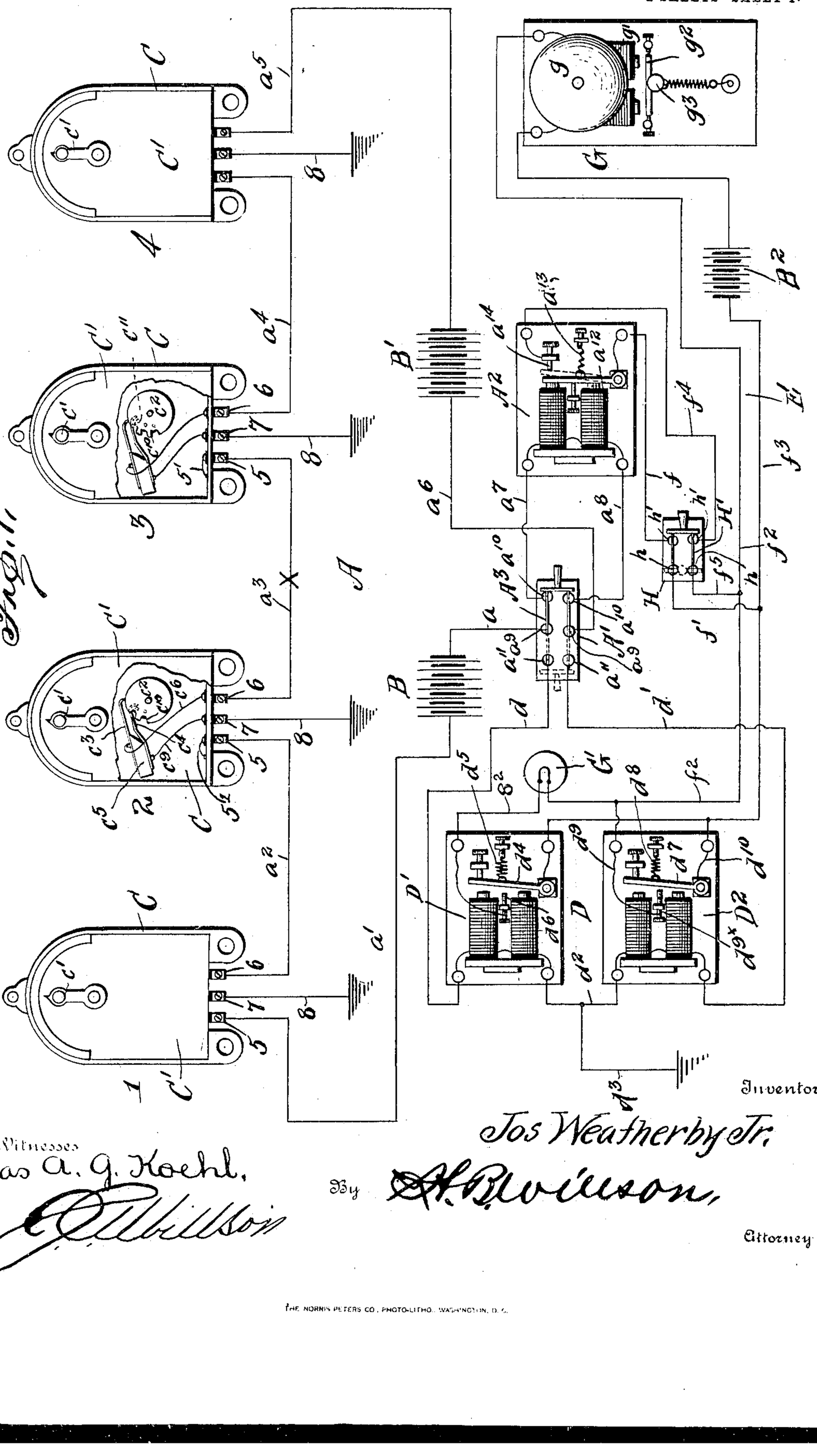
No. 758,724. PATENTED MAY 3, 1904.

J. WEATHERBY, JR.

SIGNALING SYSTEM.

APPLICATION FILED JUNE 1, 1903.

NO MODEL. 2 SHEETS—SHEET 1.



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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 1.

