

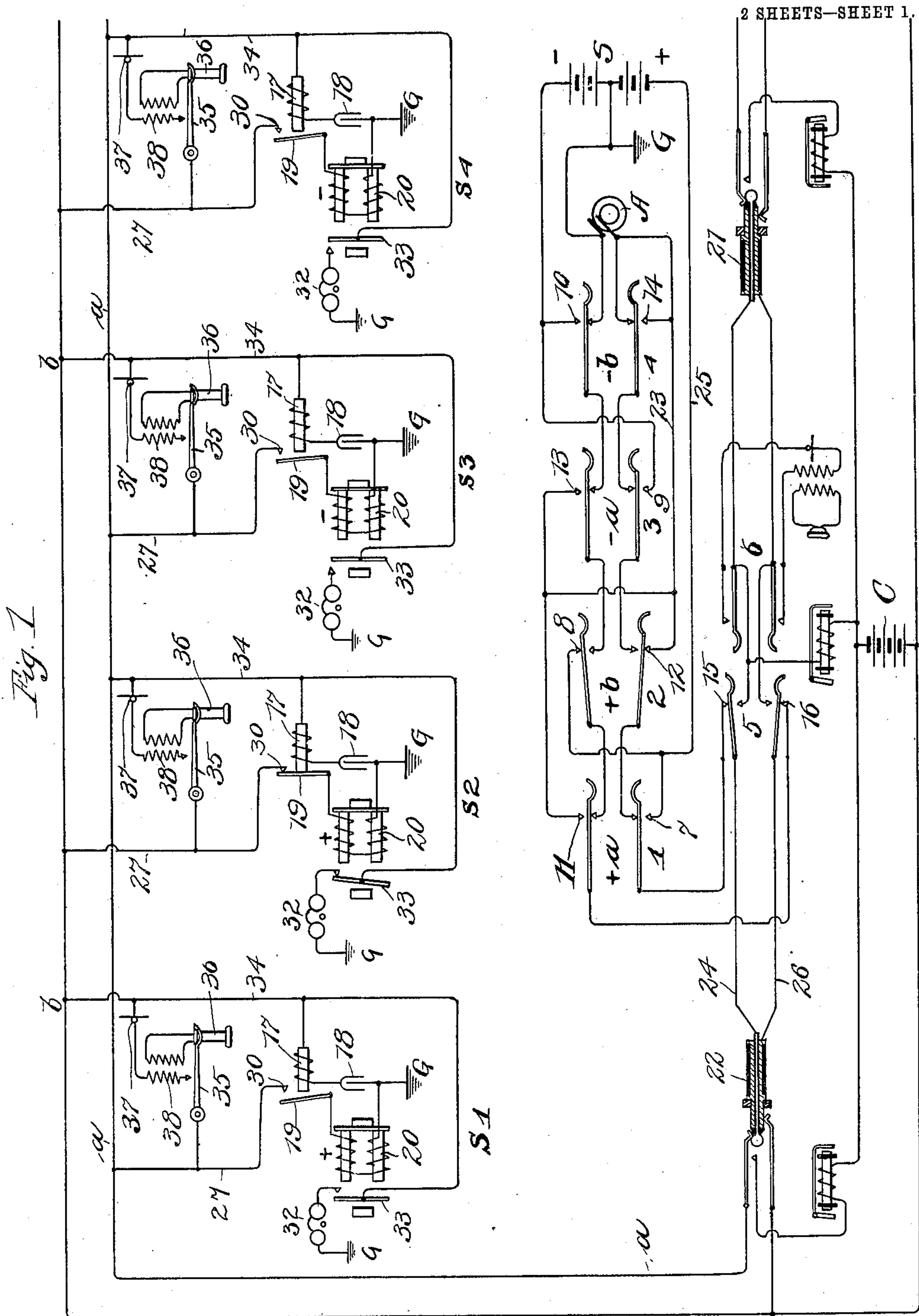
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A. O. STIGBERG.

PARTY LINE TELEPHONE EXCHANGE SYSTEM.

APPLICATION FILED MAY 6, 1904.



