H. G. WEBSTER.

TELEPHONE SYSTEM.

APPLICATION FILED JULY 5, 1906.

907,662.

Patented Dec. 22, 1908.

2 SHEETS—SHEET 1.

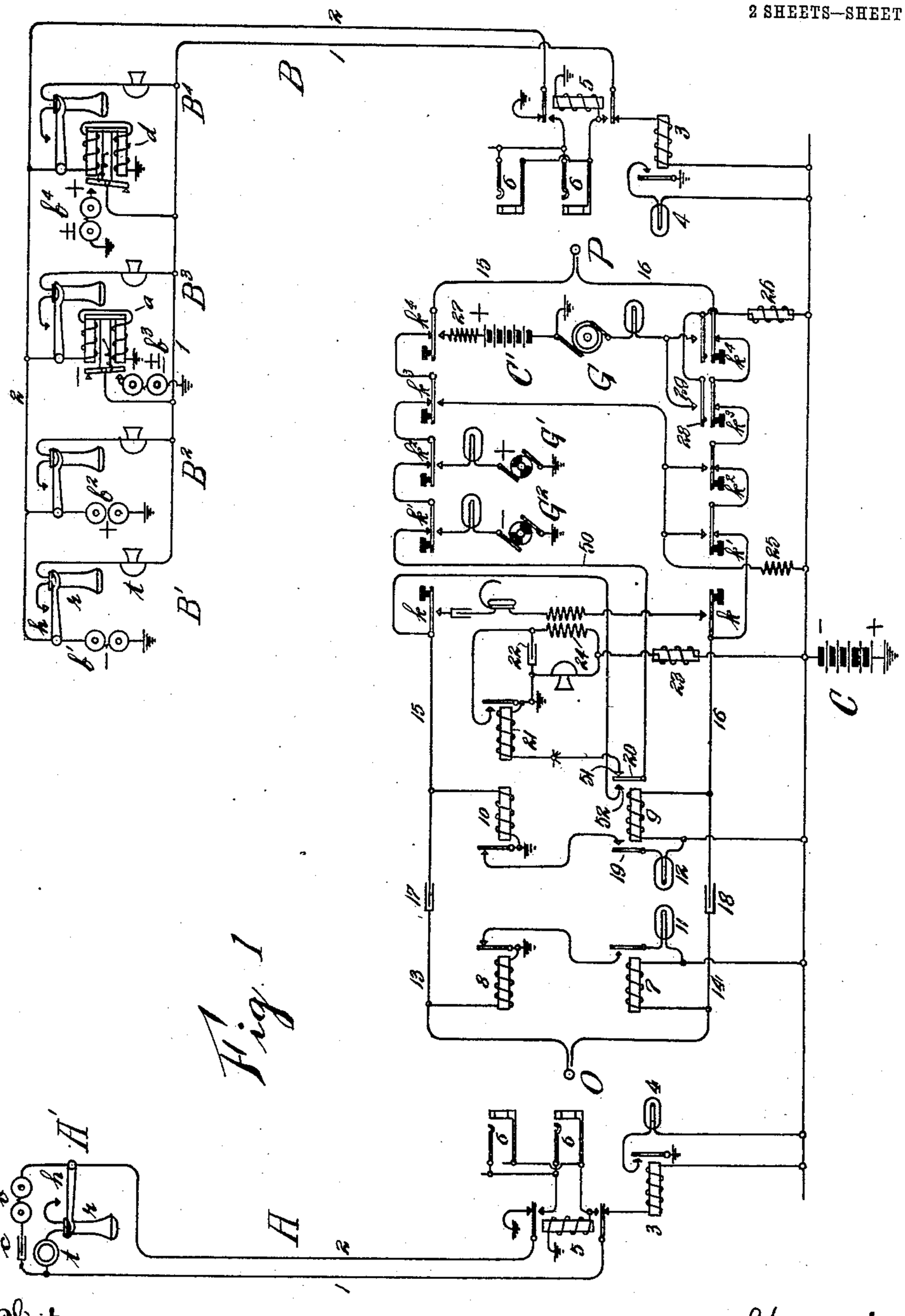

Fig. 1

Witnesses
Geo. E. Muller.
H. C. Olmstead.

