No. 717,327. Patented Dec. 30, 1902.

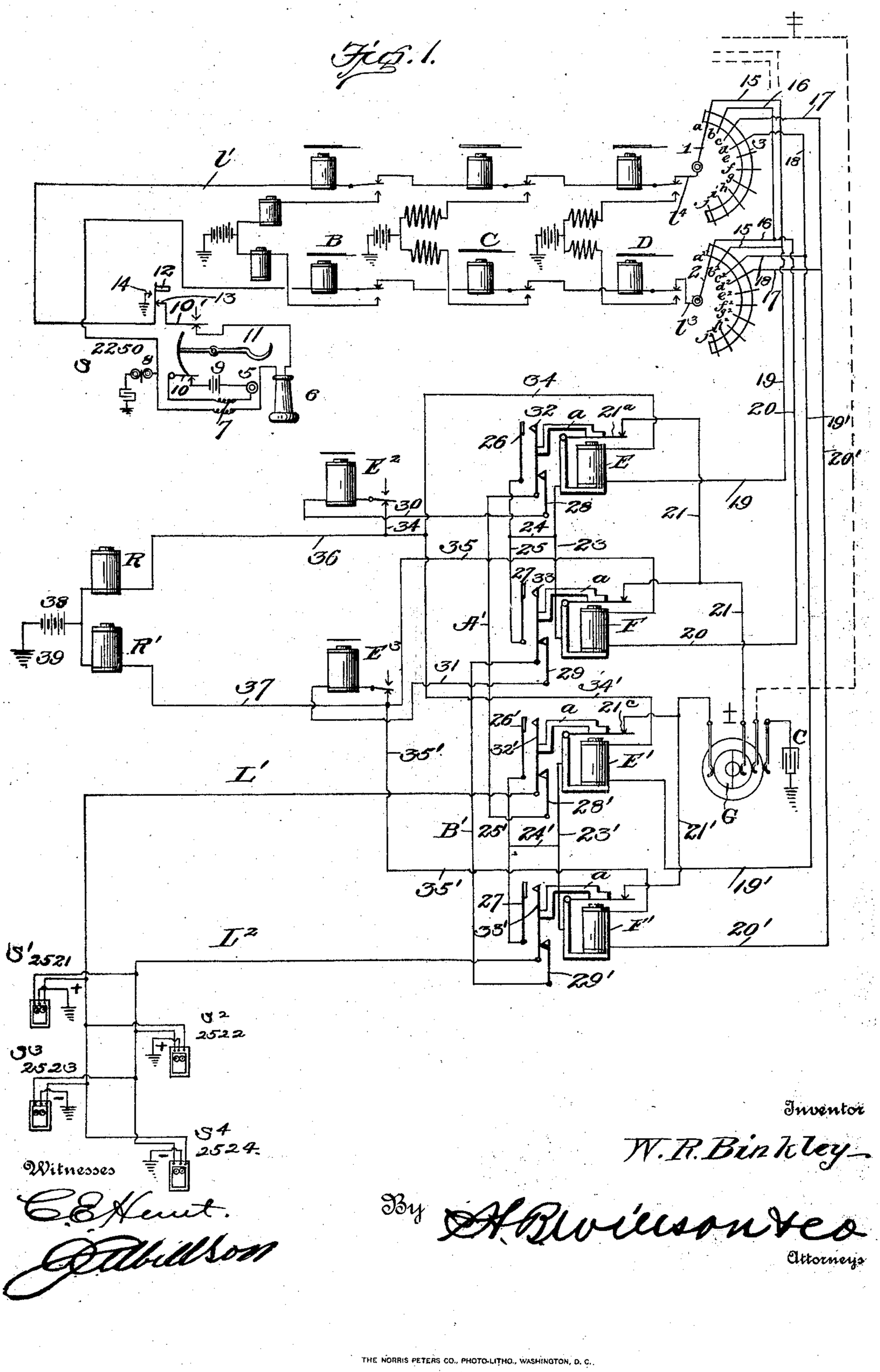
W. R. BINKLEY.

AUTOMATIC ELECTRIC EXCHANGE SYSTEM.

(Application filed July 14, 1902.)

(No Model.) 5 Sheets—Sheet 1.

Fig. 1.



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(No Model.) 5 Sheets—Sheet 2.