Witnesses:  
 Leonard W. Novander  
 Charles J. Schmidt

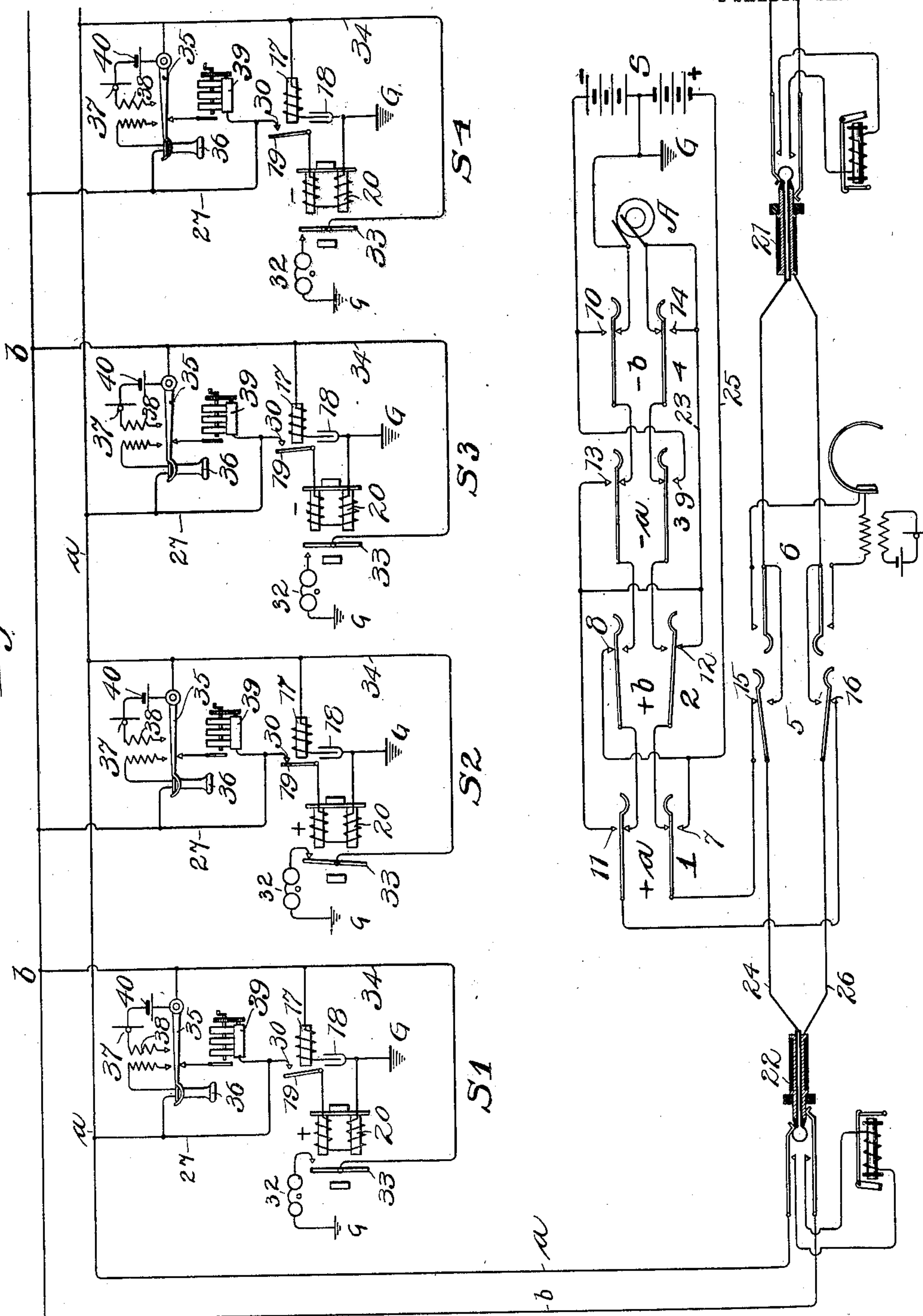
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Fig. 2.



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# UNITED STATES PATENT OFFICE.

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## PARTY-LINE TELEPHONE-EXCHANGE SYSTEM.

No. 828,866.

Specification of Letters Patent.

Patented Aug. 14, 190

Application filed May 6, 1904. Serial No. 206,609.

*To all whom it may concern:*

Be it known that I, ALFRED O. STIGBERG, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Party-Line Telephone-Exchange Systems, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to party-line telephone-exchange systems, and has for its object improved means for selectively signaling the substations connected with a party-line.

