 31 to one contact-arm 32 of knife-switch 14, and through the upper contact-clip 33 of that switch to ground and thence back to dynamo 16. Normally, therefore, the armatures of relays 12 and 13 are held by their magnets against their front stops 34 and 35, and, as will be seen by tracing the circuits, when the armatures are in this position and the switch 14 is in the position shown the circuit to the register 15 and the circuit to the buzzer 21 are both broken. Supposing, now, that one of the boxes in circuit 1—for example, box 3—is operated by the movement of its lever 27, as soon as the first notch of wheel 22 comes opposite the corresponding brush 24 circuit 1 will be broken and the armatures of relays 12 and 13 will drop, the armature of relay 12 completing a circuit through the register 15 as follows: from dynamo-lead 18 through wire 36, the armature of relay 12, and the back stop 37 of that relay to wire 38 and upper contact-clip 39 of switch 14, the contact-arm 40 of that switch and wire 41 to the register 15, and thence to ground and back to the dynamo. In like manner relay 13 completes a circuit through the buzzer 21 as follows: from dynamo-lead 18 to wire 42, the armature of relay 13, and the back stop 43 of that relay to wire 44, the upper contact-clip 45 of switch 14, the contact-arm 46 of that switch and the conductor 47 to buzzer 21, and thence to ground and back to the dynamo. As soon as the tooth following the first notch of wheel 22 makes contact with brush 24 the line-circuit is reëstablished; but at the instant when the tooth following the first notch of wheel 22 makes contact with brush 24 the first tooth of wheel 23 makes contact with brush 25, completing a ground connection through the box which short-circuits relay 13 without affecting, however, so far as relay 12 is concerned, the circuit through that relay, the armature of which is therefore raised, breaking the circuit to the register. By the further rotation of contact-wheel 22 the circuit through the magnet of relay 12 to ground will be successively broken and completed, according to the signal of that particular box, which signal will therefore be recorded by the register 15. The corresponding notches and teeth of wheels 22 and 23 come opposite their respective brushes simultaneously until the final or long tooth of wheel 22 comes opposite its brush. Wheel 23 has a space or notch opposite this long tooth, and therefore when the wheel comes to rest in the normal position the line-circuit, but not the ground connection, is completed, as already stated. It will be seen, therefore, that in the normal condition of the circuit and of the instruments if the ground connection of the box being operated is intact the buzzer 21 will ring continuously while the signal is coming in, while the register 15 will record the signal of the box, its circuit being successively completed and broken by relay 12. Should the ground connection of the box being operated be defective, the operation of the register will not be interfered with, but relay 13 will be operated the same as relay 12, thereby causing the buzzer to ring the signal of the box, and thereby the attendant will know that the ground connection of the particular box being operated is defective. Supposing now that the line-circuit is broken, but not grounded, between boxes 2 and 3, at the instant of the break the armatures of relays 12 and 13 will drop and the buzzer 21 will ring, while the register 15 will run continuously instead of intermittently, as in normal operation. The attendant being thereby advised that the circuit is broken will thereupon reverse the position of the arms of switch 14. This has the effect of dividing the line-circuit into two separate ground return-circuits, one of which includes relay 12 and the other includes relay 13. The connection from dynamo-lead 18 through relay 12 and the line-circuit 1 to the point of the break in the line is not disturbed by the reversing of switch 14, since this portion of the circuit does not pass through said switch; but by the reversal of switch 14 the opposite side of the line-circuit in which relay 13 is included is also connected to the dynamo-lead 18 through wire 48, contact-clip 49 of switch 14, arm 32 of said switch, wire 31, relay

