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907,581.

A. H. DYSON,  
TELEPHONE SYSTEM.  
APPLICATION FILED NOV. 14, 1904.

Patented Dec. 22, 1908.  
3 SHEETS—SHEET 2.

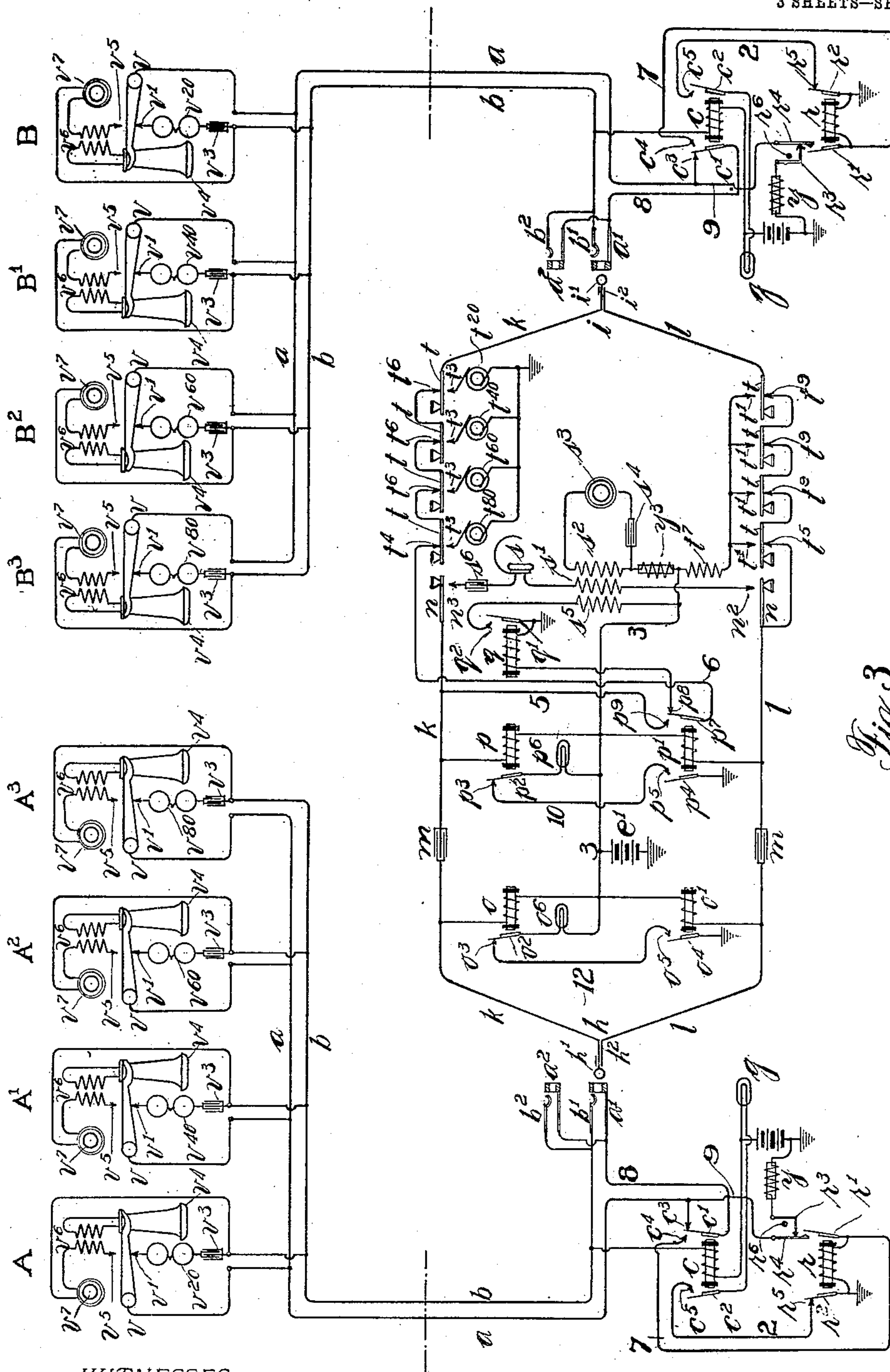


Fig. 3.

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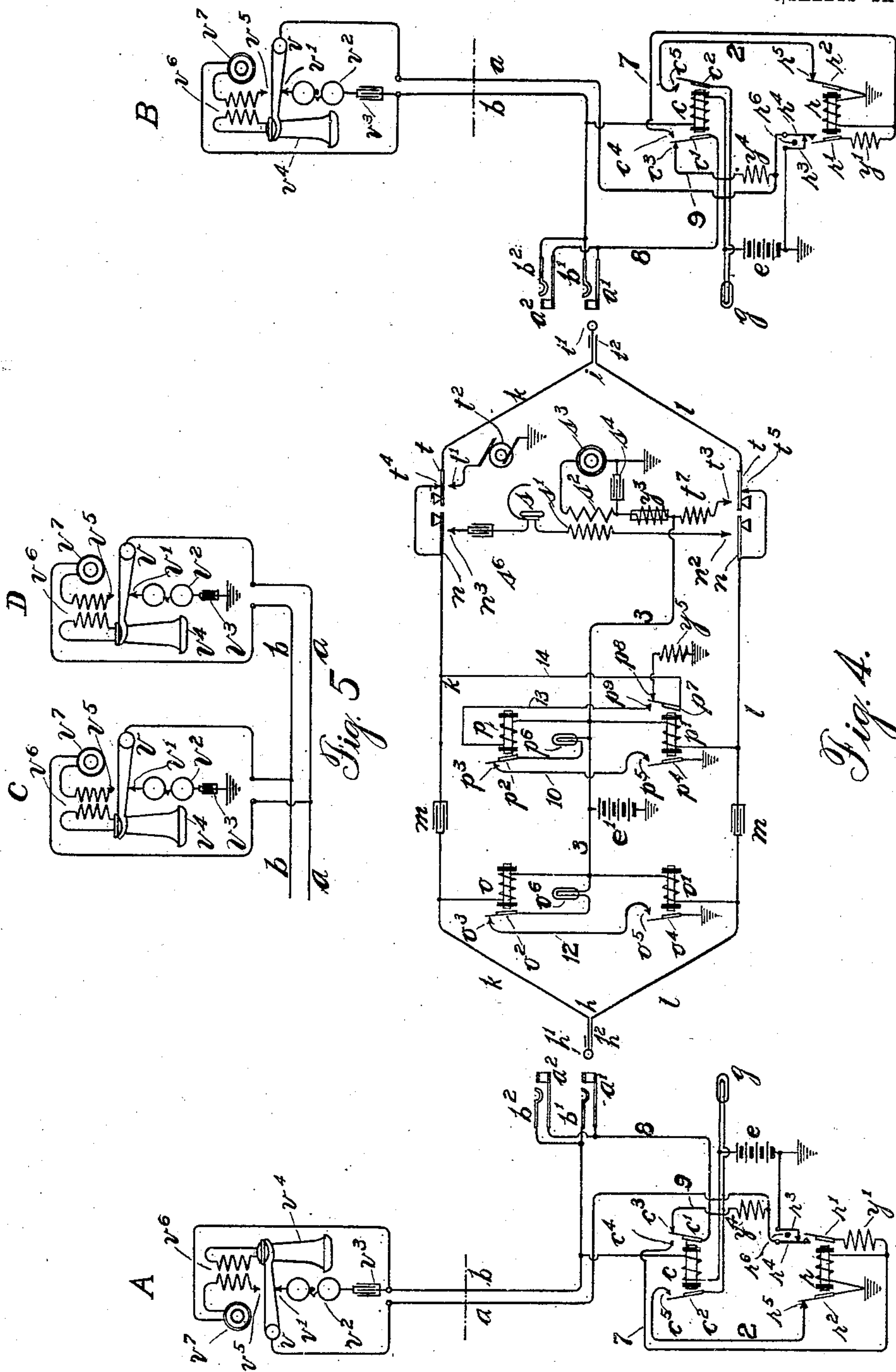
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# UNITED STATES PATENT OFFICE.

