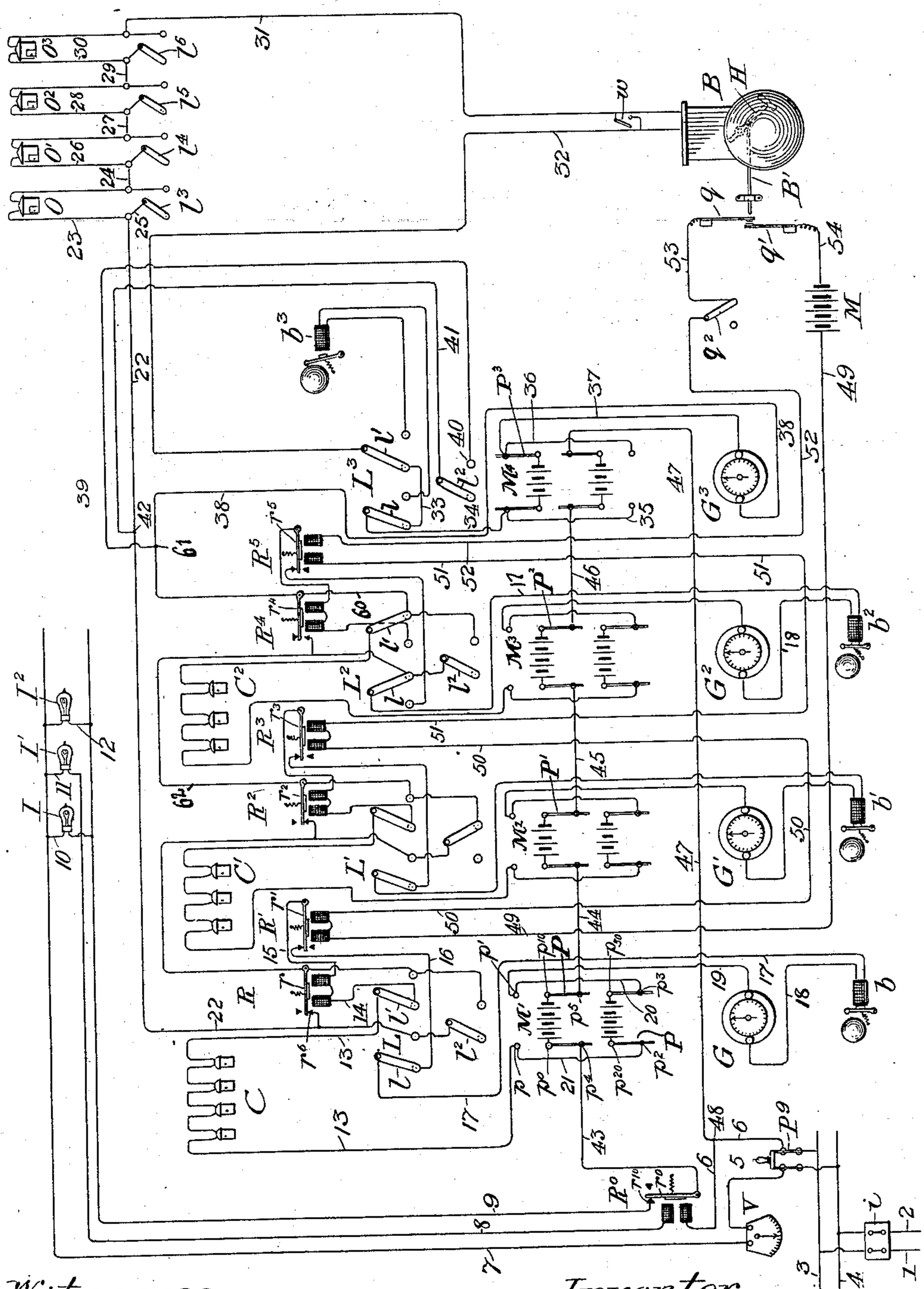
No. 648,367. Patented Apr. 24, 1900.