Inventor
Harry G. Webster
by Thomas H. Ferguson
Attorney

H. G. WEBSTER.

TELEPHONE SYSTEM.

APPLICATION FILED JULY 5, 1906.

907,662. Patented Dec. 22, 1908.

2 SHEETS—SHEET 2.

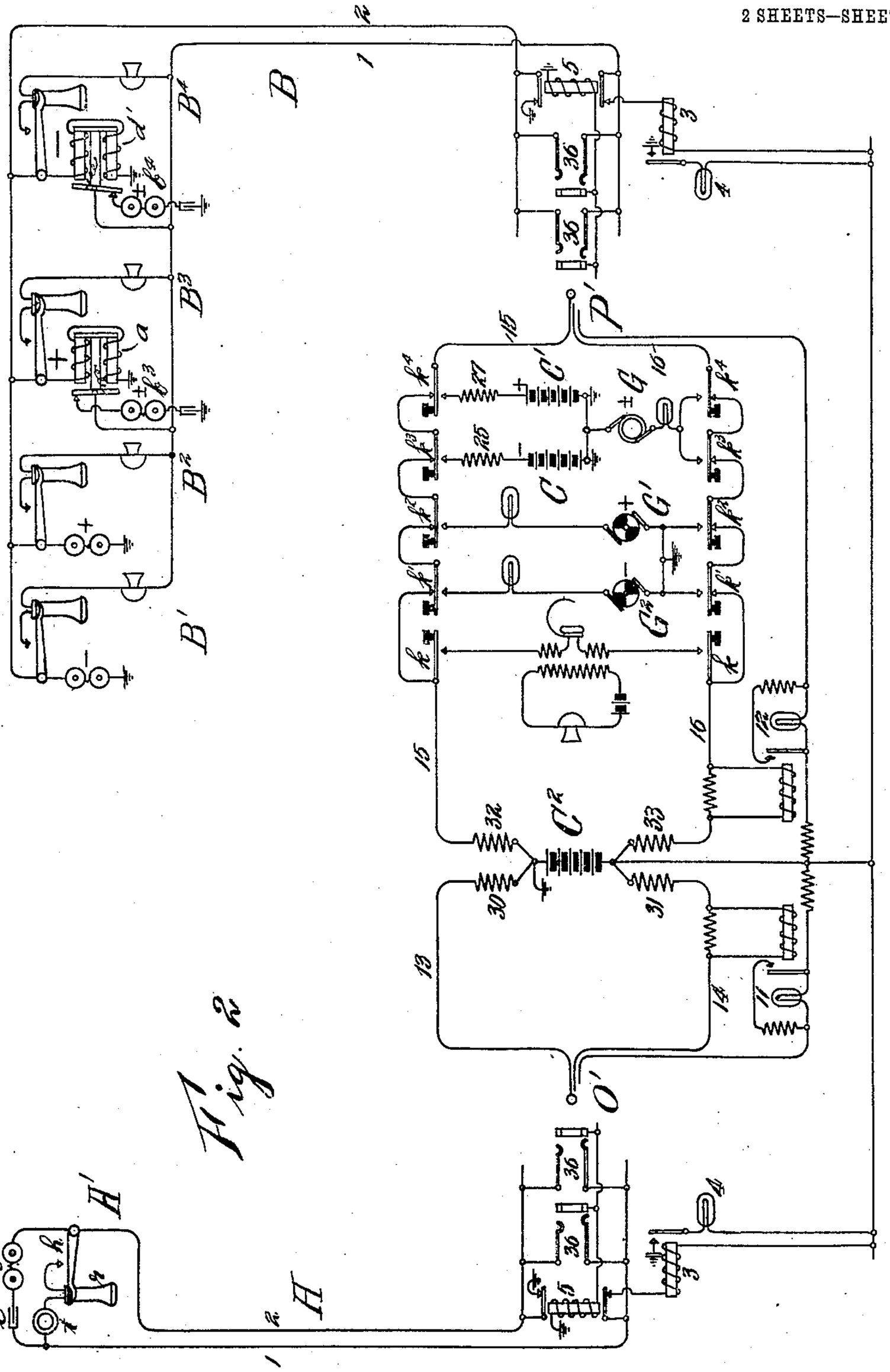

Fig. 2

Witnesses
Geo. E. Mueller.
H. C. Olmstead

Inventor
Harry G. Webster
by Thomas H. Ferguson
Attorney

UNITED STATES PATENT OFFICE.