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## TELEPHONE SYSTEM.

No. 907,581.

Specification of Letters Patent.

Patented Dec. 22, 1908.

Application filed November 14, 1904. Serial No. 232,657.

*To all whom it may concern:*

Be it known that I, ALFRED H. DYSON, a citizen of the United States, and resident of Chicago, county of Cook, and State of Illinois, have invented new and useful Improvements in Telephone Systems, of which the following is a specification.

My invention relates to improvements in telephone systems, my object being to provide improved talking and signaling circuits.

My invention relates more particularly to a multiple switchboard telephone exchange system, in which two conductors are used in extending the line circuits to the spring jacks of the multiple switchboard and a similar number of conductors through the connecting cords.

In accordance with my invention, I provide, in connection with such a system, a normally complete talking circuit between the subscriber's station and the spring jacks associated with his line.

I use in connection with my invention a line signal relay adapted, when energized, to display a signal which may be a lamp, and a line signal cut-off relay adapted, when energized, to prevent the display of the said signal. The said line signal relay further operates to close, upon its energization, a normally open contact in a circuit adapted to connect, when closed, the said cut-off relay with the spring jacks of the telephone line, whereby the said cut-off relay will be energized when the operator inserts a plug into a spring jack.

It will be seen that the circuit of the cut-off relay has two points of control, one controlled by the subscriber and the other controlled by the operator. It requires the cooperation of subscriber and operator to secure the energization of the said cut-off relay.

Other features of my invention will appear hereinafter.

Referring to the drawings, Figure 1 illustrates diagrammatically a subscriber's line extending in a metallic circuit from a sub-station to the central office, and common battery telephone exchange switchboard line and cord circuit apparatus arranged in accordance with my invention. Fig. 2 illustrates a modification of the cord circuit apparatus shown in Fig. 1. Fig. 3 illustrates an application of my invention to a four-party line telephone system, adapted for

selective ringing. Fig. 4 illustrates a modification of my invention in which a test relay is not employed to determine the idle or busy condition of a tested line. Fig. 5 represents a selectively ringing two party substation arrangement.

Although in the drawings I have for convenience in illustration shown two batteries  $e$  and  $e^1$ , it will be understood that these may be one and the same battery.

Like characters refer to like parts in the various figures.

Referring first to Fig. 1, the telephone line  $a b$  extends to the sub-station A where subscriber's apparatus is provided, consisting of hook switch  $v$ , bell  $v^2$ , condenser  $v^3$ , receiver  $v^4$ , induction coil  $v^5$  and transmitter  $v^7$ . Other arrangements of sub-station apparatus are well known in the art, and I do not confine myself to the particular arrangement illustrated. Limb  $b$  of the telephone line extends to the central office and terminates in spring contact  $b^1$  of the answering spring jack  $a^1 b^1$ . Limb  $a$  terminates at the central office in sleeve contact  $a^1$  of said spring jack, passing through normally closed contact  $c^3 c^1$ . Contacts  $a^1$  and  $b^1$  of the answering spring jack are connected respectively to contacts  $a^2$  and  $b^2$  of the multiple spring jacks, one only of which is shown.

At the central office is shown relay  $c$ , which is represented as consisting of a core and an energizing winding thereon and associated circuit controlling mechanism. The other relays shown in the system are of similar construction. The winding of relay  $c$  is legged from limb  $b$  of the telephone line to the active pole of grounded battery  $e$ . The said relay  $c$  is provided with armature  $c^1$ , connected by conductor 8 with sleeve contact  $a^1$  and normally resting upon anvil  $c^3$ , which is connected by conductor 9 through contact  $r^4 r^3$  and resistance  $y$  to ground. The anvil  $c^4$ , with which said armature  $c^1$  is adapted to make contact when the relay is energized, is connected, by means of conductor 7 and through the winding of relay  $r$ , to ground, and is also connected with armature  $r^1$  of said relay. Armature  $c^2$  of relay  $c$  is connected through lamp signal  $g$  to the active pole of battery  $e$ . Anvil  $c^5$ , with which said armature is adapted to make contact when relay  $c$  is energized, is connected by conductor 2 with anvil  $r^5$ , associated with relay  $r$ . Relay  $r$  is provided with armature  $r^1$ , connected to conductor 7.