R. A. SMITH.

FIRE ALARM SYSTEM AND APPARATUS.

(Application filed Aug. 31, 1899.)

(No Model.) 3 Sheets—Sheet 1.



Witnesses:
D. W. Edelin
Elbert Williamson

Fig. 1.

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Fig. 2.

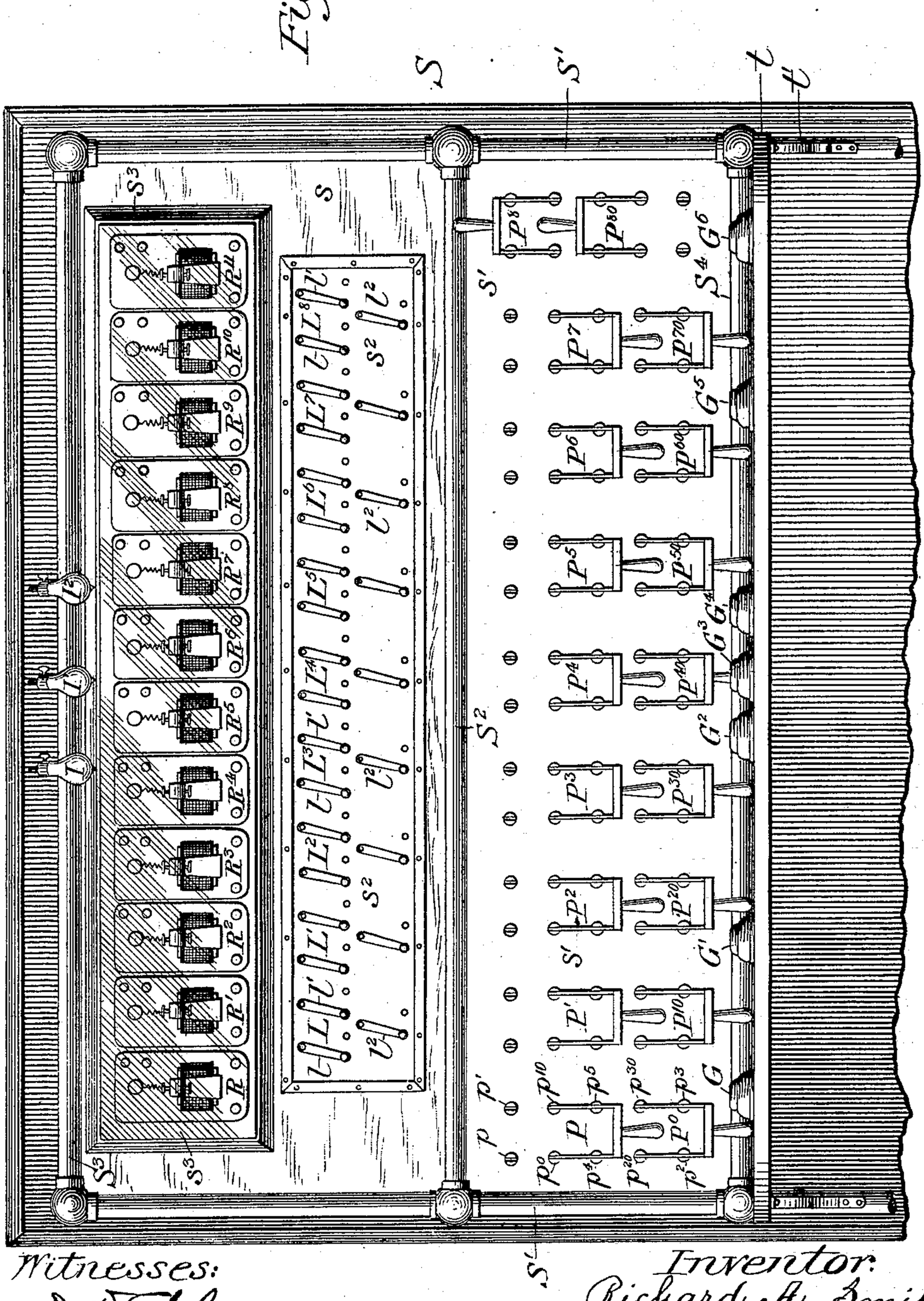

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Fig. 3.