HARRY G. WEBSTER, OF CHICAGO, ILLINOIS, ASSIGNOR TO MILO G. KELLOGG, OF CHICAGO, ILLINOIS.

TELEPHONE SYSTEM.

No. 907,662. Specification of Letters Patent. Patented Dec. 22, 1908.

Application filed July 5, 1906. Serial No. 324,845.

To all whom it may concern:

Be it known that I, HARRY G. WEBSTER, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Telephone Systems, of which the following is a specification.

My invention relates to telephone exchange systems and particularly to so-called "party line" systems, or those in which a plurality of substations are connected with a central exchange by a single circuit.

The object of my invention is to provide improved means whereby the signal-bell at any one of a plurality of substations may be operated without causing the operation of the bells at any of the other stations, in a structure which is distinguished by economy of manufacture and efficiency of operation.

In accordance with the preferred form of my invention, I provide at one or more of the substations a polarized relay of relatively high resistance and connected from one limb of the line to ground. If the system be one in which current for signaling and transmission is furnished from a central source, I connect the relays to that line limb associated with the inactive or grounded terminal of the central battery. If the circuit be one having four stations, polarized relays are provided for two of the stations, so connected that one will respond to a direct current of positive polarity and the other to a direct current of negative polarity, the other two stations on the circuit being provided with the ordinary pulsating bells responding to intermittent currents of positive and negative polarity, respectively. The two stations, which are provided with the polarized relays, are equipped with the ordinary magneto bell which responds to alternating current, and these bells may be of low resistance without a condenser and normally disconnected from the line, or may be of high resistance and normally connected from that line limb associated with the active terminal of the battery through normally closed contacts of the relays to a condenser and ground. When low resistance bells are used, the application of direct current actuates the relay at the substation desired, bringing its associated bell into association with the line limb normally connected with the active terminal of the central battery, while at the same time that line limb is connected with the source of alternating current. In the case where high resistance bells and condensers are used, the connection of the proper direct current source to one limb of the line operates the polarized relay to disconnect from the opposite limb that bell which it is desired shall not be operated.

My invention will be more fully understood from the accompanying drawings forming part of this specification, in which—

Figure 1 illustrates my invention in a structure in which the alternating current bells are normally disconnected from the line, and Fig. 2 illustrates the modification in which the alternating current bells are normally connected with the line.

Like characters of reference refer to corresponding parts in the two figures.

Referring to Fig. 1, the exchange system generally is of a well known type in which the substation A′ is connected to a central office battery C by a suitable telephone line A, and in which substations B′, B², B³ and B⁴ are connected to the central battery by the line B. The equipment at substation A′ is here shown as comprising an alternating bell *b* in series with a condenser *c* in bridge of the telephone line, and a receiver *r* and transmitter *t* in a normally open bridge closed at the upper contact of the switch-hook *h*. The equipment at the substations connected by line B is the same as that at A′, except with regard to the signaling apparatus. Stations B′ and B² are provided with pulsating bells responding to negative and positive pulsations respectively, and these bells are shown as permanently connected from limb 2 of the line to ground. Substation B³ is provided with a polarized relay *a* responsive to direct negative current, connected from limb 2 to ground; the relay contacts control the circuit of the grounded alternating current bell b^3 and this bell may be, if desired, of relatively low resistance. This bell is normally disconnected from the line; but when relay *a* is energized by the proper current, the closure of the relay contacts connects the bell to limb 1 of the line. Station B⁴ is provided with a similar polarized relay *d* connected from limb 2 to ground, this relay being responsive to positive direct current and serving, when actuated, to connect to limb 1 of the line a bell b^4 similar to b^3. It will be understood that the substation equipment of line B is equally applicable to line A, a single station

being shown at A′ merely for the sake of simplicity.