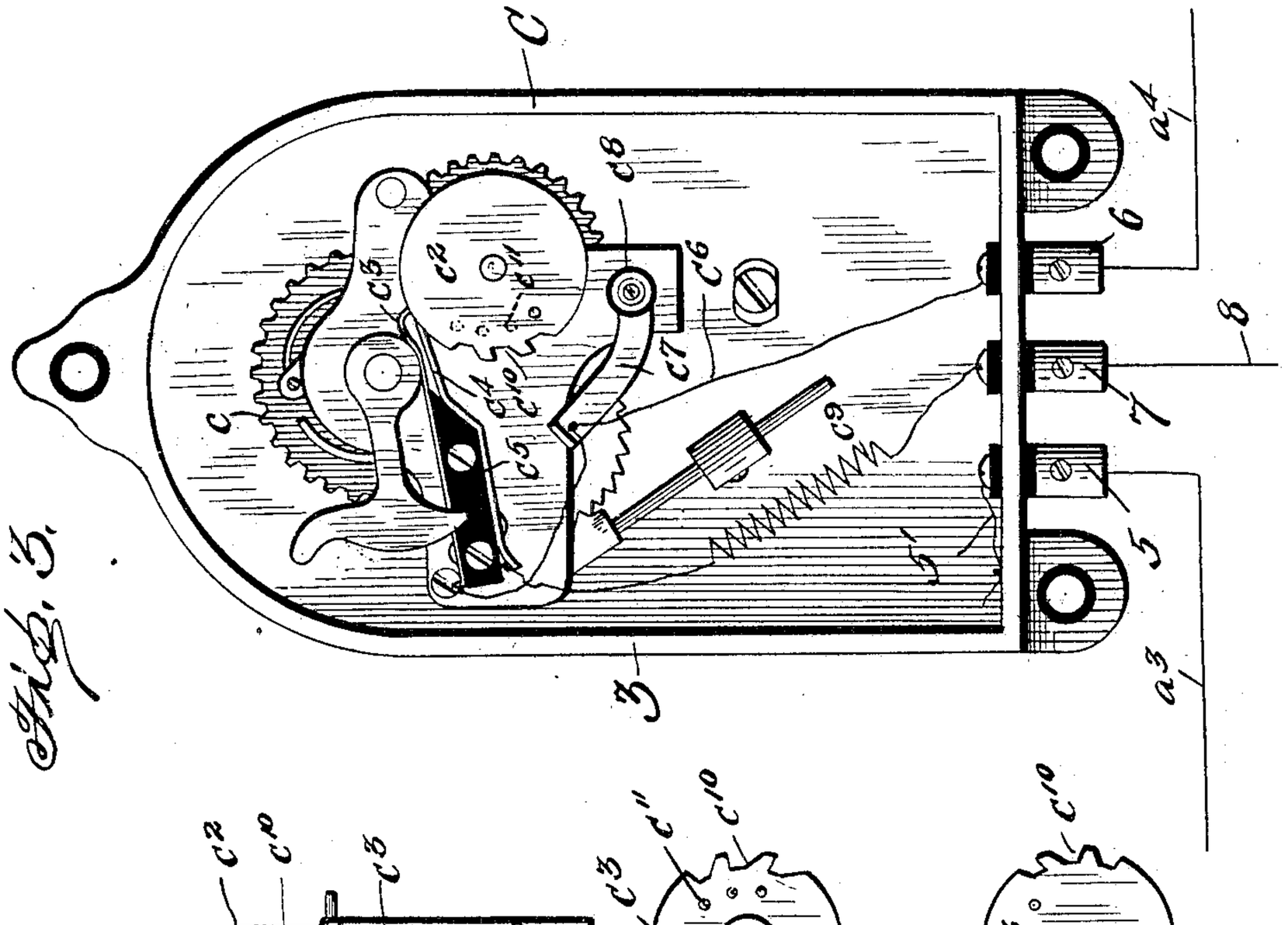


Fig. 4.