I provide a system of which the exchange apparatus may be applied to any telephone system without changing the existing connections and the substation apparatus of which is so arranged as to telephonically balance the lines at all times and to prevent leakage therefrom of voice or other currents.

I provide a set of selective keys for the central exchange, and it is necessary to provide only one set of keys for each board, a set being connected with all the ringing-keys ordinarily employed on a switchboard.

The substation apparatus comprises an alternating-current relay connected between one line-limb and a common conductor and a polarized relay adapted for connection between the other line-limb and the common conductor. The alternating-current relay controls the circuit through the polarized relay, and the polarized relay upon energization serves to connect a signal-bell between the common conductor and the line-limb to which the alternating-current relay is connected. A set of keys at the central exchange contains a key for each substation, and actuation of these keys serves to connect a source of alternating current between the common conductor and one line-limb and simultaneously to connect one pole of a source of direct current with the other line-limb. Thus upon the actuation of one of the selective keys both relays at the corresponding substation will be simultaneously actuated and the signal-bell will be connected with the common conductor, part of the alternating current then flowing through the bell to cause actuation thereof.

My invention may be applied with equal

facility and efficiency to common-battery and to local-battery exchange systems, and in Figure 1 I have shown a common-battery party-line, while in Fig. 2 I have shown a local-battery party-line connected with a central exchange.

I have shown substations  $S'$ ,  $S^2$ ,  $S^3$ , and  $S^4$  connected with the line-limbs  $a$   $b$  of a telephone-line leading to a central exchange. The cord-circuit at the central exchange is provided with an ordinary operator's key, consisting of a ringing side 5 and a listening-in side 6. A selective apparatus comprises keys 1, 2, 3, and 4, each key corresponding to the similarly-numbered substation. The positive pole of a source of direct current  $S$  is connected with the alternate contact 7 of the key 1 and with the alternate contact 8 of the key 2, while the negative pole of said source is connected with the alternate contact 9 of the key 3 and with the alternate contact 10 of the key 4. One terminal of the source  $A$  of alternating current is connected with the alternate contacts 11, 12, 13, and 14 of the keys 1, 2, 3, and 4, respectively, the other pole of said source being connected to ground, an intermediate point of the source  $S$  being also connected to ground. Normally the source  $A$  is connected, through the normal contacts of the keys, with the alternate contacts 15 and 16 of the operator's ringing-key 5, and upon actuation of key 5 current from the source  $A$  will pass through the cord-strands, and the cord-circuit may thus normally be used to actuate the signaling apparatus connected across the line-limbs of a single subscriber's line. Upon the simultaneous action of key 5 and any of the selective keys the source  $A$  will be connected between ground and one line-limb, while one pole of the source  $S$  will be connected between ground and the other line-limb.

At each substation I connect an alternating-current relay 17 between one line-limb and ground through a condenser 18. This relay 17 controls an armature 19, which upon attraction by the relay closes a circuit leading from the other line-limb through a polarized relay 20 and to ground. I have shown the relay 17 at substations  $S'$  and  $S^3$  as connected between line-limb  $b$  and ground and the polarized relay 20 adapted for connec-



tion between line-limb  $a$  and ground, while at substations  $S^2$  and  $S^4$  the relay 17 is connected between line-limb  $a$  and ground and polarized relay 20 is adapted for connection between line-limb  $b$  and ground. The relays 20 at substations  $S^1$  and  $S^2$  are positively polarized, while those at substations  $S^3$  and  $S^4$  are negatively polarized.