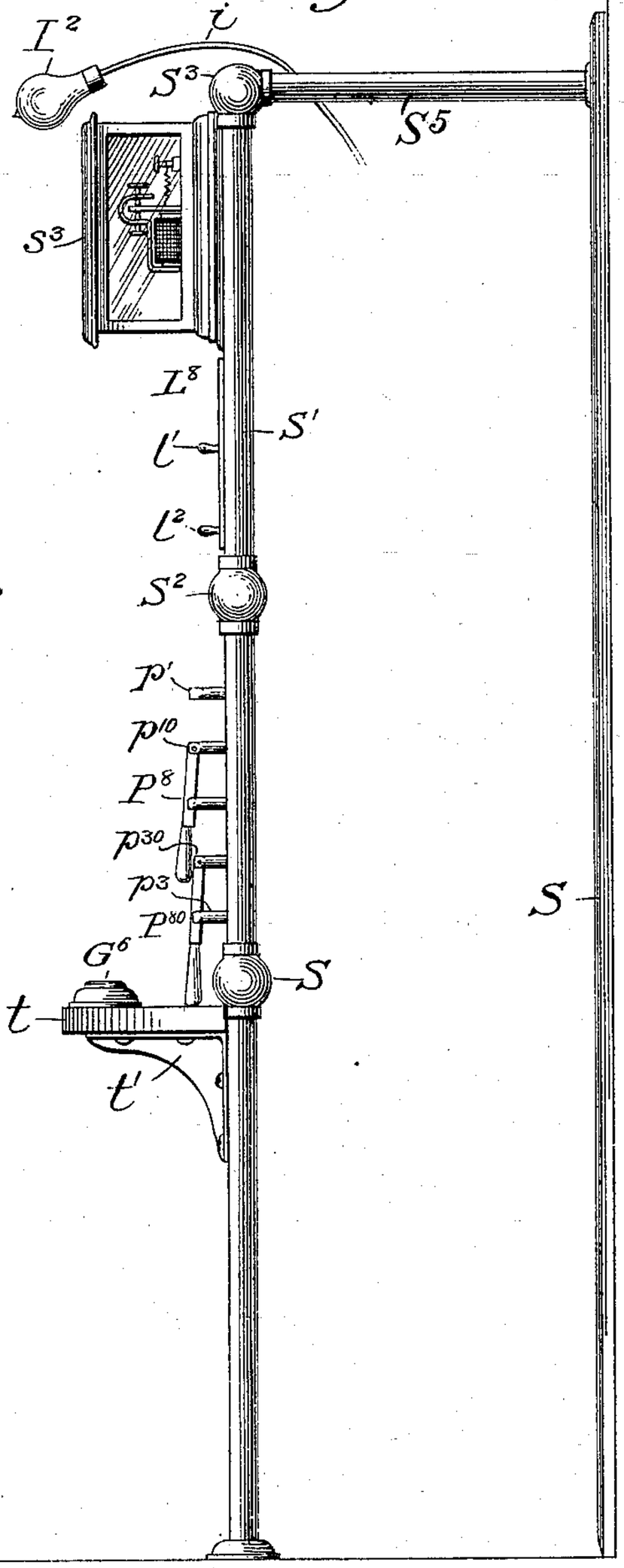
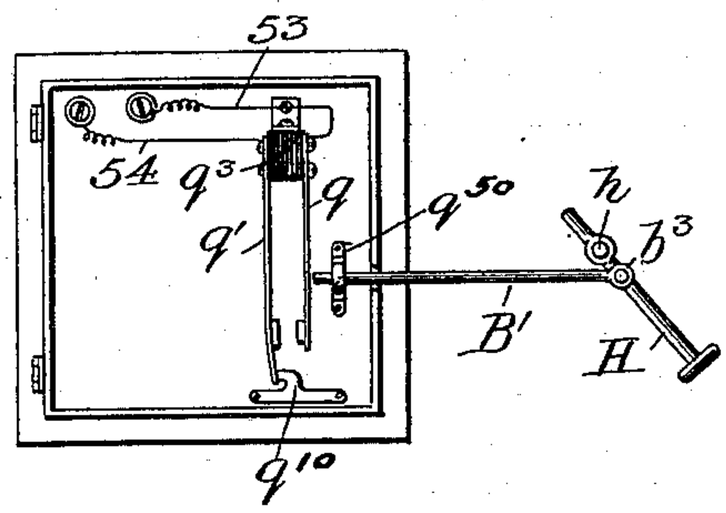