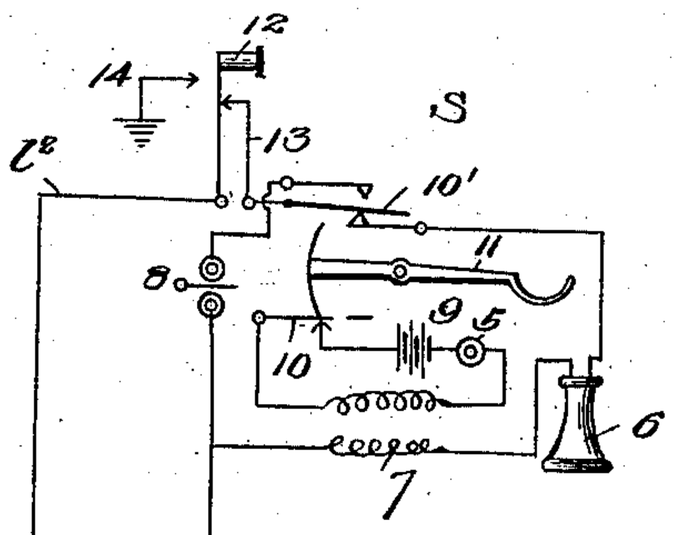
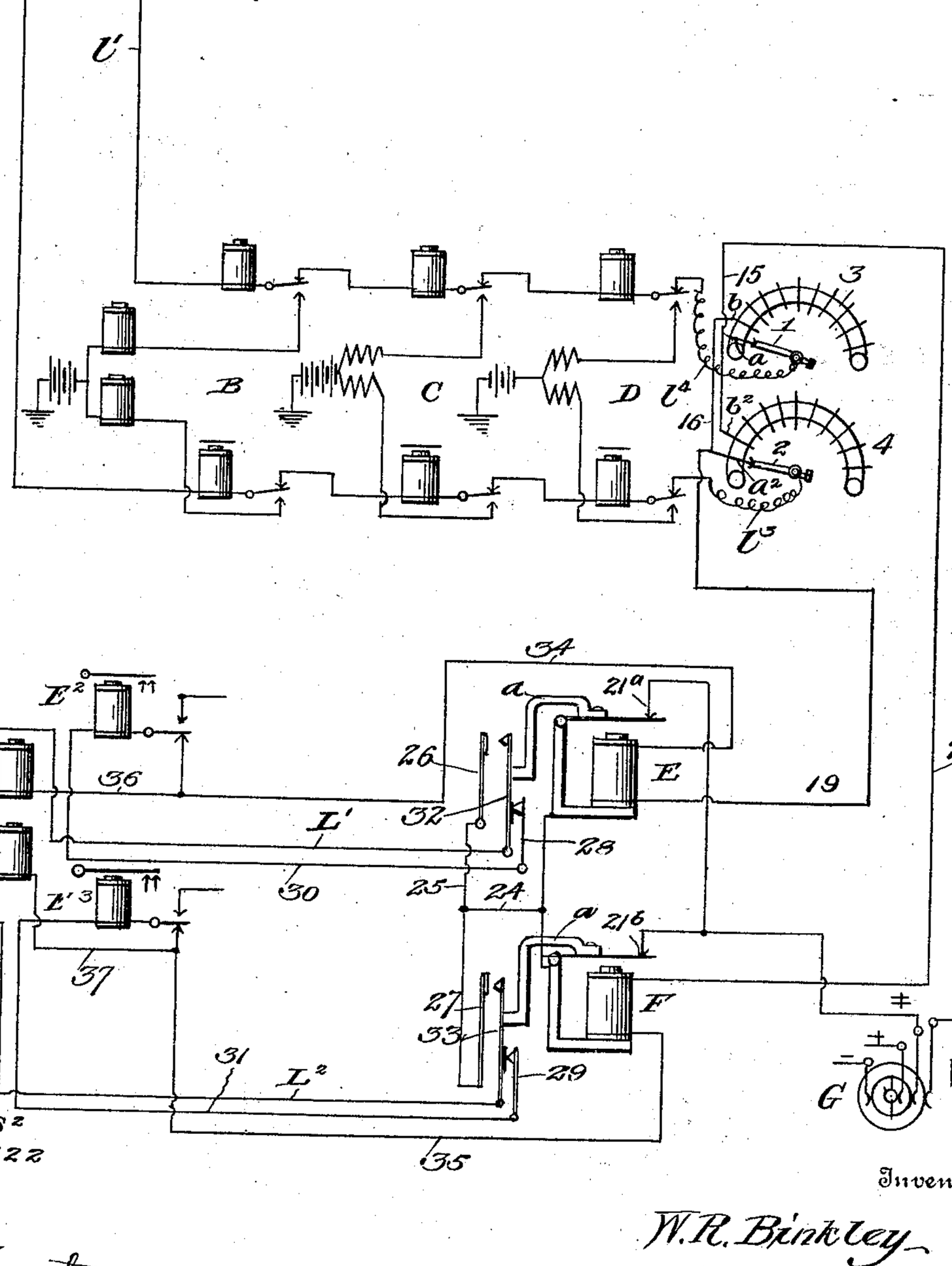


Fig. 2.