At the central exchange I have shown both answering-plug 21 and calling-plug 22 inserted in the spring-jacks, a subscriber connected with answering-plug 21 having called for a connection with substation  $S^2$ , whereupon the operator has actuated both ringing-key 5 and selective key 2, corresponding with substation  $S^2$ . A current from the alternating-current source will now flow as follows: from the ground  $G$ , through the generator  $A$ , through conductor 23, alternate contact 12 of key 2, through key 2 and key 1, and through back contact 15 to the tip-strand 24 of the cord-circuit through the tip of the plug 22, through line-limb  $a$ , and through the relay 17 and condenser 18 at substation  $S^2$ , to ground. At the same time direct current flows from the ground through the source  $S$  and from the positive pole thereof to conductor 25, alternate contact 8 of key 2, through keys 2 and 1, to alternate contact 16 of key 5, through the sleeve-strand 26, through line-limb  $b$ , through conductor 27 at substation  $S^2$ , contact 30 of the relay 17, armature 19 of said relay and through the windings of the polarized relay 20 and to ground, the armature 19 having become attracted upon passage through the relay 17 of alternating current from the source  $A$ . As the relay 20 at the substation  $S^2$  is positively polarized, its armature will be attracted, and the grounded signal-bell 32 will be connected with the line-limb  $a$  through the attracted armature 33 and the conductor 34, and part of the alternating-current from the line-limb  $a$  will pass through the armature 33 and the signal-bell 32 to ground to actuate the bell. Thus upon actuation of the operator's ringing-key and either of the selective keys alternating current will flow simultaneously through the alternating-current relay and the signal-bell, while direct current will simultaneously flow through the polarized relay to maintain the circuit through the signal-bell. In the same manner actuation of selective keys 1, 3, or 4 will actuate the apparatus and signal-bells at the substations  $S^1$ ,  $S^3$ , and  $S^4$ , respectively. The actuation, for instance, of either of selective keys 1 or 3 will cause both relays 17 to respond; but since the relays 20 at the substations are oppositely polarized only one will respond to the direct current, the same being true of keys 2 and 4 and the corresponding substations  $S^2$  and  $S^4$ .

It will be noticed that upon simultaneous actuation of relay 17 and polarized relay 20

at any substation two paths will be offered the alternating current to ground—one through the polarized-relay armature and the signal-bell, the other path through the relay 17 and condenser 18. The winding of the relays 17, however, may be of comparatively high impedance, while the condenser 18 may have a comparatively low capacity, and the frequency of the source  $A$  at the central station may be comparatively low, and thus under such conditions nearly all of the alternating current will flow through the signal-bell in preference to flowing through the winding of the relay 17 and through the low-capacity condenser 18, the adjustment being preferably such that just enough current will flow through the relay 17 to maintain attraction of its armature. The relays 17 being of comparatively high impedance will also prevent leakage of the high-frequency voice-currents, and thus the telephonic efficiency of the system will not suffer. The signal-bells, however, are entirely disconnected from circuit while conversation is carried on over the line, and the leakage through the signal-bell heretofore experienced is entirely eliminated.

The telephonic apparatus at each substation comprises a switch-hook 35, a receiver 36, a transmitter 37, and an induction-coil 38, and in the common-battery system, as shown in Fig. 1, the receiver may be connected in a local circuit with the secondary of the induction-coil, while the primary winding and the transmitter may be connected serially in bridge of the line upon removal of the receiver from the hook, a common source of current  $C$  at the central exchange supplying necessary current to the substations for conversation.

In Fig. 2 I have shown my invention applied to a local-battery system, the connections of the selective keys at the central exchange being exactly like those of the common-battery system, while the substation apparatus includes also a hand-generator 39, normally disconnected from circuit, but upon actuation serving automatically to connect itself in bridge of the line-limbs. The transmitter and a local source of current 40 are connected in a local circuit with the switch-hook upon removal of the receiver therefrom, which receiver upon its removal from the switch-hook is connected with the secondary winding of the induction-coil in bridge of the line-limbs.

I thus provide a party-line system which is adaptable to any telephone system and in which subscribers may be selected from the central exchange independently of each other and which station is at all times entirely balanced and free from leakage.

I do not wish to be limited to the precise arrangement of apparatus and circuits shown, as changes may readily be made by



those skilled in the art without departing from the scope of the invention.

I claim as new and desire to secure by Letters Patent—

1. In a party-line telephone-exchange system, the combination with a central exchange, of a telephone-line leading therefrom to a plurality of substations, an alternating-current relay at each substation connected between one line-limb and a common conductor, a polarized relay adapted for connection between the other line-limb and said common conductor, said alternating-current relay controlling the circuit through said polarized relay, a signal-bell adapted to be connected in bridge of said alternating-current relay upon actuation of said polarized relay, and means at the central exchange for simultaneously sending alternating current into one line-limb and direct current into the other line-limb to actuate the relays and the signal-bell at one of the substations.