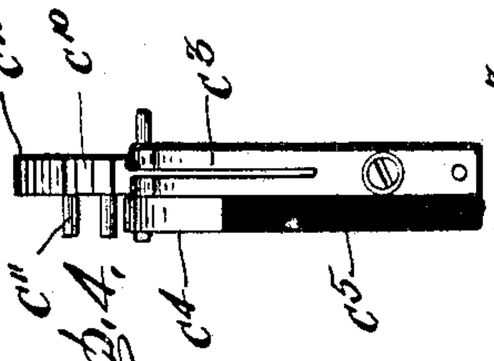
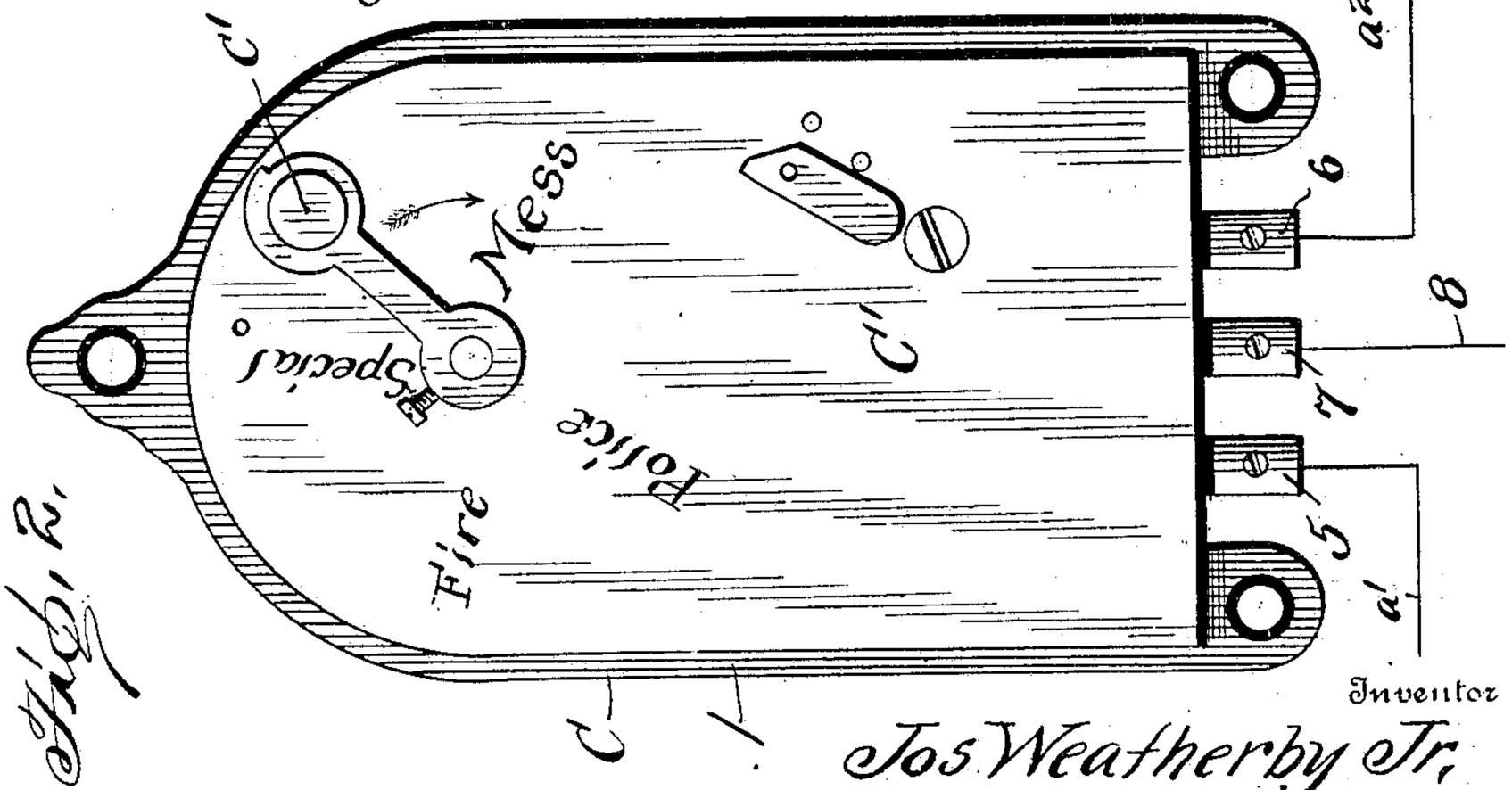


Fig. 5.