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(No Model.) 5 Sheets—Sheet 3.

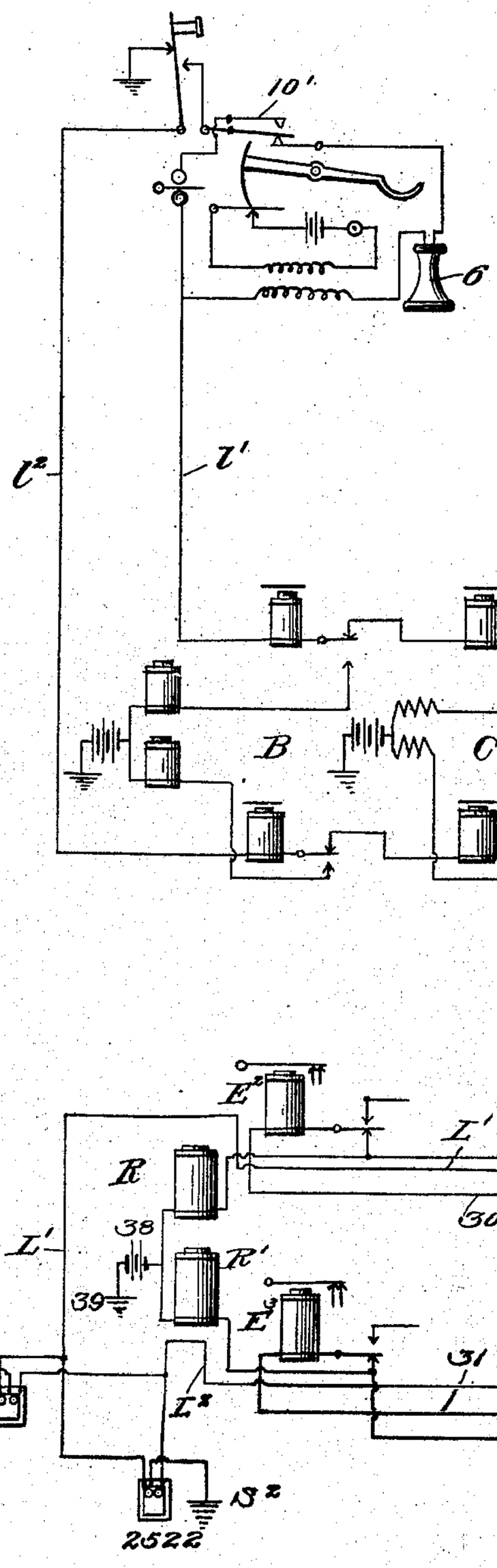

Fig. 3.

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Fig. 4.