Fig. 4.



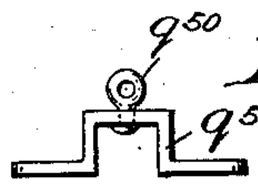


Fig. 5.

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UNITED STATES PATENT OFFICE.

RICHARD ALEXANDER SMITH, OF NORFOLK, VIRGINIA.

FIRE-ALARM SYSTEM AND APPARATUS.

SPECIFICATION forming part of Letters Patent No. 648,367, dated April 24, 1900.

Application filed August 31, 1899. Serial No. 729,054. (No model.)

To all whom it may concern:

Be it known that I, RICHARD ALEXANDER SMITH, a citizen of the United States, residing at Norfolk, in the county of Norfolk and State of Virginia, have invented new and useful Improvements in Fire-Alarm Systems and Apparatus, of which the following is a specification.

My invention relates to fire-alarm-telegraph systems, and particularly to the central-office circuits and apparatus for such systems. In working out these circuits and the apparatus for them a very important point which has been kept constantly in view is the provision of means for repeating signals sent in from one loop over all the other loops without the use of the complicated and expensive mechanisms usually required for the purpose.

With regard to the circuits my invention contemplates the use of individual loops extending from the central office or from each district-station into different portions of the territory to be covered. Each of these loops has connected in it in series a number of alarm-boxes of the well-known closed-circuit break-wheel type. Of course the system might be adapted to work with normally-open loops; but as this is now considered very poor practice and as it would merely necessitate reversals of the connections of relays entirely within the scope of the ordinary electrician I have not thought it necessary to illustrate or describe it. Each loop has its relay in the central office, which controls a main gong and engine-alarm circuit, and each loop has a normally-closed gap controlled by a relay which in turn is controlled by the gong-circuit. I have found by actual use of this arrangement of circuit that all signals may thus be repeated in a system of moderate size without the necessity arising for non-interference or other complicated apparatus. Heretofore there have been many small towns where a fire-alarm system would be very desirable that have been forced to do without such protection because the necessary repeaters would cost from one to three thousand dollars, whereas the entire system, without the repeater, in any ordinary case might be built for less than a thousand dollars. In my system the arrangement is such that even with good operative repeating no parts are required except such as may be purchased in the open market at low prices and aggregated by any skilled electrician or engineer working in accordance with my plans—that is to say, that the main part of the invention lies in the circuits and in the arrangement of ordinary apparatus, so that, for instance, instead of having to purchase special parts, such as relays, ordinary Western Union relays may be used and the like.

My switchboard consists, essentially, of a back or wainscoat and a frame standing a short distance from it and built up in detachable sections, together with suitable panels carried in the frame and supporting the relays, switches, galvanometers, &c.

My invention is fully described in the following specification and illustrated in the annexed drawings, wherein the same reference letters and figures point out the same parts throughout.

Referring to the drawings, Figure 1 is a diagram showing the arrangement of circuits and apparatus for a fire-alarm system having a single central station in accordance with my invention. Fig. 2 is a front view of my switchboard. Fig. 3 is a side view of the same. Figs. 4 and 5 are detail views showing the circuit-closer and the link-guide, respectively, used in connection with the gong to control the repeating relay-circuit.