Associated with said armature are contact springs  $r^4$ , connected to limb  $a$ , and  $r^3$ , connected through resistance  $y$  to ground, said springs normally resting in contact. When relay  $r$  is energized, its armature  $r^1$  will make contact with and retract spring  $r^4$  and break contact between spring  $r^4$  and spring  $r^3$  at a time subsequent to the closing of contact  $r^1 r^4$ , the spring  $r^3$  being so arranged as to follow the retraction of spring  $r^4$  until this motion is arrested by stop  $r^{61}$ . Armature  $r^2$  of relay  $r$  is connected to ground, normally rests against anvil  $r^5$  and is adapted to open contact  $r^2, r^5$  upon the energization of relay  $r$ . The above description applies also to the apparatus associated with substation B.

Referring now to the cord circuit, plugs  $h$  and  $i$  are provided with tip contacts  $h^1, i^1$  and sleeve contacts  $h^2, i^2$ , the said tip contacts being connected by cord strand  $k$ , and sleeve contacts by cord strand  $l$ . Relays  $o, p$  and  $o^1, p^1$  are legged from battery  $e^1$  to cord strands  $k$  and  $l$  respectively, the condensers  $m, m$  being introduced in said strands at points intermediate of the bridges of relay  $o, o^1$  and  $p, p^1$ . Relay  $o$  is provided with armature  $o^2$ , connected through supervisory lamp  $o^6$  and conductor 3 to battery  $e^1$ . The said armature normally rests in contact with anvil  $o^3$  connected to anvil  $o^5$  of relay  $o^1$ , and is adapted, upon the energization of relay  $o$ , to open its contact with said anvil  $o^3$ . Relay  $o^1$  is provided with armature  $o^4$  connected to ground. Associated with said armature is anvil  $o^5$  with which said armature is adapted to make contact when relay  $o^1$  is energized.

The connections and arrangement of armatures  $p^2, p^4$ , anvils  $p^3, p^5$  and signal lamp  $p^6$  associated with relays  $p$  and  $p^1$  are similar to those just described with reference to the mechanisms of relays  $o$  and  $o^1$ . Relay  $p^1$  is provided with an additional armature  $p^7$ , connected over conductor 6 with tip contact  $i^1$  of plug  $i$ . The said armature normally rests against anvil  $p^8$ , which is connected through the winding of relay  $q$  to ground. Anvil  $p^9$ , with which the said armature is adapted to make contact, is connected, by means of conductor 5, to cord strand  $k$ . The armature  $q^1$  of relay  $q$  is connected to ground and is adapted, upon the energization of said relay, to make contact with the anvil  $q^2$ , connected through tertiary winding  $s^5$  of the operator's induction coil and conductor 3 to battery  $e^1$ . The two levers of the operator's listening-in key  $n, n$  are so arranged that, when depressed, they will make contact with anvils  $n^2$  and  $n^3$  respectively. Bridged between the said anvils are operator's condenser  $s^6$ , receiver  $s$  and secondary winding  $s^4$  of the operator's induction coil. The primary winding  $s^2$  of said coil is connected through resistance  $y^3$  and conductor 3 to battery  $e^1$  and through operator's transmitter  $s^3$  to ground. The condenser  $s^4$  is bridged be-

tween the battery and ground connections of the said winding.

The levers  $t, t$  of the operator's ringing key are connected with the tip  $i^1$  and sleeve  $i^2$  respectively, and normally rest in contact with anvil  $t^4$ , connected with armature  $p^7$  of relay  $p^1$ , and anvil  $t^5$ , connected with cord strand  $l$ . Anvil  $t^1$  is connected through generator  $t^2$  to ground, and anvil  $t^3$  through resistance  $t^7$  to battery  $e^1$ . When the operator depresses the two levers  $t, t$  of the ringing key, they make contact respectively with anvils  $t^1$  and  $t^3$ .

Referring to Fig. 2, the cord circuit arrangement there illustrated is similar to that shown in Fig. 1, except as to the arrangement of the operator's ringing apparatus. I have here shown a generator  $T^2$  which is so constructed as to deliver current of negative frequency, or current in which the negative pulsations predominate. The levers  $t, t$  of the ringing key associated with said generator normally rest in contact with anvils  $t^4, t^5$ , already described with reference to Fig. 1. Anvil  $T^3$  is connected directly to ground, and anvil  $T^1$  is connected to ground through said generator  $T^2$ . The levers of said ringing key are adapted to engage anvils  $T^1$  and  $T^3$  respectively when depressed. I have also shown a second generator  $T^2$  adapted to deliver alternating current. This generator is provided with a ringing key individual to it, whose levers  $t, t$  normally rest against anvils  $t^6$  and  $t^9$  which are connected respectively to the levers of the ringing key associated with generator  $T^2$ . Anvils  $t^1$  and  $t^3$  are arranged in the manner described with reference to the similarly designated anvils in connection with Fig. 1. The levers of the ringing key associated with generator  $t^2$  are connected respectively to contacts  $i^1$  and  $i^2$  of plug  $i$  by cord strands  $k$  and  $l$ .

In Fig. 5, I have illustrated a telephone line  $a, b$  and two substations C and D connected thereto. The bell associated with subscriber's station C is legged from limb  $b$  of the telephone line to ground, and the bell associated with subscriber's station D is legged from limb  $a$  of the telephone line to ground.

Referring now to Fig. 3, the arrangement is similar to that shown in Fig. 1, except as regards the arrangement of the substation apparatus and the operator's ringing equipment. I have here illustrated two telephone lines  $a, b$ , extending respectively to substations A, A<sup>1</sup>, A<sup>2</sup>, A<sup>3</sup>, and B, B<sup>1</sup>, B<sup>2</sup>, B<sup>3</sup>. The description given with reference to substations A and B in Fig. 1 applies generally to these with the following additional description. Subscriber's bells  $v^{20}, v^{40}, v^{60}$ , and  $v^{80}$  shown in Fig. 3 are so constructed as to respond respectively only to such currents as closely approximate 20, 40, 60 and 80 alternations per second. Referring now to the operator's ringing equipment shown, the



four generators  $t^{20}$ ,  $t^{40}$ ,  $t^{60}$ , and  $t^{80}$  are adapted respectively to supply current closely approximating 20, 40, 60 and 80 alternations per second. Each generator is provided with ringing key levers  $t$ ,  $t$  individual thereto, adapted, when depressed, to make contact with their associated anvils  $t^1$   $t^3$ , connected respectively through resistance  $t^7$  to battery and through generator to ground. Anvils  $t^4$  and  $t^5$  correspond to similarly designated anvils in Fig. 1. Anvils  $t^6$  and  $t^9$ , shown as resting in contact with levers  $t$ ,  $t$  of the ringing key associated with generator  $t^{60}$ , are connected respectively to the levers of the ringing key of generator  $t^{80}$ . Similarly designated anvils, similarly associated with generator  $t^{40}$ , are connected respectively to the levers of the ringing key of generator  $t^{60}$ . Similarly designated anvils, similarly associated with generator  $t^{20}$ , are connected respectively to the levers of the ringing key of generator  $t^{40}$ . Cord strands  $k$  and  $l$  connect contacts  $i^1$  and  $i^2$  respectively to the levers of the ringing key of generator  $t^{20}$ .