13, and wire 30. By the reversal of switch 14 the connection of clip 33 to ground is broken, and it will be seen that the two line-circuits now formed are normally open, but each will be completed when one of its call-boxes is operated through the ground connection of that call-box. By the reversal of switch 14 the connection of register 15 has been changed, so that the circuit through that register will be completed by either relay 12 or relay 13 when energized, the circuit of register 15 being now from ground through wire 41 and switch-arm 40 to clip 50 of the switch 14 and thence through wire 51 to the two hand-switches 19 and 20 of relays 12 and 13, respectively, and thence (the arms of said switches being in their normal positions, as shown) to the front stops 34 and 35 of the said relays, respectively. After the restoration of the circuit at the point where it is broken the boxes still work when operated upon ground-return circuits until the lineman upon return to the central station notifies the attendant that the line has been repaired, whereupon the attendant will reverse the switch 14 to its original position, so restoring the circuit to its original condition. Should the circuit be grounded at any point—as, for example, between boxes 2 and 3—the effect is to create a short circuit by which relay 13 is deënergized and the buzzer 21 rung; but the register 15 is not operated, since relay 12 is still energized. The operator perceiving this understands that the line is grounded, and thereupon reverses switch 14 and also reverses switches 19 and 20 of the relays 12 and 13, so that the switch-arms 19 and 20 are now in circuit with the back stops 37 and 43 of said relays. The circuit through relay 12 is then complete from the dynamo-lead 18 through wires 28 and 29 and the line-circuit to the point where the ground exists, the armature of relay 12 being held against its front stop; but the arms of the switch 14 being now in their lower position the circuit of register 15 passes through the lower clip 50 of that switch and through circuit 51 and owing to the arm of switch 19 being in its lower position (shown by dotted lines in the drawings) relay 12 will complete a circuit through the register only when its armature drops. Similarly there is now a circuit from the dynamo-lead 18 through wire 48 and the magnet of relay 13 to the point where the ground exists, and the armature of relay 13 being thereby held up and the arm of switch 20 being in the position shown in dotted lines relay 13 will complete a circuit through the register only when its magnet-circuit is broken. Restoration of the insulation of the line-circuit at the point where the ground existed has the effect of connecting both sides of the line-circuit to the same terminal of the dynamo, and therefore the register will continue to run continuously, from which the operator will understand that the circuit has been repaired and that the switch 14 and switches 19 and 20 should be reversed to their normal position. Should there be a break in one portion of the line-circuit and a ground on one side of the break, but not on the other, the attendant may throw down switch 14, as before, and may reverse the switch 19 or 20 of whichever of the two relays is connected to that side of the circuit on which the ground exists. Both relays will then operate the register 15. It will be seen, therefore, that my system is capable of being adapted to correct a great variety of troubles such as are commonly experienced on call-box, fire-alarm, and watchmen's signal-box circuits and that the means employed for making the correction are so simple that they may be operated correctly by persons having no electrical knowledge and who are entirely unacquainted with the principle upon which the system operates, and, further, it will be seen that the indications afforded by the register 15, the buzzer 21, the relays 12 and 13, and the signal-lamps are such as to indicate plainly in each case of trouble in the circuit the particular kind of trouble which exists, so that correction may be made promptly and without possibility of error.

It is often of great importance that when a break or ground occurs in the circuit the connections at the central station shall be changed instantly, so that signals may be received. Thus when my system is employed as a fire-alarm system it may happen that owing to the fire reaching the wires the circuit may be grounded or broken while the alarm is being sent in or even before one of the boxes on the circuit is operated to send in the alarm. If, however, the circuits may be changed over sufficiently rapidly as soon as the break or ground is indicated at the central station, it will still be possible in most cases to receive the signal of a box which has begun to operate before the break or ground occurred, and so long as the circuit is not broken or grounded on both sides of the box to be operated the signal of that box may be received at any time after the switch 14 and the switches 19 and 20 have been properly adjusted. Owing to the simple nature of these switches and their ready accessibility, necessary changes can be made with great rapidity.

I do not limit myself to the use of a dynamo for supplying current for operating the circuits, as it will be apparent that a battery or batteries may be used instead. Neither do I limit myself to the use of any particular type of switch for changing the circuits when a break or ground occurs.

I ordinarily provide in the wires 28, 36, 42, and 48, leading from the dynamo-lead 18, lamps 52, 53, 54, and 55, which serve to indicate visually the operation of the circuits and instruments.

It will be apparent that instead of the

ground return herein provided for a separate conductor may be provided which will be the equivalent of the ground return.

In Fig. 3 I illustrate a slightly different arrangement of circuits and instruments. In this arrangement batteries 56, 57, and 58 are employed for supplying current necessary for the operation of the system, battery 56 being in circuit normally for the purpose of supplying current to relay 12, battery 57 being normally out of circuit, but arranged to supply current to relay 13, and battery 58 being arranged to supply current for the operation of register 15. In this arrangement I have not provided a buzzer 21, and therefore relay 13 is normally out of circuit, but is included in the return side of the line-circuit when the switch 14 is shifted to its lower position. It will be obvious, however, that I might provide a buzzer 21 and that in such case the circuit of relay 13 will be arranged the same as in Fig. 1. In the arrangement shown in Fig. 3, also, neither pole of battery 56 is grounded normally; but when the switch is thrown to its lower position the return-terminal of the battery is grounded through the switch, as indicated. In other respects the system is substantially the same as that shown in Fig. 1, and no further description of it is necessary. It will be apparent that in the arrangement shown in Fig. 1 if it is not desired to use the auxiliary signal or buzzer 21 for indicating line condition the relay 13 may be out of the circuit normally the same as in Fig. 3, since the only purpose of including said relay in the circuit normally is to connect it operatively with the buzzer 21.