Assuming that subscriber A′ wishes to communicate with a substation on line B, he removes his receiver from its switch-hook, thus closing circuit through limbs 1 and 2 and energizing relay 3 to cause the illumination of lamp 4 in the well known manner. Upon the insertion of the answering plug O, cut-off relay 5 is energized by current flowing from battery C through the cord circuit, and the relay contacts assume their alternate position, thus disconnecting limbs 1 and 2 from their normal circuit and connecting them to the terminals of the spring-jack 6. Current will then flow from battery C, through the cord relays 7 and 8 and the line limbs, energizing the substation transmitter and preventing the illumination of the supervisory lamp 11. Upon ascertaining that a subscriber, connected with line B, is desired, the operator tests in the usual way by applying the tip of her calling plug P to the sleeve or test contact of the spring-jack 6 associated with the desired line. If the line be busy or connected at some other point, current will flow from battery C, through relay 9 and strand 16 of the cord circuit already connected, thence through the sleeve of the connected jack to the sleeve of the tested jack, then through the tip of the testing plug, strand 15, wire 50, armature 20 of relay 9, contact 51 and through the common test relay 21 to ground, actuating the armature of the test relay. This actuation closes a circuit of battery C through impedance 23 and winding 24 of the operator's induction coil, thus giving the required test indication.

If the line be idle, the operator inserts the calling plug P into the spring-jack and operates the proper ringing key to call the substation desired. If station B′ is wanted, she operates key k'; the operation of the sleeve lever of this key includes the winding of cut-off relay 5 in circuit with battery C through the resistance 25, thus connecting the two line limbs to the spring-jack terminals, and the operation of the tip lever of the key connects the negative pulsating generator G^2 to limb 2 of the line. A circuit for ringing current may then be traced from ground, through generator G^2, strand 15, tip contacts of the plug and spring-jack, contacts of relay 5, limb 2 of the line, to ground through relays a and d and bells b' and b^2. Relay d, being responsive only to positive currents, will not be actuated. Relay a will be intermittently actuated; but bell b^3 being responsive only to alternating currents which are not at this time present on limb 1, no signal results. Bell b^2, being responsive to positive pulsations only, does not operate, while bell b' operates to give the required signal. It is likewise apparent that if the receiver at station B′ be removed while the bell b' is being operated, the consequent connection of the two line limbs will not cause bells b^3 or b^4 to respond. If substation B^2 is to be called, the operator operates ringing key k^2, thus establishing the same conditions as before, except that limb 2 is now connected to the positive pulsating generator G′ and bell b^2 responds. If station B^3 is desired, the operator actuates ringing key k^3. The operation of the lower lever of this key connects cut-off relay 5 to battery C, through impedance 26 at contact 28, thus operating the relay; and at the same time, the grounded alternating generator G is connected to the sleeve strand 16 of the cord through contacts 29 and 28. These circuits serve to maintain the proper energization of relay 5 and to impress alternating current upon limb 1 of the line. The simultaneous operation of the tip lever of key k^3 connects the negative terminal of battery C to limb 2 of the line through resistance 25 and strand 15. The negative current thus flowing over limb 2 causes the operation of relay a to connect its associated bell to limb 1, while relay d and bells b'—b^2 remain unactuated. Upon the connection of bell b^3, it responds to the alternating current present at this time to give the required signal, bell b^4 being in its normal disconnected condition. If, during this time, the receiver of any substation be removed, thus connecting the two line limbs, the alternating current thus impressed upon limb 2 will flow to ground through the line limb, strand 15, resistance 25 and battery C or its associated circuits, this action being due to the relatively low resistance and inductance of 25, as compared with that of the bells b'—b^2 and relay d, and these latter instrumentalities are therefore unactuated at such time.

If substation B^4 is to be called, the operator actuates ringing key k^4, thus connecting the positive terminal of battery C′ to limb 2 through resistance 27 and establishing a circuit for limb 1 as before. In this case, bell b^4 is similarly connected to limb 1 and gives its required signal, the bells at the other stations remaining quiet.