Referring to Fig. 4, I show a variation of Fig. 1 in which resistance  $y$  is omitted, a resistance  $y^4$  is connected in conductor 9, and spring  $r^3$  is connected to ground without intervening resistance. A resistance  $y^1$  is inserted in the circuit connecting the winding of relay  $r$  with its armature  $r^1$ . In the cord circuit, the circuits of relays  $o$ ,  $o^1$  and  $p^1$  are similar to those of Fig. 1. The winding of relay  $p$  is connected by conductor 13 to anvil  $p^9$  and is extended to cord strand  $k$  upon the energization of relay  $p^1$  through contact  $p^9$   $p^7$  and conductor 14. Anvil  $p^8$  is connected through resistance  $y^5$  to ground and is normally in contact with armature  $p^7$ . Relay  $q$  and winding  $s^5$  are omitted. Anvil  $t^4$  is connected to cord strand  $k$ .

Referring first to Fig. 1, the operation of the system is as follows: Assuming that the subscriber A desires to be connected with another subscriber, he removes his telephone from its hook, thus opening contact  $v$ ,  $v^1$  and closing contact  $v$ ,  $v^5$ , whereby a comparatively low resistance path for the flow of current over the telephone line is provided through transmitter  $v^7$ . Current of battery  $e$  is thereby closed through the winding of relay  $c$ , limbs  $b$  and  $a$ , over conductor 9, contact  $r^4$ ,  $r^3$ , resistance  $y$  to ground and back to the battery. Relay  $c$  is thereby energized and attracts its armature  $c^2$  to make contact with anvil  $c^5$ , thereby closing current from battery  $e$  through signal lamp  $g$ , conductor 2, contact  $r^5$ ,  $r^2$  and to ground, thus lighting said lamp and notifying the operator that a connection is desired. The energization of relay  $c$  also attracts its armature  $c^1$ , breaking contact  $c^1$ ,  $c^3$ , thereby disconnecting contact  $a^1$  of the spring jack from limb  $a$ . Said armature  $c^1$ , when so attracted, closes con-

tact  $c^1$ ,  $c^4$ , thereby connecting said contact  $a^1$  of the spring jack with the energizing winding of relay  $r$ . The operator, observing the signal, thereupon inserts the plug  $h$  into the answering spring jack of the calling subscriber, the tip contact  $h^1$  and sleeve contact  $h^2$  of the plug engaging respectively spring contact  $b^1$  and sleeve contact  $a^1$  of the spring jack. The circuit of battery  $e^1$  is thereby closed over conductor 3, relay  $o^1$ , cord strand  $l$ , contact  $h^2$ ,  $a^1$ , conductor 8, contact  $c^1$ ,  $c^4$ , conductor 7 and through the winding of relay  $r$  to ground and back to the battery. This flow of current causes the energization of relays  $o^1$  and  $r$ . The energization of relay  $r$  attracts its armature  $r^2$  out of contact with anvil  $r^5$ , thus opening the circuit of signal lamp  $g$  and extinguishing the lamp. Armature  $r^1$  is also attracted and engages spring  $r^4$ , thus connecting contact  $a^1$  of the spring jack with limb  $a$  of the telephone line over conductors 8 and 7, thereby establishing the talking circuit of limb  $a$  of the telephone line. Said armature  $r^1$ , when attracted, retracts spring  $r^4$  and causes it to break contact with spring  $r^3$  at a period subsequent to the closing of contact  $r^1$ ,  $r^4$ , so that a new path for the flow of current from limb  $a$  to ground is provided through contact  $r^4$ ,  $r^1$  and the winding of relay  $r$  before the normal path through contact  $r^4$ ,  $r^3$  is destroyed, thus preventing the deenergization of relay  $c$ . The energization of relay  $o^1$  attracts its armature  $o^4$  into contact with anvil  $o^5$  and would cause the illumination of supervisory signal lamp  $o^6$ , were it not for the fact that the insertion of the plug into the spring jack closes current of battery  $e^1$  through relay  $o$ , cord strand  $k$ , limbs  $b$  and  $a$  of the telephone line to ground, thereby energizing said relay  $o$  and causing its armature  $o^3$  to be drawn out of contact with anvil  $o^3$ , thereby opening the circuit of the said signal lamp  $o^6$ . The operator now depresses the levers  $n$ ,  $n$  of her listening-in key, thus bridging her telephone into circuit, and ascertains the number of the subscriber wanted which, it is assumed, will be subscriber B. She thereupon touches the tip contact  $i^1$  of plug  $i$  to a sleeve contact of one of the spring jacks associated with the line of subscriber B, for the purpose of determining whether or not said line is busy. Assuming that sleeve contact  $a^2$  is the one selected for testing; in case the line is busy the said contact will be at a potential different from that of the earth owing to current flowing from battery  $e^1$ , over cord strand  $l$ , of the cord circuit already connected with the line of subscriber B, through the sleeve contact of the plug and spring jack then connected and to ground through resistance  $y$  or the winding of relay  $r$ , depending upon whether or not subscriber B then has his telephone removed from its hook. The difference of potential will cause a flow of cur-



rent from said contact  $a^2$  over tip  $i^1$ , cord strand  $k$ , over conductor 6 through the winding of relay  $q$  and to ground, thus energizing relay  $q$  and attracting its armature, and closing circuit of battery  $e^1$  over conductor 3 through tertiary winding  $s^5$  of the operator's induction coil, and to ground through contact  $q^2$ ,  $q^1$ . This causes a click in the operator's telephone, and notifies her that the line desired is busy.