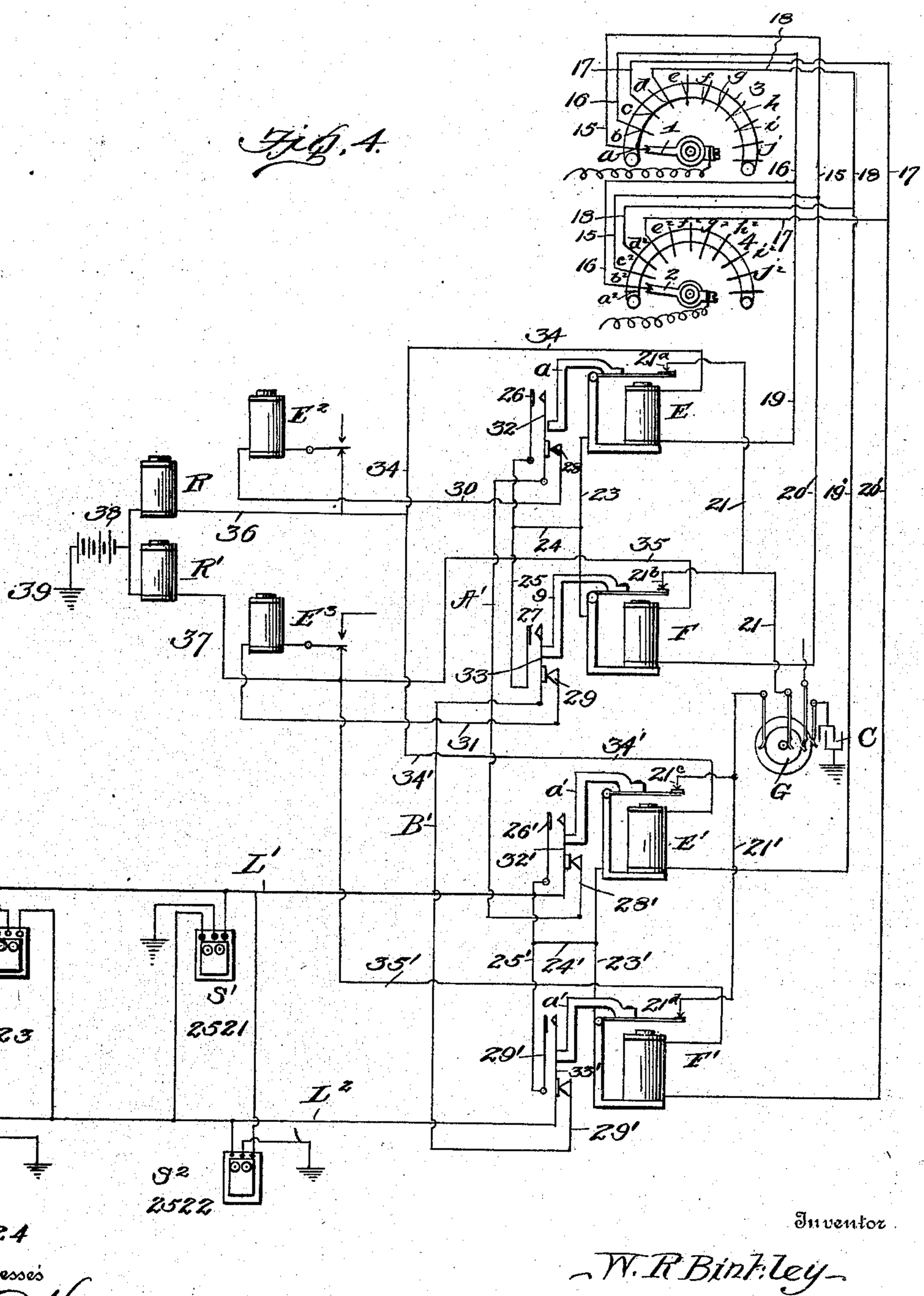

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Fig. 5.