Referring to Fig. 1, C, C′, and C^2 are loops extending out from the central office and each including in series a number of signal-boxes, as plainly indicated in the drawings. R, R^2, and R^4 are individual relays each included in one of the loops and adapted to control the gong-circuit. M' M^2 M^3 M^4 are secondary or storage batteries each consisting of a duplicate set of cells, one set being adapted to be included in each of the loops while the other set, its duplicate, is being charged. G, G′, G^2, and G^3 are galvanometers, the first three of which, together with the first three of the storage batteries, appertain to the three box-loops shown, while the fourth galvanometer and the fourth battery belong to the gong-circuit, which also extends out to a number of engine-houses, fire-chiefs' houses, &c., in series. These are shown at O, O′, O^2, and O^3. *b*, *b*′, and b^2 are single-stroke signal-bells in the box-circuits. R′, R^3, and R^5 are

relays included in the local circuit controlled by the gong and in turn control their respective box circuits or loops. The circuits of all of these pieces of apparatus will be traced and their functions made clear presently.

The secondary batteries, which are now commonly used in fire-telegraph systems in place of the old-fashioned gravity-batteries, are usually charged in large installations by local generators especially installed for the purpose. In smaller installations they are charged from the city mains, as almost every town that would aspire to a fire-telegraph system is already provided with an electric-lighting system. I have therefore shown the wires 1 2, which are supposed to lead from a source of current suitable for charging the batteries, with open ends. They enter this installation through a fuse-block *i* and are connected to the station bus-bars 3 4. These bus-bars are connected, respectively, to the two sides of a double-pole knife-switch P^9, which, together with the ammeter V and the relay R^0, is located at any suitable point in the room. This may be upon the switch-board, if desired, but not necessarily so, as the condition of the charging-wires is shown by the three incandescent lamps I I' I^2. The circuits of the lamps and batteries are as follows: from switch P^9 by wire 5 to ammeter V, by wire 7 to one side of all the lamps, through lamp I' by branch 11, by wire 8 to the relay R^0, and by wire 6 back to the switch and the bus-bar. This circuit is always complete when the switch P^9 is closed and serves for two purposes—first, by means of the lamp I' at the board to show that the charging-current is on and by the ammeter, which is usually located at the switch, that the current is up to the proper amperage, and, second, to operate the relay to close the charging-circuits proper as follows: from the switch P^9 by wires 5 and 7 to the lamps I and I^2, through these lamps in parallel (the parallel resistance thus obtained being low enough to insure the proper volume of charging-current and enabling the current-flow to be cut down if any batteries are cut out by simply cutting off one lamp at the key-socket, as shown in Fig. 2, this of course doubling the resistance) by wire 9 to the front contact r^{10} of the relay R^0, through the armature r^0 by wire 43 to the post p^4, thence through the battery M′ to post p^5, by wire 44 to and through the same connections of battery M^2, by wire 45 to and through battery M^3, by wire 46 to and through battery M^4, and by wire 47 back to the point 48 and wire 6 to the switch P^9. The reason for having the relay R^0 control this circuit is that when the current ceases to flow into the charging-main for any reason with the switch P^9 closed the charging-circuit through wires 43 and 48 will be broken, thus preventing the batteries from discharging back through the generator or generators at the other end of the wires 1 2. Where the current ceases because of the stoppage of the generators, this is obviously necessary, and where it is cut off by reason of an accidental cross or short circuit it is even more so.