2. In a party-line telephone-exchange system, the combination with a central exchange, of a bimetallic telephone-line leading therefrom to a plurality of substations, a relay at each of said substations connected between one line-limb and ground, an additional relay at each substation adapted for connection between the other line-limb and ground, said first relay controlling the circuit through said additional relay, a signal-bell adapted to be bridged about said first relay upon actuation of said additional relay, and central-exchange apparatus for simultaneously sending current to ground and into both line-limbs to actuate the relays and signal-bell at one of said substations.

3. In a telephone-exchange system, the combination with a central exchange, of a bimetallic telephone-line leading therefrom, a pair of substations, a relay responsive to alternating currents at each substation connected between one line-limb and ground, a second relay at each substation adapted for connection between the other line-limb and ground upon actuation of said alternating-current relay, said second relays being oppositely polarized, a signal-bell at each substation adapted to be bridged about the alternating-current relay upon actuation of the corresponding polarized relay, and switching means at the central exchange for simultaneously connecting a source of alternating-current between ground and the line-limb connected with the alternating-current relay and either terminal of a source of direct current between ground and the other line-limb, whereby said alternating-current relays are energized to close the circuit through the said polarized relays, whereby the direct current may pass through said polarized relays to attract the correspondingly-polarized armature at one substation to connect the signal-bell in bridge of the alternating-current relay.

4. In a party-line selective system, the combination with a central exchange, of a bimetallic telephone-line leading therefrom to a plurality of substations, a relay responsive to alternating currents at each substation connected between one line-limb and ground, a polarized relay at each substation responsive to direct current and adapted for connection between the other line-limb and ground upon energization of said alternating-current relay, a signal-bell adapted for connection in bridge of the alternating-current relay upon attraction of the armature of the polarized relay, means at the central exchange for connecting a source of alternating current between ground and one limb of the telephone-line and for simultaneously connecting a source of direct current with ground and with the other limb of said line, said alternating current causing actuation of one of said alternating-current relays to close circuit through the associated polarized relay to allow the direct current from the other limb to energize said polarized relay to connect said signal in bridge of the alternating-current relay.

5. In a telephone party-line selective system, the combination with a central exchange, of a bimetallic telephone-line leading therefrom to a plurality of substations, a relay responsive to alternating currents at each substation connected between one line-limb and ground through a condenser, a polarized relay at each substation adapted for connection between the second line-limb and ground upon actuation of the associated alternating-current relay, a signal-bell adapted for connection between the first line-limb and ground upon actuation of said polarized relay, means at the central exchange for connecting a source of alternating current between ground and either line-limb and for simultaneously connecting either pole of a source of direct current with the other line-limb, whereby the relays at one of said substations are simultaneously actuated to connect the signal-bell in circuit, the alternating current passing partly through the alternating-current relay and the condenser and partly through the signal-bells.

6. In a party-line telephone-exchange system, the combination with a central exchange, of a bimetallic telephone-line leading therefrom to a plurality of substations, telephonic apparatus at each substation adapted to be bridged across the line-limbs, a relay at each substation responsive to alternating currents and connected between one line-limb and ground through a condenser, a polarized relay at each substation adapted for connection between the second line-limb and ground upon actuation of the associated alternating-current relay, and a signal-bell adapted to be bridged between the first line-limb and ground upon the actuation of said



polarized relay, means at the central exchange for connecting a source of alternating current between ground and a line-limb for actuating the alternating-current relay at one of said substations, and means for simultaneously connecting one pole of a source of direct current with the other line-limb to simultaneously actuate the associated polarized relay, whereby said signal-bell is connected in circuit, part of said alternating current upon actuation of said polarized relay passing through said signal-bells to cause the actuation thereof.

7. In a telephone party-line selective system, the combination with a central exchange, of a bimetallic telephone-line leading therefrom to a plurality of substations, a relay responsive to alternating current at each substation connected between one line-limb and ground, a polarized relay at each substation responsive to direct currents connected between the other line-limb and ground, said alternating-current relay controlling the circuit through said polarized relay, a grounded signal-bell normally disconnected from circuit and adapted upon actuation of the polarized relay to be connected to the line-limb to which the alternating-current relay is connected, and means at the central exchange for connecting a source of alternating current between ground and either line-limb and for simultaneously connecting either pole of a source of direct current with the other line-limb, whereby the relays at one of the substations are simultaneously actuated to connect the signal-bell in circuit, whereby the alternating current through a substation divides, part thereof passing through the alternating-current relay and part passing through the signal-bell, the said alternating-current relay being of high impedance.