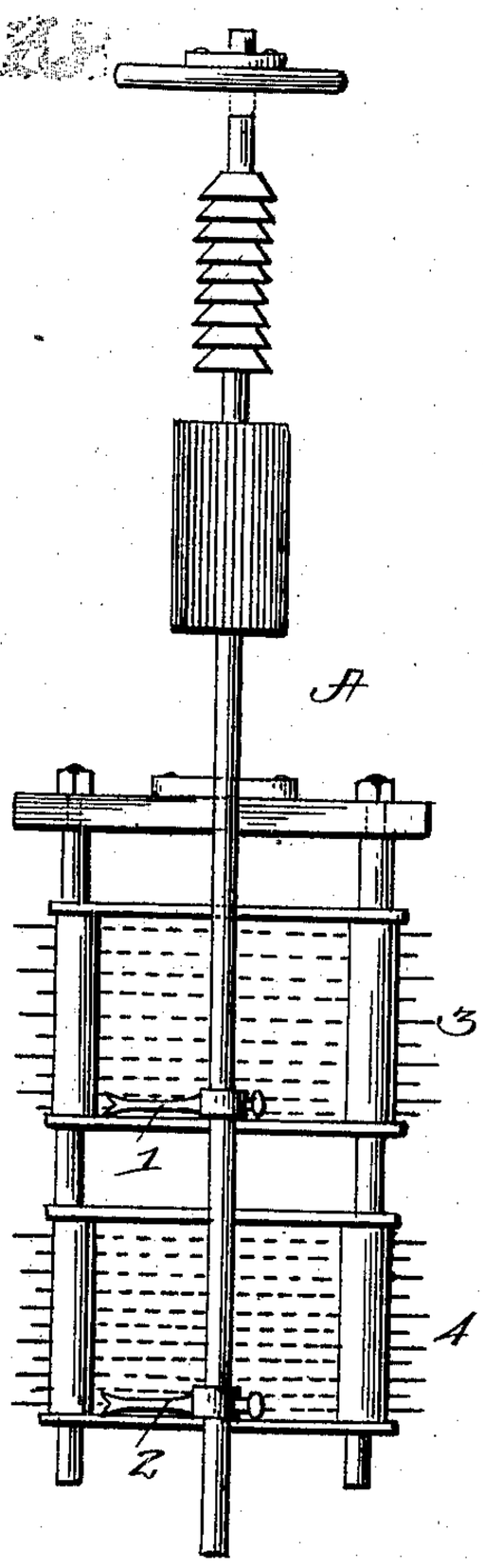
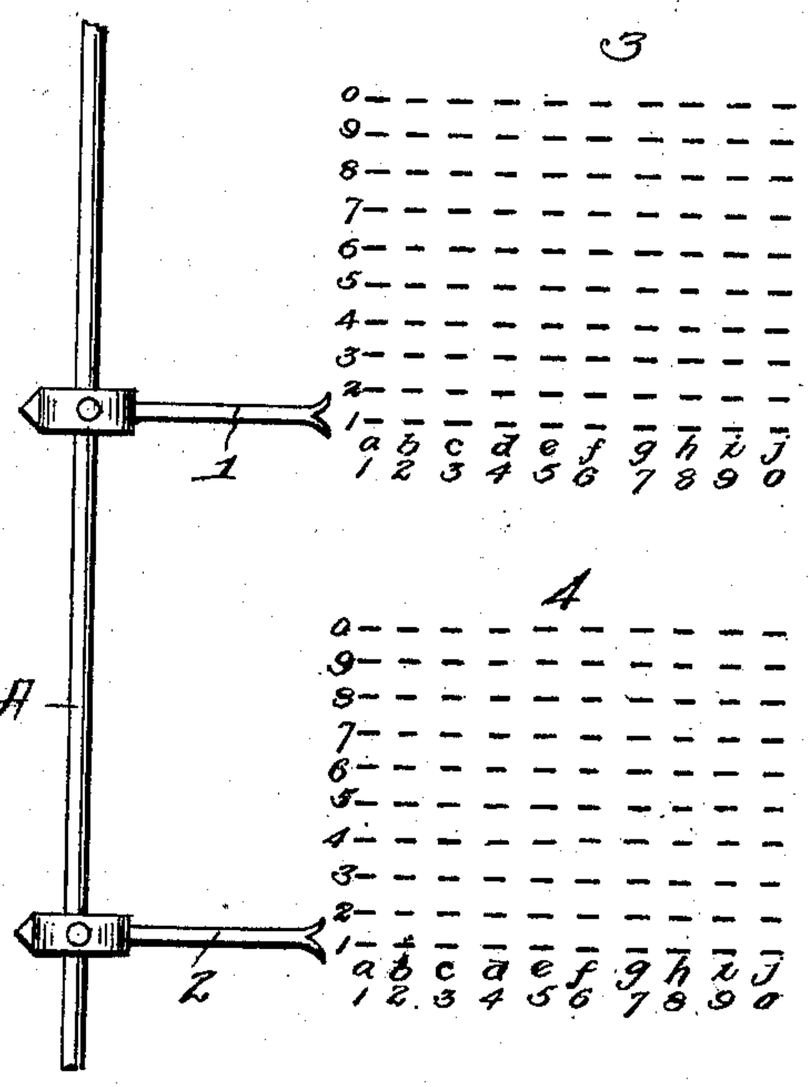


Fig. 6.



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UNITED STATES PATENT OFFICE.

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AUTOMATIC ELECTRIC EXCHANGE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 717,327, dated December 30, 1902.

Application filed July 14, 1902. Serial No. 115,498. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM RAGAN BINKLEY, a citizen of the United States, residing at New Bedford, in the county of Bristol and State of Massachusetts, have invented certain new and useful Improvements in Automatic Electric Exchange 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.

My invention relates to certain improvements in electrical exchange systems of that character wherein all the switching of the subscribers' telephone-circuits is performed automatically and electrically by the action of the subscriber at his own station in manipulating a key or other translative device which, through intermediate connections, electrically operates exchange mechanism at a central office; and the present invention is designed for use in connection with the well-known "Strowger system" and is applicable to existing plants without change in the calling devices and without imposing any other labor, care, or thought on the part of the operating subscriber than is now required.

The objects of the invention, briefly stated, are, first, to provide a system of wiring whereby any subscriber in calling the number of any other subscriber of a party-line will at the same time place his instrument in circuit with one of a number of relays, which will respond when the key is pressed, impressing upon the subscriber's line a current of such strength and polarity as will ring the bell at the subscriber's station which is being called; second, to provide an arrangement of the relays in pairs and in series in the normal wires connecting the subscriber's switch with the connector-switch and in connection with dissimilar points of two banks of contacts in such manner as to secure the most effective results in the operation of the system, and, third, to simplify and cheapen the cost of production and maintenance of the system, thus rendering the apparatus of great value where rates are low by reason of the presence of a party-line service of a competing company.