After the restoration of the ringing-key, current will flow from battery C, through relay 9, strand 16, plug and jack contacts and relay 5, energizing both relays, thus maintaining the connection of limbs 1 and 2 to the spring-jack terminals and causing the illumination of supervisory lamp 12; and the actuation of armature 20 disconnects test relay 21 from tip strand 15 and completes the talking circuit of the tip strand at contact 52. When the subscriber responds, additional current will flow through relay 9, limbs 1 and 2 of the line, the substation receiver and transmitter and back through strand 15 and relay 10, the energization of this latter relay extinguishing the lamp 12, all in the well

known manner. When either subscriber hangs up his receiver, the consequent de-energization of relay 8 or 10 causes the illumination of the corresponding lamp 11 or 12. The illumination of both lamps constitutes the usual disconnect signal; and upon the removal of the connecting plugs, the apparatus assumes its normal condition.

Fig. 2 differs from Fig. 1 in that the exchange system illustrated, instead of being of the type having but two contact-pieces for the connection terminals or spring-jacks, is of that type illustrated and described in United States Patent No. 647,588, dated April 17, 1900, of which a detailed description is unnecessary, and also differs from Fig. 1 in that the polarized relays, when actuated, serve to disconnect from the circuit the bell which is not required to respond, rather than to connect to the circuit that bell which should respond. In this figure, at station B^3, the alternating bell b^3 is included in series with a condenser and is normally connected to ground and limb 1 of the line through the normally closed contacts of the polarized relay a', and a corresponding bell is similarly connected at substation B^4 through the contacts of the relay d'—the former relay responsive to positive currents, and the latter to negative currents. The bells at stations B' and B^2 are controlled as in the prior diagram, and the operation of key k' or k^2 applies a direct earth connection to limb 1 of the line during their operation so that, if a receiver be removed at such time, bells b^3 or b^4 may not respond. If station B^3 is to be called, the operation of ringing-key k^3 connects the alternating current source to limb 1 of the line and connects the negative terminal of battery C to limb 2 through the resistance 25. This latter connection operates relay d' at substation B^4, thus disconnecting its bell from the circuit, and bell b^3 alone responds. At the same time, the low resistance connection of limb 2, through resistance 25, prevents a false signal at substations B' or B^2, should a receiver be removed during the progress of ringing. Correspondingly, if substation B^4 is to be called, the operation of key k^4 connects the positive terminal of battery C' to limb 2 through resistance 27, thus operating relay a' at substation B^3 and disconnecting the bell at that station, while bell b^4 is actuated.

It will be evident that the several grounds indicated may be a common return and that the several sources of current may be combined in a number of ways; also that my invention is not limited to a system in which a central battery is used for energizing the substation transmitter. I therefore do not wish to be limited to that which is shown and described, but aim to cover by the following claims all modifications or alterations of the invention.

What I claim as new and novel and desire to cover by Letters Patent of the United States, is:—

1. A signaling system comprising a central office, a signaling circuit extending by two limbs only from central to a plurality of stations, signal-receiving devices at the stations associated with one line limb, means controlled over the opposite line limb for controlling the connection of said devices with their associated line limb, other signal receiving devices permanently connected to said opposite line limb, and means for causing the operation of said devices.

2. A signaling system comprising a central office, a signaling circuit extending by two limbs only from central to a plurality of stations, signal-receiving devices at the stations associated with one line limb, means controlled by central over the opposite line limb for controlling the connection of said devices with their associated line limb, other signal receiving devices permanently connected to said opposite line limb, and means for causing the operation of said devices.

3. A signaling system comprising a central office, a signaling circuit extending by two limbs only from central to a plurality of stations, signal-receiving devices at the stations associated with one line limb, relays controlled by central over the opposite line limb for controlling the connection of said devices with their associated line limb, other signal receiving devices permanently connected to said opposite line limb, and means for causing the operation of said devices.

4. A signaling system comprising a central office, a signaling circuit extending by two limbs only from central to a plurality of stations, signal-receiving devices at the stations associated with one line limb, polarized relays controlled by central over the opposite line limb for controlling the connection of said devices with their associated line limb, other signal receiving devices permanently connected to said opposite line limb, and means for causing the operation of said devices.