In the following claims I intend by the term "signal-receiving device" to include generically any signal-receiving device—such as a sounder, bell, or the like—which might be inserted in the line-circuit in place of relay 12 or relay 13, or both, and also to include any automatic switch such as might be substituted for said relays.

It will be apparent that my system is susceptible of many variations and modifications to adapt it for particular conditions, and I do not limit myself to the particular details illustrated and described.

What I claim is—

1. In a signaling system, the combination with a normally closed circuit comprising metallic outgoing and return lines, and a plurality of signaling devices having contact mechanism for controlling said circuit and also for connecting it to ground, and means for supplying current, of a plurality of signal-receiving devices, and a switch comprising a single operating device and contact members operated thereby, said switch interposed between one of said lines and means for supplying current and adapted when operated to produce separate ground-return circuits independently connected to means for supplying current, one of said signal-receiving devices being included in the circuit of said lines in the normal position of the switch, and one of said signal-receiving devices being included in one side of said circuit and another in the opposite side of said circuit, in the opposite position of the switch.

2. In a signaling system, the combination with a normally closed circuit comprising metallic outgoing and return lines, and a plurality of signaling devices having contact mechanism for controlling said circuit and also for connecting it to ground, and means for supplying current, of two relays, a switch comprising a single operating device and contact members operated thereby, said switch interposed between one of said lines and means for supplying current and adapted when operated to produce separate ground-return circuits independently connected to means for supplying current, one of said relays being included in the circuit of said lines in the normal position of the switch, and said relays being included in opposite sides of said circuit in the opposite position of the switch, and signaling means connected to that relay which is normally in circuit, said switch adapted to connect the other relay also to said signaling means when said switch is shifted from normal position.

3. In a signaling system, the combination with a normally closed circuit comprising metallic outgoing and return lines and a plurality of signaling devices having contact mechanism for controlling said circuit and also for connecting it to ground, and means for supplying current, of a plurality of signal-receiving devices, and a double-throw switch interposed between one of said lines and means for supplying current and arranged when reversed from normal position to produce two independent ground-return circuits independently connected to means for supplying current, and a plurality of signal-receiving devices, one included in the line-circuit in the normal position of the switch, and one included in one of said ground-return circuits and another in the other ground-return circuit in the opposite position of the switch.

4. In a signaling system, the combination with a normally closed circuit comprising a plurality of signaling devices having contact mechanism for controlling said circuit and also for connecting it to ground, of two relays included in opposite sides of said circuit, a signaling device normally controlled by one of said relays and actuated by the breaking of said circuit, another signaling device normally controlled by the other relay and actuated by the breaking of said circuit, and a switch comprising a single operating device and contact means operated thereby arranged when operated to connect both sides of said circuit independently to means for supplying electrical energy, and to connect both said relays to one

of said signaling devices and to cause them to operate the same independently upon closing of their respective circuits.

5. In a signaling system, the combination with a normally closed circuit comprising a plurality of signaling devices having contact mechanism for controlling said circuit and also for connecting it to ground, of two relays included in opposite sides of said circuit, a signaling device normally controlled by one of said relays and actuated by the breaking of said circuit, another signaling device normally controlled by the other relay and actuated by the breaking of said circuit, and a double-throw switch arranged when operated to connect both said relays with one of said signaling devices and to cause them to operate the same upon the completion of their circuits, and to connect both sides of the circuit independently with means for supplying electric energy.

6. In a signaling system, the combination with a circuit comprising a plurality of signaling devices having contact mechanism for controlling said circuit and also for connecting it to ground, means for supplying electrical energy, and a switch adapted in one position to produce a normally-closed circuit including means for supplying electrical energy, and in another position to produce independent ground-return circuits independently connected to means for supplying electrical energy, of a plurality of relays, one of which is included in the circuit formed when the switch is in the first position, and two of which are included in the two circuits formed when the switch is in the second position, said relays having front and back contacts, signaling means, and switches adapted to cause said relays to operate said signaling means upon the closing of either the front contact or of the rear contact, at will.

7. In a signaling system, the combination with a circuit comprising a plurality of signaling devices having contact mechanism for controlling said circuit and also for connecting it to ground, means for supplying electrical energy, one terminal of which is normally connected to ground and the other to one side of said circuit, and a switch arranged in its normal position to connect the opposite side of said circuit with said grounded terminal, and in its opposite position to break such connection and connect that side of the circuit independently with a source of supply, two relays included in opposite sides of said circuit, and two signaling devices, one normally controlled by one of said relays and the other by the other relay, said switch arranged when in its second position to connect both said relays to one of said signaling devices.