With the above and other objects subordinate thereto in view the invention consists in certain novel features of construction and combination and arrangement of parts, which will be hereinafter fully described and claimed, and illustrated in the accompanying drawings, in which—

Figure 1 is a diagrammatic view of a party-line-telephone system embodying my invention, showing one of the subscriber's stations connected up with the exchange mechanism and another station. In this view the main shaft, banks of contacts, &c., are distorted from their natural positions to more clearly illustrate the operation. Fig. 2 is a similar view, on an enlarged scale, of three of the stations and the switch or exchange mechanism, showing the circuits and ringing-relays for a two-party line. Fig. 3 is a similar view showing one of the ringing-relays actuated to impress a ringing-current on the line. Fig. 4 is a diagrammatic view showing the arrangement in a four-party line. Figs. 5 and 6 are detail views of the wiper-operating devices and the wipers with the coöperating banks of contacts.

Referring now more particularly to the drawings, A designates the main operating-shaft, which carries the spring-wipers 1 and 2 and which is designed to be slidably and revolubly mounted in the usual way. This shaft may be operated by any ordinary type of feed mechanism—such, for instance, as that employed in exchanges of the Strowger type or any other feed mechanism which may be found suitable for the purpose. I have merely shown the shaft and coöperating switch mechanism at the central office conventionally and have omitted the calling or translating devices at the subscribers' stations by means of which the said switch mechanism is operated, as these devices are all well known to those versed in the art and require no detailed illustration or description.

The wipers 1 and 2 are adapted to engage the contacts of the banks or series 3 and 4, which contacts are arranged in each bank in two different lines or rows, the vertical rows in Fig. 6 representing units and the horizontal rows tens. To these contacts are connected the normal wires leading to the individual or first selector-switch, which is the subscriber's switch, thence to the line-wires leading from and to the telephone-stations. The mode of

operation of the wipers in connecting any one telephone-station with any other station in the system through the operation of the shaft is well understood by those versed in the art. I modify the usual construction by uniting or bridging the contact points or normals of one bank with the dissimilar points or normals of corresponding positions in the other bank, as and for the purpose hereinafter described.

S′, S², S³, and S⁴ represent telephone-stations arranged in the system, and L′ L² the line-wires. Each telephone-station includes the ordinary devices embodied in telephone systems of the automatic exchange party-line type, the same consisting of a transmitter 5, receiver 6, induction-coil 7, a bell 8, having the usual ground connection when a party-line, and a local battery 9, connected by suitable circuit-wires, together with switches 10 10′ for throwing the bell and talking devices into and out of circuit of the line, a telephone-hook 11, which alternately closes said switches, and a switch-key 12, movable between the line-contact 13 and grounded contact 14 for transmitting electric impulses to operate the mechanism at the central office which controls the action of the ringing-relays.

B, C, and D represent, respectively, the first or thousands selector-switch, the second or hundreds selector-switch, and a third selector-switch which may be the connector for all numbers in between, say, 2,499 and 2,601. These switches are connected up in the ordinary manner with the line-wires at the central office.

In carrying my invention into practice I connect or bridge the contact-points of the two banks or rows 3 and 4, so that dissimilar points of these two banks when united and taken in pairs are connected to pairs of normal wires which lead to outgoing lines through the subscriber's or first selector-switch, and I also connect said points to ringing-relays E and F, E′ and F′, it being observed that as a matter of illustration the points *a b c d* of bank 3 are respectively connected to the dissimilar contact-points b^2 a^2 d^2 c^2 of bank 4 by the wires 15, 16, 17, and 18, the pairs of contacts thus connected being in turn connected to the magnets of the relays by the wires 19 20 and 19′ 20′. As shown, the relays are operated in pairs, having only their external or ringing circuits interconnected, so that each will open up the lines L′ L² and impress the ringing-current on the outside line, which will be traced out hereinafter.