8. In a telephone party-line selective system, the combination with a central exchange, of a bimetallic telephone-line leading therefrom to a plurality of substations, an alternating-current relay at each substation connected between one line-limb and ground, a polarized relay responsive to direct current and adapted for connection with the other line-limb and ground upon actuation of said alternating-current relay, a signal-bell normally connected between ground and the contact of the armature of said polarized relay but disconnected from said armature, said armature being connected with the line-limb associated with the alternating-current relay, means at the central exchange for simultaneously sending alternating current through one line-limb and direct current through the other line-limb whereby said alternating-current relay is actuated to close circuit through the polarized relay whereupon said polarized relay is energized to attract its armature whereby said signal-bell is connected with the line-limb leading to said alternat-

ing-current relay, and a condenser of low capacity connected in series with the alternating-current relay, whereby nearly all the alternating current will flow through the signal-bells upon attraction of the polarized-relay armature.

9. In a telephone party-line selective system, the combination with a central exchange, of a bimetallic telephone-line leading therefrom, a plurality of substations, an alternating-current relay at each substation connected between one line-limb and ground through a condenser, a polarized relay responsive to direct current and adapted for connection between the other line-limb and ground upon actuation of said alternating-current relay, an armature for said polarized relay connected with the same line-limb as said alternating-current relay, a signal-bell connected to ground and with the contact of said armature but normally disconnected from said armature, and means at the central exchange for simultaneously sending alternating current of comparatively low frequency through one line-limb and direct current through the other line-limb, whereby both relays at one substation are actuated to connect said signal-bell in circuit, alternating current thereupon flowing partly through said alternating-current relay and said condenser and partly through said signal-bell, said condenser being of low capacity to cause most of the alternating current to pass through the signal-bell, and the winding of said alternating-current relay being of comparatively high impedance to prevent leakage of voice-currents.

10. In a telephone party-line selective system, the combination with a central exchange, of a bimetallic telephone-line leading therefrom to a plurality of substations, a relay at each substation responsive to alternating currents connected between one line-limb and ground through a condenser, a polarized relay at each substation responsive to direct currents and adapted for connection between the other line-limb and ground upon actuation of said alternating-current relay, a signal-circuit adapted to be bridged about said alternating-current relay and condenser upon actuation of said polarized relay, and means at the central exchange for simultaneously sending alternating current of comparatively low frequency through one line-limb and direct current through the other line-limb, whereby both relays at one substation are actuated and whereby said signal-circuit is connected in bridge of said alternating relay and condenser, said condenser being of comparatively low capacity to cause most of the alternating current to pass through the signal-circuit and said alternating-current relay being of comparatively high impedance to prevent leakage of telephonic currents.

11. In a party-line telephone-exchange



system, the combination with a central exchange, of a telephone-line leading therefrom to a plurality of substations, a relay at each substation connected between one line-limb and ground, an additional relay connected between the other line-limb and ground, the circuit through said additional relay being controlled by said first relay, a signal-circuit adapted to be connected in bridge of said first relay upon actuation of said additional relay, and means at the central exchange for sending current simultaneously to both line-limbs and through the relays connected therewith.

12. In a party-line telephone-exchange system, the combination with a central exchange, of a telephone-line leading therefrom to a plurality of substations, an alternating-current relay at each substation connected between one line-limb and a common conductor, an additional relay controlled by the alternating-current relay and adapted for connection thereby between the other line-limb and the common conductor, a signal-circuit controlled by said additional relay and adapted upon actuation of said relay to be connected with the first line-limb and the common conductor, and means in the alternating-current-relay circuit for deflecting the current therefrom and causing the greater part thereof to pass through the signal-circuit.

13. In a party-line telephone-exchange system, the combination with a central exchange, of a telephone-line leading therefrom to a plurality of substations, an alternating-current relay at each substation connected between the first line-limb and a common conductor, a second relay at each substation controlled by the alternating-current relay and adapted for connection thereby between the second line-limb and the common conductor, a signal-circuit controlled by said second relay and connected between the first line-limb and the common conductor upon actuation of said second relay, and impedance in the alternating-current-relay circuit for deflecting the current therefrom and causing the greater part thereof to pass through the signal-circuit.