The arrangement of the double-pole double-throw switches P P′, &c., is as follows: As shown in Fig. 2, the uppermost pair of posts p p' appertain particularly to the switch P or P′, while the lowermost pair of posts p^2 and p^3 appertain particularly to the switch P^0. The intermediate pair of posts p^4 p^5 are so placed as to be common to both switches; but only one switch can be thrown into contact with them at once. Now each switch has one of the pair of secondary batteries included between its switch-blades. Thus the switch P^0 is pivoted upon the posts p^0 and p^{10}, and one of the first pair of storage batteries at P is bridged between these posts. In a similar way the other one of the pair is bridged across the posts p^{20} and p^{30}, upon which is pivoted the switch P^0. The uppermost pair of posts p and p' and the lowermost pair of posts p^2 and p^3 are connected in parallel through wires 20 and 21 to the wires 13, the boxes C, the switch l', wire 14, relay R, wire 15, armature r', and the back contact thereof of relay R′, by wire 16 to switch l, wire 17 to bell b, wire 18 to galvanometer G, wire 19, and back to the switch-post—that is, to the loop-circuit C. The intermediate posts p^4 and p^5 are serially connected all across the board in the charging-wires 43 44 45 46 47. It must thus be apparent that by throwing the upper switch down into contact with posts p^4 and p^5, as shown in Fig. 1, the battery connected with said switch is connected into the charging-circuit, while by throwing the lower switch down into contact with the posts p^2 and p^3 the other battery of the pair is connected into the loop-circuit for service. Obviously if both switches were thrown up, as are P^8 and P^{80} in Fig. 2, the connections of the batteries as regards charging and discharging would be reversed relatively. Each galvanometer G, &c., indicates at all times the condition of its circuit. The bell b or b', &c., responds to the changes due to signals in any particular loop. By the method of repeating, which will be described, it will be seen that these bells also respond to changes in all the loops. Their use in Fig. 1 in the position shown does not necessarily mean that they are the only responsive devices in the loop-circuits. They are intended to stand for whatever in the way of signal-receiving devices may be included in the loops either at the central station or outside. Thus each loop may have one or more engine-houses connected with it, and in that case its responsive devices would all be closed-circuit devices, such as those shown at b.

Thus far I have described the charging-circuits, the loop-circuits, and the battery connection. The system would be operative with only these, for each loop would serve for the

transmission of signals to its individual bell *b b'*, &c. I will now describe the gong-circuit and the repeaters. B in Fig. 1 is any suitable electromechanical stroke-gong, which is arranged to work on a closed circuit and which is provided with a hammer H and clockwork mechanism for operating the same, normally held up against operation by the energization of a controlling-magnet. From the hammer H, I extend a link B' into a box, preferably of cast metal, which I locate beside the gong in any suitable part of the room. This box and its arrangement of parts are best shown in Figs. 4 and 5. Referring to those figures, the link B' extends through an orifice in the wall of the box and through the eye of a guide q^{50}. This eye is pivoted upon a small bridge q^5, fastened to the back of the box, and its function is to give lateral play to the link B' as the latter is swung by the hammer. Within the box a pair of springs *q q'* are mounted upon a block of insulation q^3 and are connected by wires 53 54 to suitable binding-posts. The spring *q'* normally rests under considerable tension against a stop q^{10}, and the spring *q* lies in the path of the end of the link B', so as to be pushed over and lift the twin spring from its support, thus making a good contact with it.