In case the tested line is not busy, the sleeve contacts of the spring jacks associated therewith will be at the potential of the ground, and no flow of current will result and the operator will know that the line is idle. She thereupon inserts the plug into the spring jack, depresses levers  $t$ ,  $t$  of her ringing key, sending ringing current from generator  $t^2$  out over the line through cord strand  $k$  and limb  $b$ , said current returning over limb  $a$ , cord strand  $l$ , through resistance  $t^7$ , conductor 3 and through the circuits of battery  $e^1$  to the other side of said generator  $t^2$ . At this time, relay  $c$  is maintained in an energized condition by a current flow from battery  $e$  through the winding of said relay, over a portion of limb  $b$  of the telephone line, contact  $b^2$ ,  $i^1$ , cord strand  $k$  and through generator to ground. Relay  $r$  is maintained in an energized condition by a flow of current from battery  $e^1$  over conductor 3, through contact  $t^3$ ,  $t$ , cord strand  $l$ , contact  $i^2$ ,  $a^2$ , conductor 8, conductor 7 through said relay  $r$  and to ground. When the ringing key is released, relays  $c$  and  $r$  become deenergized and so remain until the called subscriber responds.

Until the subscriber B answers the call, the supervisory lamp signal  $p^6$  will be displayed, due to the closing of battery there-through by the closure of contact  $p^4$ ,  $p^5$ , due to the energization of relay  $p^1$  by current flowing over a path as follows: from battery  $e^1$ , conductor 3, through said relay  $p^1$ , cord strand  $l$ , contact  $i^2$ ,  $a^2$ , conductor 8, conductor 9, through resistance  $y$  to ground. The energization of said relay  $p^1$  attracts its armature  $p^8$  into contact with anvil  $p^9$ , thereby closing the break in cord strand  $k$ , normally existing at said contact.

When subscriber B removes his telephone from its hook in response to the call, thereby uniting limbs  $a$  and  $b$  of the telephone line at the substation, relays  $c$  and  $r$  will be energized in the manner already described with reference to substation A, also relay  $p$  will be energized attracting its armature  $p^2$ , thus opening the circuit of supervisory signal lamp  $p^6$  and causing the extinguishment of said lamp, by currents flowing over the following path: from battery  $e^1$ , conductor 3, through the winding of said relay, cord strand  $k$ , conductors 5 and 6, contact  $i^1$ ,  $b^2$ , limbs  $b$  and  $a$  of the telephone line and to ground.

Subscribers A and B are now in conversation through condensers  $m$ ,  $m$ , their transmitters being energized by currents flowing through relays  $o$ ,  $c$  and  $p$ ,  $c$ , respectively, over limbs  $b$  of the telephone lines, limbs  $a$  and to ground. When they have finished their conversation, they replace their telephones on the hooks, thereby opening the circuits of the telephone lines at the substations and causing the deenergization of relays  $c$  and also of relays  $o$  and  $p$ . The deenergization of relays  $o$  and  $p$  closes the circuit of battery  $e^1$  through supervisory lamp signals  $o^6$  and  $p^6$ , thereby displaying them and notifying the operator that disconnection is desired. She thereupon withdraws plugs  $h$  and  $i$ , which deenergizes relays  $o^1$  and  $p^1$ , whereby the circuits of supervisory lamp signals  $o^6$  and  $p^6$  are opened and the lamps extinguished. When the subscribers A and B replace their telephones on the hooks, relays  $r$  will continue energized or become deenergized, depending upon the relative activities of armatures  $c^1$  and  $r^1$  in their returns to normal; proper signals are secured in either case.

Referring to Fig. 2 and Fig. 5, the depression of ringing key levers  $t$ ,  $t$ , associated with generator  $t^2$  in Fig. 2, will send ringing current out over limb  $b$  of the telephone line, the return path for said current being through bell  $v^1$  of subscriber's station C and to ground at the substation. Relays  $c$  and  $r$  are energized at this time, as already described in connection with Fig. 1. In case substation D is called for, the operator will depress levers  $t$ ,  $t$  of the ringing key associated with generator  $T^2$ , thus sending ringing current out over limb  $a$  of the telephone line, the said current passing through bell  $v^1$  of the subscriber's station D, finding its return path to ground at said substation. At this time, relay  $c$  is maintained in an energized condition, as described with reference to Fig. 1, except that current therethrough returns directly to ground by means of anvil  $T^3$  instead of through generator  $t^2$ . Relay  $r$  is maintained in an operated condition by a portion of the current from generator  $T^2$ , passing therethrough to ground, the current of said generator being of negative frequency, or a current in which the negative pulsations predominate.

Referring to Fig. 3, the operation of the arrangement there shown is generally the same as that already given with reference to Fig. 1, except as regards the ringing operations. Relays  $c$  and  $r$  are maintained in operated condition when ringing current is being sent over the telephone line in a similar manner to that described with reference to Fig. 1. Assuming that the subscriber B has been called for, the operator, after inserting plug  $i$  into a spring jack associated with the line extending to said substation B, will de-



press the levers  $t$ ,  $t$  of the ringing key associated with generator  $t^{20}$ . The ringing current thereby sent over the line will closely approximate twenty alternations per second, and a portion thereof will pass through each of the substations B, B<sup>1</sup>, B<sup>2</sup>, B<sup>3</sup>. The bell  $v^{20}$  associated with substation B alone will ring, being the only bell of the bells associated with said substations adapted to respond to current of approximately twenty alternations per second. Subscriber B is thereby advised that his attention is desired and answers the call by removing his telephone from its hook. It will be seen that subscriber B<sup>1</sup> or B<sup>2</sup> or B<sup>3</sup> may have their respective bells selectively rung by the operator by means of generators  $t^{40}$ ,  $t^{60}$  and  $t^{80}$  respectively, in a manner similar to that already described with reference to substation B.