Fig. 6.

Fig. 2.



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UNITED STATES PATENT OFFICE.

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SIGNALING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 758,724, dated May 3, 1904.

Application filed June 1, 1903. Serial No. 159,661. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH WEATHERBY, Jr., a citizen of the United States, residing at New Cumberland, in the county of Cumberland and State of Pennsylvania, have invented certain new and useful Improvements in Signaling Systems; and I do 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.

This invention relates to calling or signaling systems, and is particularly designed for use in connection with district-messenger-call-box, fire-alarm, and other single-wire closed-circuit systems having instruments wired in series.

The main object of the invention is to provide a system by means of which if a wire is broken, cut, or becomes electrically disconnected at one or more points in the main or external circuit the system will still be operative and signals can still be sent from all the boxes in said circuit.

Another object of the invention is to provide a system of this character having call-boxes of novel construction, together with a novel combination of wiring and instruments at the central or receiving station whereby, in addition to the above-noted result, notice will be instantly given at the central office of the break in the line.

Still another object is to provide a means by which the cut, broken, or disconnected wire can be conveniently located, so that it may be repaired.

With these and other objects in view the invention consists in certain novel features of construction, combination, and arrangement of parts, as will be hereinafter more fully described, and particularly pointed out in the appended claims, reference being had to the accompanying drawings, in which—

Figure 1 is a diagrammatic view of a calling or signaling system embodying my invention, showing in full and broken lines the respective arrangement of the switches when the system is in normal condition and when there is a break in the line. Fig. 2 is a front view of one of the call-boxes in closed condition. Fig. 3 is a similar view, the cover being removed to expose the interior; and Figs. 4, 5, and 6 are detail views of the commutator mechanism.

In the accompanying drawings I have shown the application of my invention to a district-messenger-call system, although I do not desire to limit it thereto, as it may be employed in connection with fire-alarm and other signal systems.

Referring now more particularly to the drawings, the numerals 1, 2, 3, and 4 represent call-boxes which are installed in series in a closed circuit A, comprising the wires a, a', a^2, a^3, a^4, a^5, a^6, a^7, and a^8 and having therein a controlling knife-switch A′ and a relay or electromagnet A^2. As shown, each call-box has binding-posts 5 and 6, to which the adjacent ends of the bridge-wires a', a^2, a^3, a^4, and a^5 are connected, and each call-box also has a binding-post 7 for the attachment of the ground connection 8. The switch A′ is of the double-pole double-throw type, and the wires a a^6 are connected to the pivot-posts a^9 of its switch member A^3, while the wires a^7 and a^8 are connected to one of its sets of connecting-lugs a^{10}. The switch member A^3 swings between the lugs a^{10} and an opposite set of connecting-lugs a^{11} and when engaged with said lugs a^{10} maintains the closed condition of the circuit A. The electromagnet or relay A^2 is connected to the wires a^7 and a^8, and its armature a^{12} is retracted, when the magnet is de-energized, by a retracting-spring a^{13} and drawn into engagement with a contact a^{14}. Included in the circuit A are batteries B B′, which are connected up, respectively, with the wires a a' and a^5 a^6. Any other suitable source of electric energy may be used in place of the batteries.

Each call-box comprises a box or casing C, having a removable cover C′, bearing on its outer face points marked "Mess.," "Police," "Fire," "Special." Within it is arranged the usual spring-driven clockwork mechanism c, set in motion by the adjustment of the crank