Located at the central office is a motor-generator G, capable of supplying pulsating positive, (+,) pulsating negative, (−,) or alternating (∓) current to the several relays, and in circuit with said generator is a grounded condenser C, whose function is to cut off a direct ground connection—that is, to intercept the path of a direct current, but not an alternating or pulsating current. From the generator to the relays lead feed-wires 21 21′, suitably branched to connect the relays to the generator in pairs, and these wires are provided with contacts 21ª, &c., normally engaged by the armatures of the relays. The two relays E and F are connected by a conductor 23, which is connected by a bridge-wire 24 with another conductor 25, having contacts 26 and 27. These contacts are arranged in juxtaposition to other contacts 28 and 29, connected to conductors 30 and 31, leading, respectively, to relays E² and E³, and between the two contacts 26 and 28 plays a switch 32, while between the two contacts 27 and 29 plays a switch 33, which switches are respectively connected to the line-wires L′ and L² through conductors A′ and B′, which lead, respectively, to the contacts 28′ and 29′, engaging the corresponding switches 32′ 33′ of the relays E′ F′, which switches 32′ 33′ are in direct connection with said line-wires L′ L². The magnets of the relays E and F have leading therefrom wires 34 and 35, which connect the same with the relays E² E³, and from said wires lead branches 36 and 37, which connect the relays with retard-coils R R′, which coils R R′ are connected with each other and with a battery 38 and ground-tap 39. The switches 32 and 33 are of spring metal and normally retained in engagement with the contacts 28 and 29 by their resiliency. They are pressed into engagement with the contacts 26 and 27 by the arms *a*, projecting from the relay-armatures, when the relay-magnets are energized and the free ends of the armatures are drawn down, as hereinafter described. The relays E′ and F′ are connected up in the ringing-circuit in like manner, the parts coöperating therewith and corresponding to those before described in connection with relays E and F, being designated by similar primed reference numerals or characters. The system of wiring necessarily differs in detail in telephone systems in which the subscribers are differently grouped or arranged; but the principle of arranging the ringing-relays in pairs and in series with the normal wires leading from the connector-switch to the subscriber's switch will in each case remain the same.

As an illustration of the operation of my invention, I have represented station S′ (2,521) as having been called from station S by means of the ordinary transmitting device, (not shown,) the action of which through the connector-switch and feed mechanism sets the wipers 1 and 2 in engagement with the proper contacts of the banks 3 and 4. The parts will then be disposed as shown particularly in Figs. 2 and 3, which show a two-party line. The line-circuits *l′* and *l²* will be through first selector-switch B, second selector-switch C, third selector-switch D, *l²* taking conductor *l³*, wiper 2, bank-contact *a²*, conductor 16, conductor 19, relay E, conductor 34 to relay E², back through return-conductor 30, contact 28 to switch 32, to L′ and station S′, while *l′* will take conductor *l⁴*, wiper 1, bank-contact

a, conductor 15, conductor 20, relay F, conductor 35, relay E^3, back through return-conductor 31 to spring-contact 29, switch 33, line L^2, to station S'.

In signaling S' from S the subscriber at S presses signal-switch 12 against ground-tap 14, when the electric circuit will be as follows: from ground by way of 14 to switch 12, thence to switches B, C, and D, conductor l^3, wiper 2, bank-contact a^2, conductor 16, conductor 19, relay E, conductor 34, retard-coil R, and battery 38 to ground. The effect of establishing this circuit will be seen in Fig. 3 upon relay E, the armature having been drawn down by the magnet, thereby opening feed-wire 21 and inside line-wire 30 and closing switch 32, thus connecting outgoing line-wire L' with the contact 26, which carries the ringing-current received from generator G through bridge 24, conductor 23, (which connects the two relays,) armature of relay F, back-contact 21^b, conductor 21, brush g of generator G to ground through condenser C. Going back to 26, the ringing-current circuit will be over L' to S', through the bell to ground, thus signaling S' or 2,521. Had station S^2 or 2,522 been called, the wipers 1 and 2 would rest on bank-contacts b b^2, and by reason of the bridging of the dissimilar points b with a^2 and a with b^2 a reversal of the circuit would have been effected, so that l^2 would be connected with conductor 20 and relay F, and the same operation of switch 12 would actuate relay F, impressing upon line L^2 a ringing-current in precisely the same manner, except that the armature of said relay would break contact with 21^b. In like manner, referring to Fig. 4, which represents a four-party line, and tracing the circuits from c d^2 and d c^2, which correspond to numbers 2,523 and 2,524, (stations S^3 and S^4,) relays E' and F' are operated the same as E and F, but send a ringing-current of opposite polarity along lines L' and L^2.

It will be understood that relays E^2 and E^3 are the line-relays of the individual or subscriber's switch, which in the present instance is the switch of the called subscriber. They perform no part in the selective ringing system and are shown in the present specific illustration only because they are in the circuits at all times. Their function is to close the circuit of the local battery through the operating-switch magnets in calling or making connection with a station.

The foregoing description for a two-party line applies equally as well to a four-party line, as shown in Figs. 1 and 4, the construction for a two-party line (shown in Figs. 2 and 3) differing therefrom in showing the switches 32 and 33 in direct connection with the line-wires L' and L^2 and in omitting the relays E' and F'. The operation of the magnets is clearly disclosed in Fig. 3.