5. A signaling system comprising a central office, a signaling circuit extending by two limbs only from central to a plurality of stations, signal-receiving devices at the stations associated with one line limb, relays connected with the opposite line limb for controlling the connection of said devices with their associated line limb, other signal receiving devices permanently connected to said opposite line limb, and means for causing the operation of said relays and said devices.

6. A signaling system comprising a central office, a signaling circuit extending by two limbs only from central to a plurality of stations, signal-receiving devices at the stations associated with one line limb, polarized

relays connected with the opposite line limb for controlling the connection of said devices with their associated line limb, other signal receiving devices permanently connected to said opposite line limb, and means for causing the operation of said relays and said devices.

7. A signaling system comprising a central office, a signaling circuit extending by two limbs only from central to a plurality of signal-receiving stations, signal-receiving devices at said stations normally disconnected from said circuit, means controlled by central for causing the connection of said devices to said circuit, means for causing the operation of a connected device, other signal receiving devices permanently connected to said circuit, and means for operating said other signal receiving devices.

8. A signaling system comprising a central office, a signaling circuit extending by two limbs only from central to a plurality of signal-receiving stations, signal-receiving devices at said stations normally disconnected from said circuit, means controlled by central for causing the connection of a pre-determined one of said devices with said circuit, means controlled by central for causing the operation of the connected device, other signal receiving devices permanently connected to said circuit, and means for operating said other signal receiving devices.

9. A signaling system comprising a central office, a signaling circuit extending by two limbs only from central to a plurality of signal-receiving stations, a signal-receiving device at each of said stations associated with one line limb but normally disconnected therefrom, a relay at each of said stations connected with the opposite line limb, means for causing the operation of any pre-determined one of said relays to connect the associated device with its line limb, means for actuating the connected device, other signal receiving devices permanently connected to said opposite line limb, and means for operating said other signal receiving devices.

10. A signaling system comprising a central office, a signaling circuit extending by two limbs only from central to a plurality of signal-receiving stations, a signal-receiving device at each of said stations associated with one line limb but normally disconnected therefrom, a relay at each of said stations connected with the opposite line limb, means controlled by central for causing the operation of any pre-determined one of said relays to connect the associated device with its line limb, means controlled by central for actuating the connected device, other signal receiving devices permanently connected to said opposite line limb, and means for operating said other signal receiving devices.

11. A signaling system comprising a central office, a signaling circuit extending by two limbs only from central to a plurality of signal-receiving stations, signal-receiving devices at two of the stations associated with, but normally disconnected from one line limb, relays at the two said stations connected to the opposite line limb for causing the connection of the associated one of said devices with the first-mentioned line limb, means for actuating either of said relays without actuating the other, means for operating the device thus connected, other signal receiving devices permanently connected to said opposite line limb, and means for operating said other signal receiving devices.

12. A signaling system comprising a central office, a signaling circuit extending by two limbs only from central to a plurality of signal-receiving stations, signal-receiving devices at two of the stations associated with, but normally disconnected from one line limb, relays at the two said stations connected to the opposite line limb for causing the connection of the associated one of said devices with the first-mentioned line limb, one of said relays being responsive to direct current of positive sign and the other to direct current of negative sign, means at the central office for supplying positive or negative direct current to said opposite line limb and for supplying signaling current to the first-mentioned line limb, other signal receiving devices permanently connected to said opposite line limb, and means for operating said other signal receiving devices.

13. A signaling system comprising a central office, a signaling circuit extending by two limbs only from central to a plurality of signal-receiving stations, signal-receiving devices at two of the stations associated with, but normally disconnected from one line limb, relays at the two said stations connected to the opposite line limb for causing the connection of the associated one of said devices with the first-mentioned line limb, said relays being individually responsive only to currents of different value, means at the central office for supplying to said opposite line limb the proper current to operate either of said relays and for supplying to the first-mentioned line limb signaling current to operate the signal-receiving device so connected, other signal receiving devices permanently connected to said opposite line limb, and means for operating said other signal receiving devices.

In witness whereof, I hereunto subscribe my name this 2nd day of July, 1906.

HARRY G. WEBSTER.

Witnesses:
GEO. E. MUELLER,
H. C. OLMSTEAD.