Returning to Fig. 1, the springs *q* and *q'* are connected in a local circuit, which contains a battery M, which may be composed of ordinary open-circuit cells, such as the Leclanché, and which also contains all of the relays R' R^3 R^5 in series as follows: from battery M by wire 49 to relay R', wire 50 to R^3, wire 51 to R^5, wire 52 to a switch q^2, by which the circuit may be broken, if desired, and thence by wire 53 to spring *q* and from spring *q'* by wire 54 back to the battery. When the springs *q* and *q'* are forced together by the dropping of the hammer of the gong for a stroke, all of these relays attract their armatures simultaneously, and each loop-circuit C, C', and C^2, if in proper condition, will be broken for the moment, the bells *b b' b²* and such other bells as may be in the loops thus responding by giving one stroke, the same as the gong B. The circuit of the gong B, by which it is controlled, is by way of wire 31 to and through the loops O^3, O^2, O', and O and wire 22 to and through the front stop and armatures of the relays R, R^2, and R^4 in series, and thence by the wire 38 to the galvanometer G^3 and by the wire 37 to the switch and secondary battery P^3 and by wire 34 to the set of switches L^3, and thence by wire 32 back to the gong. With this arrangement if there is a break on any loop due to a signal the relay of that loop will release its armature and break the gong-circuit, thus giving the signal not only by the gong striking, but through the repeating-circuit 53 54, &c., to all the other loops. In Fig. 1, however, I have chosen to show the gong-circuit as switched out of the ordinary way by the switches at L^2. These switches are part of a complete set extending across the face of the switchboard, of which there are three for each circuit, which I have lettered *l*, *l'*, and l^2 for each group or for each loop. Of these *l* and *l'* are the terminals of the loop-wires 13 and 17 and normally rest upon contacts which connect these loop-wires through the magnet of the loop-relay, as R, and through the armature and back-stop of the repeating relay, as R'. This normal connection is shown in loop C at the left of Fig. 1. It will there be perceived that the switch l^2 has but one contact and that it is shown open. When closed, it short-circuits the contact r^6 and the armature *r* of the relay R, so that the signals coming in from that loop will not affect the gong-circuit 22, &c. This position of the switch may be used when a test of the loop is desired or when for any reason the loop is placed out of service, as by a cross or short circuit.

When the switches *l* and *l'* are thrown to the right, they break their loop-wires away from the normal connection to the relay and repeating magnet and throw them into connection directly with the gong-circuit. This condition is shown at the third set of switches L^2. Here the loop-circuit coming from the boxes of the loop C^2 is connected by the switch *l'* of the set L^2 through wire 60 to wire 38 at the point 61, thence to and through the galvanometer and the rest of the gong-circuit by wires 31 and 22 and through the armature *r* and r^2 by wire 62 to contact of switch *l*, and thence by wire 17 to bell b^2, galvonometer G^2, secondary battery at P^2, and back onto the loop. The loop-circuit itself being thus united with and forming a part of the central-office gong-circuit, there is no necessity for a repeater nor for a loop-relay, and of course both of these are cut off. All signals coming in over that loop affect the gong directly, while any other signals coming from other loops will affect the gong-circuit through their relays and inasmuch as the switched loop is a part of the gong-circuit will also affect it. This expedient may be resorted to when the relay or repeater of a loop is out of order, or if a repeater alone does not work the short-circuiting switch l^2 would be used.

Included in the gong-circuit is a group of these switches, (indicated at L^3 in Fig. 1.) In this group when the upper pair of switches *l* and *l'* are thrown to the left, as shown, they merely complete the circuit through a short wire 33. When they are thrown to the right, however, they include a test-bell b^3 in the gong-circuit. In using this bell for testing loops the short-circuiting switch *w* would be used to prevent the gong responding, which would of course repeat the test into all the loops. The switches l^3, l^4, l^5, and l^6 are also used to short-circuit the loops O, O', O^2, and O^3, so that the test-circuit will be past those loops by the switches and the wires 24, 25, 27, and 29 instead of by the wires 23, 26,

28, and 30. The switch l^2 being thrown upon contact 40, it closes a short circuit through wires 39 and 41 between the points 42 and 61 of the main-gong circuit, thus enabling tests of all the inside part of the circuit to be made with the switches $l\,l'$ thrown to the right without affecting any of the loops. During such a test loop-signals would come in on the bells b, b', and b^2.