Referring to Fig. 4, the operation of the line signaling apparatus may be readily understood from the description already given in connection with Fig. 1. In the present arrangement, however, resistance  $y$  of Fig. 1 is removed, resistance  $y^4$  is placed in the circuit connecting anvil  $c^3$  and spring  $r^4$ , and limb  $a$  of the telephone line is tapped directly to ground without intervening resistance. This prevents stray currents, flowing over limb  $a$ , from affecting the potential of the sleeve contacts of the spring jacks associated with the telephone line. In consequence of the removal of resistance  $y$ , a resistance  $y^1$  is inserted between armature  $r^1$  and the energizing winding of relay  $r$  in order to prevent the short circuiting of said relay  $r$  during the period when, in the course of the energization of said relay, double contact  $r^1$ ,  $r^4$ ,  $r^3$  exists. Assuming that the operator desires to determine the idle or busy condition of line  $a$ ,  $b$  extending to substation B, she touches tip contact  $i^1$  of the calling plug to a sleeve contact, assumed to be  $a^2$ , of a spring jack associated with said telephone line. In case the said line is busy, the sleeve contact tested will be at a potential different from that of the earth, due to a flow of current from battery  $e^1$  over a cord strand  $l$  of the cord circuit then connected with said telephone line, the sleeve contact of the spring jack connected therewith, and through resistance  $y^4$  or the winding of relay  $r$  to ground, depending upon whether the subscriber B then has his telephone removed from its hook or not. The difference of potential causes a flow of current from the tested sleeve contact  $a^2$ , over cord strand  $l$ , conductor 14, contact  $p^7$ ,  $p^8$  and to ground. The listening key being at this time depressed, a click is caused in the operator's telephone due to the change of potential through condenser  $s^6$ , notifying her that the line is busy. In case the line tested is not busy, the sleeve contacts of the spring jacks

associated with said line will be at the potential of the earth and no flow of current will take place, and the operator will know that the line is idle.

My invention is generally applicable to electric signaling and to telephone systems and is not restricted to the particular applications thereof herein illustrated and explained. Variations will readily suggest themselves to those skilled in the art, that do not depart from the substance of my invention.

I claim:—

1. An electric signaling system comprising a circuit extending from one station to a second, a source of current included in said circuit, a signal associated therewith, an electromagnet normally under the control of the first station for causing the display of said signal, a second electromagnet for destroying said control, plug and jack contacts associated with said circuit, means for completing a talking circuit through said plug and jack contacts, an energizing circuit for said second electromagnet local to said second station and including talking contacts of said plug and jack and being normally open at a second point, and means under the control of the first station for closing said energizing circuit at said latter point.
2. An electric signaling system comprising a circuit extending from one station to a second, a source of current included in said circuit, a signal associated therewith, an electromagnet normally under the control of the first station for causing the display of said signal, a second electromagnet for destroying said control, plug and jack contacts associated with said circuit, means for completing a talking circuit through said plug and jack contacts, an energizing circuit for said second electromagnet including talking contacts of said plug and jack and being normally open at a second point, and means actuated by said first electromagnet to close said energizing circuit at said latter point.
3. An electric signaling system comprising a main circuit extending from one station to a second, a source of current included in said circuit, a local circuit having two break-points, one normally open and the other normally closed, an electrically actuated signal included in said local circuit, means for establishing a talking circuit between said stations an electromagnet under the control of the first station for closing said local circuit at its normally open point, a second electromagnet for breaking said local circuit at its normally closed point, and an energizing circuit for said second electromagnet including a portion of said talking circuit and having a normally open break-point controlled by said first electromagnet.
4. In an electric signaling system, a circuit uniting one controlling station with a second,



a source of current connected in said circuit, a signal for said circuit, an electromagnet, associated with said circuit and controlled from said first station, normally adapted to display  
 5 said signal when energized, a second electromagnet associated with said circuit adapted, when energized, to prevent the display of said signal, an energizing winding for said  
 10 second electromagnet connected to a source of current and normally disconnected from said circuit, means controlled by said first electromagnet adapted, when said magnet is energized, to divide a limb of said signaling  
 15 circuit and include a part thereof in a local circuit with said energizing winding and means, controlled at the other of said controlling stations, adapted to cause the energization of said second electromagnet by currents  
 20 flowing over said local circuit when established.

5. In an electric signaling system, a circuit uniting one controlling station with a second, a source of current connected in said circuit, a signal for said circuit, an electromagnet, associated with said circuit and controlled from said first station, normally adapted to display said signal when energized, a second electromagnet associated with said circuit adapted, when energized, to prevent the  
 25 display of said signal, an energizing winding for said second electromagnet connected to a source of current and normally disconnected from said circuit, means controlled by said first electromagnet adapted, when said magnet is energized, to divide a limb of said signaling circuit and include a part thereof in a  
 30 local circuit with said energizing winding, means, controlled at the other of said controlling stations, adapted to cause the energization of said second electromagnet by currents flowing over said local circuit when established and means controlled by said second electromagnet adapted, when said magnet is energized, to unite the parts of said  
 35 limb.

6. A telephone system comprising a telephone line extending from a substation to a central office, a source of current included in circuit with said line, a local circuit having  
 50 two break-points, one normally open and the other normally closed, an electrically actuated signal included in said local circuit, an electromagnet under the control of the first circuit for closing said local circuit at its normally open point, a second electromagnet for breaking said local circuit at its normally closed point, plug and jack contacts associated with said line, means for completing a talking circuit through said plug and jack  
 60 contacts and an energizing circuit for said second electromagnet including talking contacts of said plug and jack and a normally open break-point controlled by said first electromagnet.

65 7. In a telephone exchange system, the

combination of a signaling circuit having two controlling stations, a source of current associated therewith, a signal for said circuit, an electromagnet associated with said circuit adapted normally to display said signal  
 70 when energized, and responsive to currents controlled from one of said stations, a second electromagnet associated with said circuit adapted to prevent the display of said signal when energized, an energizing winding  
 75 for said electromagnet permanently connected to a source of current and normally disconnected from said circuit, means controlled by said first electromagnet adapted, when said magnet is energized, to include a  
 80 portion of said signaling circuit in circuit with said winding, a spring-jack associated with said signaling circuit and a cord circuit adapted to be connected thereto and means associated therewith, adapted, upon the connection  
 85 of said cord-circuit to said spring-jack, to energize said second electromagnet by currents flowing through a contact of said spring-jack and plug over said portion and through said energizing winding.