c' to one of the aforesaid points, such motion of said mechanism turning a commutator-wheel c^2 one, two, three, four, or more revolutions, according to the points to which the crank has been turned, to sound the signal one or more times. The commutator is provided with brushes c^3 c^4, which are carried by a block of insulation c^5. The brush c^3 is connected by a wire c^6 to a stop-arm c^7, which is insulated from the frame by an insulating-washer c^8, and to the binding-post 6. The brush c^4 is connected by a wire c^9 to the binding-post 7, to which the ground-wire 8 is attached. Formed in the edge of the commutator-wheel are notches c^{10}, and on one side of said wheel are contact-pins c^{11}, which coöperate, respectively, with the brushes c^3 and c^4. These notches are of proper number and arrangement to cause the circuit A when the commutator is revolved to be opened in rapid succession the number of times necessary to operate the signal at the central office to indicate the number of the box, and the pins correspond in number to the notches. The pins are also so arranged that each contact-pin comes into engagement with the brush c^4 before the brush c^3 enters the adjacent notch and moves out of contact with brush c^4 before brush c^3 passes out of the notch. This arrangement prevents short-circuiting when in the normal action of the parts the circuit is through the brush c^3 and closed circuit A and at the same time admits of the completion of a circuit through the ground-wire 8 when the circuit connection of brush c^3 is broken.

The switch A′ and relay A^2 are disposed at the central or receiving station, and also disposed at said station is a circuit D, comprising wires d d', connected to relays or electromagnets D′ D^2, which are coupled by a conductor d^2, having a ground connection d^3. The armature d^4 of the magnet D′ is retracted by a spring d^5 and is adapted when the magnet is energized to engage a contact d^6, and the armature d^7 of the magnet D^2 is similarly retracted by a spring d^8 and adapted when said magnet is energized to engage a contact $d^{9\times}$. The wires d d' are connected to the connecting-lugs a^{11} of the switch A′, and the switch member A^3 is adapted to engage either set of lugs a^{10} or a^{11}, as shown, respectively, in full and dotted lines in Fig. 1. The circuit D forms an auxiliary normally inactive part of the main circuit A.

E denotes a local open circuit located at the central station, the same comprising wires f, f', f^2, f^3, f^4, and f^5 and a battery or other source of electric energy B^2. In this circuit is included a signal device G, an incandescent flash-lamp G′, and a controlling-switch H. The signal device G may be of any preferred construction, but as shown consists of an ordinary single-stroke tap-bell comprising the gong g, electromagnets g', and spring-retracted armature g^2, carrying the bell-hammer g^3. The lamp G′ serves as an auxiliary signal for indicating the approximate point of a break in the line. In place of the lamp I may use an annunciator or any other suitable form of aural or visual signal. The switch H may be, as shown, an ordinary knife-switch of the double-pole single-throw type. Its switch member H′ is pivoted to the posts h, to which the wires f' f^5 are connected, and is movable to engage the connecting-lugs h', which are connected by the wires f f^4 to the armature a^{12} and contact-point a^{14} of the relay A^2, whereby the local circuit may be connected up so as to be controlled and thrown into and out of circuit of the line through the relay A^2. The wire f^2, containing the lamp G′, is connected to the contact-points d^6 $d^{9\times}$, and the wire f^3, containing the battery B^2, is connected to the armatures d^4 d^7 of the relays D′ D^2. The wires f^2 f^3 are connected directly with the contact-point d^6 and armature d^4 of relay D′ and by branch wires d^9 d^{10} with the contact-point $d^{9\times}$ and armature d^7 of relay D^2.

Assuming the parts to be in the normal position, (shown in Fig. 1,) I will now describe the circuits and trace the path of the current, as follows: Starting from switch A′ the current flows through wire a to battery B, thence through wire a' to binding-post 5 of box 1, through the frame of the box, via wire 5′, to the commutator-wheel c^2, thence by way of brush c^3, wire c^6, and binding-post 6 to wire a^2, thence successively through the other boxes, 2, 3, and 4, in like manner, and finally back to wire a via wire a^5, battery B′, one of the lugs a^{10}, one side of switch A^3, wire a^8, relay A^2, wire a^7, and other lug a^{10} and other side of switch A^3. It will thus be perceived that as the circuit described is normally closed the current flowing through the magnets of relay A^2 will normally hold the armature a^{12} in contact with the cores of the magnets and that when said circuit is broken and relay A^2 deënergized the spring a^{13} will draw armature a^{12} away from the cores of the magnets and bring it into engagement with contact a^{14}, thereby closing the circuit E. Therefore should the crank c' of any of the call-boxes be turned in the direction of the arrow the clockwork mechanism c will be set in motion, causing the commutator-wheel c^3 to revolve one or more times, according to the degree of movement given the crank, allowing the brush c^3 to drop into the notches c^{10}, thus breaking the circuit A for one or more short intervals, according to the box operated. Assuming that the crank of box 3 is operated, then the main closed circuit will be opened three times, that being the number of the notches in the commutator-wheel of said box. If box 4 were operated, the circuit would be opened four times, and so on. When the circuit is thus opened by the action of the commutator-wheel revolving and the contact being broken between it and brush c^3, relay A^2 is simultaneously deënergized a number of