Referring now to Figs. 2 and 3, S is a wainscoat, of wood or other suitable material, mounted upon a wall. Set out from this wainscoat a sufficient distance to permit the passage of persons behind it is a frame having vertical members S′ S′ and horizontal members S^2, S^3, and S^4. This framing I preferably construct of tubular brass in short lengths connected by brass fittings. In this way a very flexible board is obtained, for by substituting a T for an angle fitting at each upper corner I can add another panel when required. The vertical members are secured to the floor by suitable flanges, and at their upper extremity horizontal members S^5 connect the board with the wainscoat S. The upper portion of the board consists of a panel s, of wood, set into the frame and carrying a case s^3, glazed in front and on the side and containing the relays R R′ R^2, &c. The relays shown in Fig. 2 suffice for six loops, one of each pair being loop-relays and the others being repeating relays. The lid of the glazed case is hinged to permit of ready access to the relays for adjustment or repairs. Set into the panel s below the box s^3 is a fiber or ebonite panel s^2, carrying the groups of switches L L′ L^2, &c. This panel I secure by means of a brass flange around it, which also serves to give it an ornamental appearance. The lower half of the board consists of a panel s', of slate, carrying the switches P P′, &c. Mounted just below this panel, upon brackets p', is a shelf t, carrying the galvanometers G G′, &c. There are seven of these shown, six being for the loops and one for the gong-circuit. By constructing a switchboard in this way I attain at once three desirable ends—first, strength and durability; second, an ornamental appearance, and, third, a possibility of aggregating the parts or replacing any of them from the supplies carried by any good electrical-supply dealer. No special apparatus is required, the only extra work to be done after obtaining the parts and constructing the frame being to put in the relays into the glazed case, drill and fit the panels, and wire up.

In Fig. 3 I have not shown the wiring behind the board, as it would convey no meaning, as it shows in reality and would needlessly complicate the drawing. It is sufficient to say that the loop-wires and other circuit, cables and all, are brought up or down onto the wainscoat S, where a suitable cross-connecting frame permits their arrangement, from which suitable jumpers are carried across by the members S^5 of the frame to the back of the board. The pilot-lamps I, I′, and I^2 are mounted upon bracket-arms i, which extend over the front of the board. As all of the construction back of the board is alien to my invention, I have not shown this either.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. In a fire-telegraph system a series of loops extending out from a central station and containing signal-sending and signal-receiving devices, a local circuit and responsive devices therein at the central office under the control of all the loops, a second local circuit and a series of relays included therein controlling contacts in the various loops, and means whereby the responsive devices in the first local circuit may control the second local circuit, substantially as described.

2. In a fire-telegraph system a series of loops extending out from a central station, a gong-circuit at the central station adapted to be controlled by all of the loops, a series of relays controlling contacts included in the loops, and themselves included in a local circuit, a gong in the gong-circuit, and mechanism controlled by said gong in its operation to open and close the local relay-circuit, substantially as described.

3. In a fire-telegraph system a series of loops, with signal-sending and signal-receiving means in each loop, a gong-circuit common to all of the loops, and a series of relays included in the loops and controlling contacts in the gong-circuit; together with switching means for each loop whereby its relay may be disconnected and the loop simultaneously brought into direct connection with the gong-circuit, substantially as described.

4. In a fire-telegraph system a series of loops, and a gong-circuit having one portion provided with contacts controlled by relays in the loops, a normally-open shunt for said portion, and a normally-open contact with switches therefor and a test-bell adapted to be thereby brought into the gong-circuit, a main gong, and means for shunting the same, substantially as described.

5. In a fire-telegraph system a gong-circuit with a gong therein having a hammer actuated for each signal, a repeating-circuit and a pair of circuit-closing springs therein, together with a connection extending from the gong-hammer into juxtaposition with the circuit-closing springs, substantially as described.

6. In a fire-alarm telegraph system, signaling-circuits, and signal sending and receiving devices therein, in combination with storage batteries arranged in duplicate sets, switches connected to the signaling-circuits and to a charging-circuit respectively and so arranged that one set of batteries may be connected to the signaling-circuits while its twin set is being charged, the charging-cir-

cuit extending to the charging-switches in series, a short circuit or bridge across said charging-circuit and a relay therein, the relay-contacts being included in the charging-circuit between the relay itself and the charging-switches, substantially as described.

In testimony whereof I have hereunto set my hand, this 29th day of August, A. D. 1899, in the presence of two witnesses.

RICHARD ALEXANDER SMITH.

Witnesses:
CHAS. A. BRUCE,
CORA V. GRIFFIN.