8. In a telephone exchange system, the combination of a telephone line connecting a substation with a switching terminal at the central office, a signal for said line, a line relay at the central office, and source of current  
 95 in circuit therewith, associated with said line and normally adapted to display said signal in response to currents controlled by the substation switch, a cut-off relay adapted, when energized, to prevent the display of said signal, an energizing winding for said cut-off relay, and source of current in circuit therewith, normally disconnected from the telephone line and from said connection terminal, switching mechanism associated with  
 100 said line relay adapted, when said relay is energized, to establish a local circuit from said source of current through the winding of said cut-off relay to said connection terminal including a portion of a limb of the talking  
 105 circuit of the line, a cord circuit adapted to be connected to said terminal and means controlled by the connection of said cord circuit to said terminal, adapted to cause the energization of said cut-off relay by currents  
 110 flowing over said local circuit when established.

9. In a telephone exchange system, the combination of a telephone line connecting a substation with the central office, and provided with a terminal thereat, a cord circuit at the central office for making connection with said terminal, a signal for said line, a line relay adapted to be energized under the control of the substation and normally  
 120 adapted to display said signal when energized, a source of current associated therewith, a cut-off relay and source of current in circuit therewith, associated with said line, adapted, when energized, to prevent the display of said signal when energized, and responsive to currents controlled from one of said stations, a second electromagnet associated with said circuit adapted to prevent the display of said signal when energized, an energizing winding for said electromagnet permanently connected to a source of current and normally disconnected from said circuit, means controlled by said first electromagnet adapted, when said magnet is energized, to include a portion of said signaling circuit in circuit with said winding, a spring-jack associated with said signaling circuit and a cord circuit adapted to be connected thereto and means associated therewith, adapted, upon the connection of said cord-circuit to said spring-jack, to energize said second electromagnet by currents flowing through a contact of said spring-jack and plug over said portion and through said energizing winding.



play of said signal and normally in inoperative relation with said terminal, means, controlled by the energization of said line relay, adapted to establish operative relation between said cut-off relay and said terminal and means, controlled by the connection of said cord circuit with said terminal, adapted to cause the energization of said cut-off relay when said operative relation is established.

10. In a telephone exchange system, the combination of a telephone line connecting a substation with the central office, and provided with a terminal thereat, a cord circuit at the central office for making connection with said terminal, a signal for said line, a line relay adapted to be energized under the control of the substation and normally adapted to display said signal when energized, a source of current associated therewith, a cut-off relay and source of current in circuit therewith, associated with said line, adapted, when energized, to prevent the display of said signal and normally in inoperative relation with said terminal, means, controlled by the energization of said line relay, adapted to establish operative relation between said cut-off relay and said terminal, means, controlled by the connection of said cord circuit with said terminal, adapted to cause the energization of said cut-off relay when said operative relation is established, means whereby the operator may determine the idle or busy condition of a tested line, and a supervisory signal, associated with said cord circuit, adapted to be displayed and effaced under the control of the substation when the telephone line is switched for conversation.

11. In a telephone exchange system, the combination of a telephone line connecting a substation with the central office, and provided with a terminal thereat, a cord circuit at the central office for making connection with said terminal, a signal for said line, a line relay adapted to be energized under the control of the substation and normally adapted to display said signal when energized, a source of current associated therewith, a cut-off relay and source of current in circuit therewith, associated with said line, adapted, when energized, to prevent the display of said signal and normally in inoperative relation with said terminal, means, controlled by the energization of said line relay, adapted to establish operative relation between said cut-off relay and said terminal, means, controlled by the connection of said cord circuit with said terminal, adapted to cause the energization of said cut-off relay when said operative relation is established and means whereby the operator may determine the idle or busy condition of a tested line.

12. In a telephone exchange system, the combination of a telephone line connecting a substation with the central office, and pro-

vided with a terminal thereat, a cord circuit at the central office for making connection with said terminal, a signal for said line, a line relay adapted to be energized under the control of the substation and normally adapted to display said signal when energized, a source of current associated therewith, a cut-off relay and source of current in circuit therewith, associated with said line, adapted, when energized, to prevent the display of said signal and normally in inoperative relation with said terminal, means, controlled by the energization of said line relay, adapted to establish operative relation between said cut-off relay and said terminal, means, controlled by the connection of said cord circuit with said terminal, adapted to cause the energization of said cut-off relay when said operative relation is established, and a supervisory signal, associated with said cord circuit, adapted to be displayed and effaced under the control of the substation when the telephone line is switched for conversation.

13. In a telephone exchange system, the combination of a telephone line connecting a substation with the central office and provided with a terminal thereat, at the central office a cord circuit for making connection with said terminal and source of current associated therewith, a signal for said line, a line relay and source of current in circuit therewith associated with said line and normally adapted to display said signal when the line circuit is closed at the substation to energize said relay, a cut-off relay and source of current in circuit therewith associated with said line and adapted to prevent the display of said signal when said relay is energized, a circuit for energizing said cut-off relay normally in inoperative relation with said terminal, switching mechanism associated with said line relay adapted when said relay is energized to establish said circuit as a circuit local to the central office and in operative relation with said terminal including therein a portion of the talking circuit of the line and means associated with said cord circuit adapted when connection is made with said terminal and said local circuit is established to energize said cut-off relay by currents flowing over said cord circuit and said local circuit.

14. In a telephone exchange system, the combination of a telephone line connecting a substation with the central office and provided with a terminal thereat, at the central office a cord circuit for making connection with said terminal and source of current associated therewith, a signal for said line, a line relay and source of current in circuit therewith associated with said line and normally adapted to display said signal when the line circuit is closed at the substation to energize said relay, a cut-off relay and source of cur-



rent in circuit therewith associated with said line and adapted to prevent the display of said signal when said relay is energized, a circuit for energizing said cut-off relay normally in inoperative relation with said terminal, switching mechanism associated with said line relay adapted when said relay is energized to establish said circuit as a circuit local to the central office and in operative relation with said terminal including therein a portion of the talking circuit of the line, means associated with said cord circuit adapted when connection is made with said terminal and said local circuit is established to energize said cut-off relay by currents flowing over said cord circuit and said local circuit and switching mechanism associated with said cut-off relay adapted when said relay is energized to establish the talking circuit of the telephone line.