14. In a party-line telephone-exchange system, the combination with a central exchange, of a telephone-line leading therefrom to a plurality of substations, an alternating-current relay at each substation connected between the first line-limb and ground, a second relay adapted for connection between the second line-limb and ground upon actuation of the alternating-current relay, a signal-bell adapted for connection in bridge of the alternating-current-relay circuit upon actuation of said second relay, and a condenser included in the alternating-current-relay circuit, said condenser being of low capacity, whereby alternating-current flow from the

first line-limb will be deflected from the alternating-current-relay circuit and the greater part thereof will pass through the signal-bell.

15. In a party-line telephone-exchange system, the combination with a central exchange, of a telephone-line extending therefrom and connecting with a plurality of substations, an alternating-current relay at each substation connected with the first line-limb and with ground through a condenser, a second relay adapted upon actuation of said alternating-current relay to be connected with the second line-limb and directly with ground, a signal-circuit controlled by said second relay to be connected to the first line-limb and ground upon actuation of said second relay, said alternating-current relay being of high impedance and said condenser of low capacity whereby alternating-current flow from the first line-limb will be deflected from the alternating-current-relay circuit and the greater part thereof will pass through the signal-circuit.

16. In a party-line telephone-exchange system, the combination with a central exchange, of a telephone-line extending therefrom and connecting with a plurality of substations, an alternating-current relay permanently connected between one line-limb and ground, a second relay responsive to only direct current and adapted for connection between the other line-limb and ground only upon actuation of the alternating-current relay, a signal-circuit controlled by said direct-current relay and adapted for connection between the first line-limb and ground upon actuation of said direct-current relay, and means at the central exchange for sending alternating current through one line-limb and direct current through the other line-limb, whereby said alternating-current relay is actuated to connect in circuit the direct-current relay and whereby the signal-circuit is connected with the line-limb through which alternating current flows.

17. In a party-line telephone-exchange system, the combination with a central exchange, of a telephone-line extending therefrom and connecting with a plurality of party substations, an alternating-current relay at each substation, a direct-current relay at each substation connected in circuit only upon actuation of said alternating-current relay, a signal-circuit controlled by said direct-current relay and normally disconnected from circuit thereby, and means at the central exchange for simultaneously sending alternating current and direct current through the line for causing first actuation of said alternating-current relay, then actuation of the direct-current relay, and then actuation of the signal in the signal-circuit.

18. In a party-line-exchange system the combination with a central exchange, of a



telephone-line leading therefrom connecting with a plurality of party substations, an alternating-current relay at each substation connected between one line-limb and a third conductor, a signal-circuit connecting with said line-limb, an electromagnet controlling the continuity of said signal-circuit and connected between the other line-limb and the third conductor upon actuation of the alternating-current relay.

19. In a telephone-exchange system the combination with a central exchange, of a telephone-line leading therefrom connecting with a plurality of party substations, an alternating-current relay at each substation permanently connected between one line-limb and a third conductor, a signal adapted for connection between said line-limb and the third conductor, a direct-current relay adapted for connection between the other line-limb and the third conductor, the circuit for said direct-current relay being controlled by the alternating-current relay and the continuity of the signal-circuit being controlled by said direct-current relay, and means at the central exchange for causing alternating current to flow over the one line-limb, and direct current to flow simultaneously over the other line-limb, whereby said alternating-current relay is actuated to connect the direct-current relay in circuit, whereupon the circuit through the signal is

closed and said signal actuated by the alternating current.

20. In a telephone system the combination with a telephone-line leading from a central exchange to a plurality of party-line substations, of an alternating-current relay at each substation permanently connected between one line-limb and a third conductor, a signal-bell at each substation adapted for connection between said line-limb and the third conductor, a polarized relay controlling the continuity of the signal-circuit, a circuit controlled by the alternating-current relay for connecting said polarized relay between the other line-limb and the third conductor, and means at the central exchange for causing alternating current to flow over one line-limb and polarized current over the other line-limb, whereupon said alternating-current relay at the corresponding substation is actuated to close the circuit through the polarized relay, current to flow therethrough from the other line-limb, whereupon said signal-circuit is closed and the signal therein actuated by the alternating current flowing from the first line-limb.

In witness whereof I hereunto subscribe my name this 3d day of May, A. D. 1904.

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