times according to the box operated, allowing armature a^{12} to be drawn back into engagement with contact-point a^{14} under the action of spring a^{13}, as shown in broken lines in Fig. 1, causing the local open circuit to be closed, whereupon one or more current impulses will flow through wire f, one side of switch H′, wire f', wire f^3, battery B^2, magnets of bell G, back through wire f^2, wire f^5, opposite side of switch H′, and conductor f^4. This causes the bell G to strike off a corresponding number of taps, thereby indicating the number of the box which has been operated. If a wire in the main closed circuit A should now be cut, broken, or electrically disconnected, the electromagnet or relay A^2 will be deënergized, permanently closing the local circuit E and causing bell G to make one stroke, thus giving notice of such break to the operator or attendant at the central station. Upon hearing this signal the operator throws the two sets of boxes on opposite sides of the break into two separate circuits having a common connection with the signal-circuit E by shifting switch A^3 from the full-line to the broken position shown in Fig. 1 and opening switch H′, as also shown in broken lines in Fig. 1, thereby cutting out the relay A^2 and throwing in relays D′ D^2. This causes the main circuit, which has normally been closed, to become two distinct open circuits. Assuming that the break has occurred at the point X in the wire a^3, I will now describe the two main open circuits which are thus formed and the method of indicating the location of the break at the central station. Starting at box 2 at the left side of the broken wire a^3 when the crank c' is operated, the commutator will revolve as before; but the current will flow from ground through wire 8, binding-post 7, wire c^9, brush c^4, pins c^{11}, commutator-disk c^2, box C, wire 5′, binding-post 5 to wire a^2, thence to and through box 1 via binding-post 6, wire c^6, brush c^3, commutator-wheel c^2, box C, wire 5′, and binding-post 5, thence through wire a' to battery B, to wire a, switch A^3, wire d, magnet D′, and back to ground at d^3. This causes the magnet D′ to become energized, thus moving armature d^4 into engagement with contact-point d^6 and closing circuit E, the current passing along conductor f^2, flashing lamp G′ and operating bell G, and back through wire f^3 and battery B^2. The bell is thereby caused to sound two strokes and the lamp to give two flashes. Hence it will be observed that all the boxes to the left of the break X, the battery B, switch A′, and associated wires form a normally open circuit which when closed by the commutator-switch mechanism at the operated box closes the signal-circuit E. I will now trace the second open circuit, starting at call-box 3, which circuit includes all the call-boxes to the right of the break X. Operation of the crank of said box will cause the brush c^4 to engage pins c^{11}, whereupon a current will flow from earth to wire 8, binding-post 7, wire c^9, brush c^4, pins c^{11}, commutator-disk c^2, brush c^3, wire c^6, and binding-post 6 at said box to wire a^4, through box 4 to wire a^5, battery B′, wire a^6 to switch A′, thence to wire d', electromagnet D^2, and wire d^2 to earth at d^3, causing the armature d^7 to close the circuit E, the current passing through said circuit via tap d^{10} to wire f^3 and battery B^2 to bell G, thereby operating the latter, thence back through wire f^2 and tap d^9 to the contact-point d^{9x}. It will be observed that in operating the first main open circuit from box 2 or any other box therein the lamp G′ is operated, giving a flash for each stroke of the bell, but that in the operation of the second main open circuit the lamp is unaffected as the current flows back through the tap d^9 to the relay D^2 without passing through the lamp. Therefore as box 2 when operated causes lamp G′ to flash and box 3 does not it will be clear to the operator at central that the break in the wire is between boxes 2 and 3. Upon repairing the broken wire both magnets D′ D^2 will be permanently energized and bell G will be caused to sound one stroke. This sound is a signal that the wire has been repaired, and upon its receipt the operator has only to throw the switch A^3 back into contact with poles a^{10} and again close switch H′ to restore the circuit to its normal condition. Should lightning strike the main closed circuit-wires at any point, it can freely flow to the earth at any of the call-boxes in the circuit by jumping across the small air-gap between brush c^4 and the contiguous pin c^{11}. I may, if desired, make the circuit E a normally closed instead of a normally open circuit and vary the system accordingly.