8. In a signaling system, the combination with a circuit comprising a plurality of signaling devices having contact mechanism for controlling said circuit and also for connecting it to ground, means for supplying electrical energy, one terminal of which is normally connected to ground and the other to one side of said circuit, and a switch arranged in its normal position to connect the opposite side of said circuit with said grounded terminal, and in its opposite position to break such connection and connect that side of the circuit independently with a source of supply, two relays included in opposite sides of said circuit, two signaling devices, one normally controlled by one of said relays and the other by the other relay, said switch arranged when in its second position to connect both said relays to one of said signaling devices, and switches adapted to cause said relays to operate said signaling devices upon the closing of either the front contact or the back contact, at will.

9. In a signaling system, the combination of the line-circuit comprising signaling devices having both circuit-breaking and circuit-grounding contact mechanism, the electric generator having a grounded terminal, the relays, the signaling devices, arranged one to receive signals and the other to indicate line condition, one relay normally controlling the first signaling device, the other relay normally controlling said second signaling device, the double-throw switch arranged when operated to divide the circuit into independent ground-return circuits and to connect said second relay to signal-receiving means, and the switches for reversing the connection to the contact-points of the relays of the signaling devices controlled thereby.

10. In a signaling system, the combination of the normally closed line-circuit comprising metallic outgoing and return lines and signaling devices comprising both circuit-breaking and circuit-grounding mechanism, the means for supplying electric energy, the relays, a signaling device arranged to receive the signals, the double-throw switch interposed in said circuit between one of said lines and means for supplying current, and arranged when operated to divide the circuit into independent ground-return circuits, and the switches for reversing the connection of such signaling device to the contact-points of the relays.

11. In a signaling system, the combination of a normally closed line-circuit, two signal-receiving devices included in opposite sides thereof, means for supplying current, and one or more signal-transmitting devices, included in said circuit between the signal-receiving devices and having both circuit-breaking and circuit-grounding signal-transmitting mechanism, one side of said circuit being grounded between said signal-transmitting devices and the source of current-supply, whereby in the event of a defect in the ground connection of one of said signal-transmitting devices both signal-receiving devices receive the signal transmitted.

12. In a signaling system, the combination of a normally closed line-circuit, two relays included in opposite sides thereof, means for supplying current, one or more signal-transmitting devices, included in said circuit between the relays and having both circuit-breaking and circuit-grounding signal-transmitting mechanism, one side of said circuit being grounded between said signal-transmitting devices and the source of current-supply, whereby in the event of a defect in the ground connection of one of said signal-transmitting devices both relays receive the signal transmitted, and a signaling device, for indicating line condition, arranged to be operated by the relay connected to the ungrounded terminal of said source of current-supply.

13. In a signaling system, the combination of a normally closed line-circuit, two signal-receiving devices included in opposite sides thereof, means for supplying current, one or more signal-transmitting devices included in said circuit between the signal-receiving devices and having both circuit-breaking and circuit-grounding signal-transmitting mechanism, one side of said circuit being grounded between said signal-transmitting devices and said source of current-supply, whereby in the event of a defect in the ground connection of one of said signal-transmitting devices both signal-receiving devices receive the signal transmitted, and a switch normally interposed in said circuit between said ground connection and the signal-transmitting devices, said switch adapted when operated to connect the side of the circuit to which it is connected to means for supplying current thereto, independently of the other side of the circuit.

14. In a signaling system, the combination of a line-circuit, two relays included in opposite sides thereof, means for supplying current, connected on one side to ground, one or more signal-transmitting devices, included in said circuit between the relays and having both circuit-breaking and circuit-grounding signal-transmitting mechanism, whereby in the event of a defect in the ground connection of one of said signal-transmitting devices both relays receive the signal transmitted, a signaling device, for indicating line condition, arranged to be operated by the relay connected to the ungrounded terminal of said source of current-supply, another signaling device arranged to be operated by the other relay, and a switching device, arranged when operated to divide said circuit into independent ground-return circuits connected to means for supplying electric energy, and to connect said first relay operatively with said second signaling device.

15. In a signaling system, the combination of a line-circuit, two relays included in opposite sides thereof, and having both front and back contacts, means for supplying electric current, connected on one side to ground, and one or more signal-transmitting devices, included in said circuit between the relays and having both circuit-breaking and circuit-grounding signal-transmitting mechanism, two signaling devices and separate circuits therefor, one side of one circuit connected to the armature of one of said relays and one side of the other said circuit connected to the armature of the other said relay, switching means for connecting the opposite sides of the circuits of said signaling devices to the front or back contacts of their respective relays at will, and further switching means arranged when operated to divide said line-circuit into independent ground-return circuits and to connect both relays operatively to the circuit of one of said signaling devices.

In testimony whereof I affix my signature in the presence of two witnesses.

MAYNARD W. HAMBLIN.

Witnesses:

HARRY M. MARBLE,

MINERVA PAPE.