The release or disconnection of the calling from the called subscriber is effected in the Strowger system by grounding both lines simultaneously on hanging up the receiver of the calling-station, which will operate both ringing-relays simultaneously. This simultaneous action of the pair of relays cuts off the generator, which would otherwise impress ringing-current on both lines, sending false signals to the subscribers. It is recognized that the relays may be designed in different forms to accomplish the same results; but in each case they must be dependent upon each other for supplying the ringing-currents to the subscribers' lines.

In calling from station S' or station S^2 the circuits are the same as when calling from station S, with the exception of the introduction of the spring-contacts 32–28 and 33–29 in the line-wires where they enter the individual switch. Referring, for example, to Fig. 2, let it be supposed that station S' desires to call some other station. The circuit from S' will then be over L' to contact-spring 32 to 28, thence by 30 to line-relay E^2 to 36, to retard-coil R, and battery 38 to ground at 39, thus placing it within the power of the person at S', through the usual calling device, to operate line-relay E^2. The circuit from L^2 would be by spring 33 to 29, to wire 31, to line-relay E^3, to 37, to retard-coil R', and battery 38 to ground, thus placing relay E^3 under control of the operator through the usual calling device. The operation in this connection will thus be made clear. It is to be understood that relays E and F are not affected by currents from stations S' and S^2 when these stations are calling or making a telephone connection with any other station; otherwise the system would be rendered inoperative. Said relays are in the normal wires which terminate in the bank-contact of the connector-switch, and when not engaged by said connector-switch—that is, when stations S' and S^2 are not being called by some third station—the said normals are on open circuit, and consequently cannot be affected by currents from station S' or S^2, as it is intended they should not be.

From the foregoing description, taken in connection with the accompanying drawings, it is thought that the construction and mode of operation of the invention will be fully understood, and it will be seen that simple and efficient means are provided whereby in calling the several different numbers representing the several different stations of a party-line one of a number of ringing-relays may be automatically selected, which will when operated from the calling-station impress upon the party-line a current of such strength and polarity as to ring the bell at the station of the subscriber whose number has been called. By thus providing for the automatic operation of the signal the system is rendered more desirable, and at the same time by using two series relays of about thirty-five ohms resistance each I am enabled to dispense with the one-thousand-ohms bridge and one-thousand-ohms resistance commonly used.

While the preferred embodiment of my invention is as herein shown and described, I do not wish to be understood as restricting myself to the exact form and construction shown, as many changes therein or variations therefrom might suggest themselves, all of which would be clearly included within the spirit and scope of the invention.

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

1. In an automatic exchange system for party-line telephones, exchange mechanism for connecting the stations, a motor-generator, ringing-relays connected in pairs, circuit connections between the exchange mechanism, generator and relays, means for energizing the magnet of one of the relays of a pair, a switch operated by the armature of the energized magnet to throw the generator into and out of circuit of the line through the armature and circuit connections of the other magnet to transmit a current impulse to operate a signal at a called station, and means for restoring the parts to their normal positions, substantially as set forth.

2. In an automatic exchange system for party-line-telephone systems, exchange mechanism embodying banks of contacts having dissimilar points connected, a motor-generator, ringing-relays connected in pairs, circuit connections between the contacts and different sets of relays, circuit connections between the line, generator and relays, and switch mechanism controllable from a substation and through the armatures and circuit connections of the relays to throw the generator into and out of circuit of the line to transmit a current to operate the signal at a called station, substantially as and for the purpose set forth.

3. In an automatic exchange system for party-line-telephone systems, exchange mechanism embodying banks of contacts having dissimilar points connected, a motor-generator, ringing-relays connected in pairs, circuit connections between the contacts and different sets of relays, circuit connections between the line, generator and relays, means for energizing the magnet of one of the relays of a pair, a switch operated by the armature of the energized magnet to throw the generator into and out of circuit of the line through the armature and circuit connections of the other magnet to transmit a current impulse to operate a signal at a called station, and means for restoring the parts to their normal positions, substantially as and for the purpose specified.

4. In a system of the character described, banks of contacts having dissimilar points connected, a motor-generator, a pair of connected ringing-relays whose armatures are normally in circuit with the generator but out of circuit with the line, said relays being electrically connected with said contacts, switch mechanism for connecting the relays with the line, and means for operating one of the relays to close said switch mechanism and connect said relay with the line and disconnect it from the generator, whereby a circuit from the generator to the line is established through the armatures and circuit connections of the connected relays, substantially as set forth.

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

WILLIAM RAGAN BINKLEY.

Witnesses:
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ROBERT E. ALLEN.