From the foregoing description, taken in connection with the accompanying drawings, the construction, operation, and advantages of the invention will be readily understood without requiring a more extended explanation.

Various changes in the form, construction, and arrangement of parts may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

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

1. A signaling system, comprising a series of signaling devices, wired in series in a single-wire closed circuit, an automatic switch actuated by the breaking of said circuit, an open signal-circuit containing an indicator and closed by said switch, a third circuit normally independent of the said closed and open circuits and containing automatic switches, means located at the central station for disconnecting the first-named switch from the open circuit and connecting up the last-named switch with said open circuit and the closed circuit to form two independent open circuits when a break at any point in the closed circuit oc-

curs, so that the signaling device on one side of the break will be included in one of said circuits and the signaling device on the other side of the break in the other circuit, and a break-indicating signal located in said open circuit and adapted to be shifted into one of said independent open circuits and operated thereby and to be unaffected by the other independent open circuit, substantially as described.

2. A signaling system comprising signaling devices connected in series in a single-wire closed circuit, a source of electric energy and an automatic switch in said circuit, each of said signaling devices being provided with a commutator having two sets of contact portions and coacting brushes having two connections, one with said circuit and the other with the earth, said brushes acting alternately, an open circuit containing a source of electric energy and an indicator, and adapted to be closed by the said automatic switch when the closed circuit is open, a hand-switch at the central station for disconnecting the said open circuit from the said switch, an auxiliary main circuit having automatic switches provided with a common ground connection and in circuit with the said closed circuit and adapted to independently close the same, and a hand-switch at the central station for throwing the first-named automatic switch or the said auxiliary circuit into connection with the main circuit, whereby, when a break occurs at any point in the closed circuit, by operating the said switch and the means for connecting or disconnecting the first-named automatic switch with or from the open circuit, the signaling devices upon opposite sides of the break in the said closed circuit may be thrown into two independent open circuits including the said auxiliary circuit, its automatic switches and the open circuit containing the indicator, substantially as described.

3. A signaling system comprising signaling devices connected in series in a single-wire closed circuit, a source of electric energy and an automatic switch in said circuit, each of said signaling devices being provided with a commutator having two sets of contact portions and coacting brushes having two connections, one with said circuit and the other with the earth, said brushes acting alternately, an open circuit containing a source of electric energy and an indicator, and adapted to be closed by the said automatic switch when the closed circuit is open, a hand-switch at the central station for disconnecting the said open circuit from the said switch, an auxiliary main circuit having automatic switches provided with a common ground connection and in circuit with the said closed circuit and adapted to independently close the same, a hand-switch at the central station for throwing the first-named automatic switch or the said auxiliary circuit into connection with the main circuit, whereby, when a break occurs at any point in the closed circuit, by operating the said switch and the means for connecting and disconnecting the first-named automatic switch with or from the open circuit, the signaling devices upon opposite sides of the break in the said closed circuit may be thrown into two independent open circuits including the said auxiliary circuit, its automatic switches and the open circuit containing the indicator, and a signal-circuit containing a calling-indicator and a break-indicating device and adapted to be shifted into one of said independent open circuits and operated thereby and to be unaffected by the other independent open circuit, said signal-circuit being closed in the one instance by an automatic switch in the closed circuit, and in the other instance by either one of the said automatic switches in the auxiliary main circuit, substantially as described.

4. In a signaling system of the character described, the combination of a single-wire closed circuit containing a series of signaling devices, each of said signaling devices being provided with a make-and-break device having two separate connecting elements operating at different periods, one of said sets of elements being connected with the circuit and the other with the ground, an open circuit containing an indicator, a switch in the closed circuit adapted to be automatically operated upon the breaking of said circuit to close the said open circuit, a manually-operated switch at the central office for connecting the said automatic switch with the open circuit, an auxiliary circuit containing automatic switches connected with the open circuit and adapted when operated to close said circuit, said switches adapted to be operated by currents passing in different directions through the auxiliary circuit, and a manually-operated switch at the central office for connecting the closed circuit directly with the open circuit through the first-named automatic switch or indirectly through the said auxiliary circuit, substantially as described.

5. In a signaling device of the character described, the combination of a single-wire closed circuit containing a series of signaling devices, each having a make-and-break device and a ground connection, said circuit also having a pair of batteries, an open circuit containing an indicator and having a battery and a signaling device therein, an automatic switch included in the closed circuit and adapted when said circuit is opened to close the open circuit, a manually-operated switch at the central office for disconnecting said switch from the open circuit, an auxiliary circuit containing two automatic switches and having a ground connection, one of said switches being directly connected to the conductors of the open circuit and the other having branch connections therewith at a point between the disconnector and the first-named switch of the auxiliary circuit, and a manually-operated switch at the

central office for connecting the closed circuit at a point between its batteries directly to the open circuit through the automatic switch therein or indirectly through the said auxiliary circuit.

6. In a signaling system of the character described, the combination of a single-wire closed circuit containing a series of signaling-stations, each of said stations being provided with a make-and-break device having two separate sets of connecting elements operating at different periods, one of said sets of elements being connected with the circuit and the other with the ground, a double-pole, double-throw switch at the terminals of said circuit, a main automatic switch connected with the closed circuit when the double-pole switch is in one of its operative positions, an auxiliary circuit containing automatic switches, said auxiliary circuit adapted to be connected with the main circuit and the said main automatic switch to be cut out of said circuit when the double-pole switch is adjusted to its reverse position, a normally open signal-circuit adapted to be closed by the main automatic switch when said switch is in circuit with the line, or by either of the auxiliary-circuit automatic switches when said auxiliary circuit is connected with the line, said signal-circuit containing indicators, one operated by the closing of either auxiliary switch to denote the calling-station in the line, and the other by the closing of one of said auxiliary switches to determine the point of location of a break in the line, and a manual switch for disconnecting the main automatic switch from the open signal-circuit, whereby, when the said manual switch is closed and the main automatic switch is connected by the double-pole switch with the line, all the signaling-stations will be connected in series in a closed circuit, and when said main automatic switch is cut out by the manual switch and the auxiliary circuit is cut in by the double-pole switch, upon a break in the line the stations on opposite sides of the break will be arranged in two independent open circuits, both controlling the station-indicator in the signal-circuit but only one the break-indicator therein, substantially as described.

7. In a signaling system of the character described, the combination of a single-wire closed circuit containing a series of signaling-stations, each of said stations being provided with a make-and-break device comprising a rotary commutator-disk having sets of notches and intervening projections and brushes to alternately engage the notches and projections, one of said brushes being connected with the line and the other with the ground, a double-pole double-throw switch at the terminals of said circuit, a main automatic switch connected with the closed circuit when the double-pole switch is in one of its operative positions, an auxiliary circuit containing automatic switches, said auxiliary circuit adapted to be connected with the main circuit and the said main automatic switch to be cut out of said circuit when the double-pole switch is adjusted to its reverse position, a normally open signal-circuit adapted to be closed by the main automatic switch when said switch is in circuit with the line, or by either of the auxiliary-circuit automatic switches when said auxiliary circuit is connected with the line, said signal-circuit containing indicators, one operated by the closing of either auxiliary switch to denote the calling-station in the line, and the other by the closing of one of said auxiliary switches to determine the point of location of a break in the line, and a manual switch for disconnecting the main automatic switch from the open signal-circuit, whereby, when the said manual switch is closed and the main automatic switch is connected by the double-pole switch with the line, all the signaling-stations will be connected in series in a closed circuit, and when said main automatic switch is cut out by the manual switch, and the auxiliary circuit is cut in by the double-pole switch, upon a break in the line the stations on opposite sides of the break will be arranged in two independent open circuits, both controlling the station-indicator in the signal-circuit but only one the break-indicator therein, substantially as described.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JOSEPH WEATHERBY, Jr.

Witnesses:

H. Brittingham,

C. C. Hines.