15. In a telephone exchange system, the combination of a telephone line connecting a substation with the central office and provided with a terminal thereat, at the central office a cord circuit for making connection with said terminal and source of current associated therewith, a signal for said line, a line relay and source of current in circuit therewith associated with said line and normally adapted to display said signal when the line circuit is closed at the substation to energize said relay, a cut-off relay and source of current in circuit therewith associated with said line and adapted to prevent the display of said signal when said relay is energized, a circuit for energizing said cut-off relay normally in inoperative relation with said terminal, switching mechanism associated with said line relay adapted when said relay is energized to establish said circuit as a circuit local to the central office and in operative relation with said terminal including therein a portion of the talking circuit of the line, means associated with said cord circuit adapted when connection is made with said terminal and said local circuit is established to energize said cut-off relay by currents flowing over said cord circuit and said local circuit, switching mechanism associated with said cut-off relay adapted when said relay is energized to establish the talking circuit of the telephone line, means whereby the operator may determine the idle or busy condition of a tested line, a signal controlling electromagnet associated with said cord circuit and under the control of the substation switch when the telephone line is switched for conversation, a second signal controlling electromagnet associated with said cord circuit and energized over circuits established by the connection of the cord circuit to the telephone line and a supervisory signal jointly controlled by said two electromagnets.

16. In a telephone exchange system, the combination of a telephone line connecting

a substation with the central office and provided with a terminal thereat, at the central office a cord circuit for making connection with said terminal and source of current associated therewith, a signal for said line, a line relay and source of current in circuit therewith associated with said line and normally adapted to display said signal when the line circuit is closed at the substation to energize said relay, a cut-off relay and source of current in circuit therewith associated with said line and adapted to prevent the display of said signal when said relay is energized, a circuit for energizing said cut-off relay normally in inoperative relation with said terminal, switching mechanism associated with said line relay adapted when said relay is energized to establish said circuit as a circuit local to the central office and in operative relation with said terminal including therein a portion of the talking circuit of the line, means associated with said cord circuit adapted when connection is made with said terminal and said local circuit is established to energize said cut-off relay by currents flowing over said cord circuit and said local circuit, switching mechanism associated with said cut-off relay adapted when said relay is energized to establish the talking circuit of the telephone line and means whereby the operator may determine the idle or busy condition of a tested line.

17. In a telephone exchange system, the combination of a telephone line connecting a substation with the central office and provided with a terminal thereat, at the central office a cord circuit for making connection with said terminal and source of current associated therewith, a signal for said line, a line relay and source of current in circuit therewith associated with said line and normally adapted to display said signal when the line circuit is closed at the substation to energize said relay, a cut-off relay and source of current in circuit therewith associated with said line and adapted to prevent the display of said signal when said relay is energized, a circuit for energizing said cut-off relay normally in inoperative relation with said terminal, switching mechanism associated with said line relay adapted when said relay is energized to establish said circuit as a circuit local to the central office and in operative relation with said terminal including therein a portion of the talking circuit of the line, means associated with said cord circuit adapted when connection is made with said terminal and said local circuit is established to energize said cut-off relay by currents flowing over said cord circuit and said local circuit, switching mechanism associated with said cut-off relay adapted when said relay is energized to establish the talking circuit of the telephone line, means whereby the operator may determine the idle or busy condition of a tested line.



tion of a tested line and a signal controlling electromagnet associated with said cord circuit and under the control of the substation switch when the telephone line is switched for conversation.

18. In a telephone exchange system, the combination of a telephone line connecting a substation with the central office and provided with a terminal thereat, at the central office a cord circuit for making connection with said terminal and source of current associated therewith, a signal for said line, a line relay and source of current in circuit therewith associated with said line and normally adapted to display said signal when the line circuit is closed at the substation to energize said relay, a cut-off relay and source of current in circuit therewith associated with said line and adapted to prevent the display of said signal when said relay is energized, a circuit for energizing said cut-off relay normally in inoperative relation with said terminal, switching mechanism associated with said line relay adapted when said relay is energized to establish said circuit as a circuit local to the central office and in operative relation with said terminal including therein a portion of the talking circuit of the line, means associated with said cord circuit adapted when connection is made with said terminal and said local circuit is established to energize said cut-off relay by currents flowing over said cord circuit and said local circuit, switching mechanism associated with said cut-off relay adapted when said relay is energized to establish the talking circuit of the telephone line, a signal controlling electromagnet associated with said cord circuit and under the control of the substation switch when the telephone line is switched for conversation, a second signal controlling electromagnet associated with said cord circuit and energized over circuits established by the connection of the cord circuit to the telephone line and a supervisory signal jointly controlled by said two electromagnets.

19. In a telephone exchange system, the combination of a telephone line connecting a substation with the central office and provided with a terminal thereat, at the central office a cord circuit for making connection with said terminal and source of current associated therewith, a signal for said line, a line relay and source of current in circuit therewith associated with said line and normally adapted to display said signal when the line circuit is closed at the substation to energize said relay, a cut-off relay and source of current in circuit therewith associated with said line and adapted to prevent the display of said signal when said relay is energized, a circuit for energizing said cut-off relay normally in inoperative relation with said terminal, switching mechanism associated with said line relay adapted when said relay

is energized to establish said circuit as a circuit local to the central office and in operative relation with said terminal including therein a portion of the talking circuit of the line, means associated with said cord circuit adapted when connection is made with said terminal and said local circuit is established to energize said cut-off relay by currents flowing over said cord circuit and said local circuit, switching mechanism associated with said cut-off relay adapted when said relay is energized to establish the talking circuit of the telephone line and a signal controlling electromagnet associated with said cord circuit and under the control of the substation switch when the telephone line is switched for conversation.

20. In a telephone exchange system, the combination of a telephone line connecting a substation with a switching terminal at the central office, a source of current at the central office adapted to furnish current for talking and signaling purposes, a switch at the substation for controlling the flow of current over the said line through the substation, at the central office a cord circuit adapted to make connection with said switching terminal, an electromagnet associated with said line having an energizing winding and source of current in circuit therewith responsive to currents controlled by the substation switch, a second electromagnet associated with said line having an energizing winding and source of current in circuit therewith and normally disconnected from said terminal and from said line, a local signaling circuit containing an electrically operated signal and controlled by said two electromagnets, switching mechanism associated with said first electromagnet normally adapted to cause the display of said signal when said magnet is energized, to connect the energizing winding of said second electromagnet to a contact of said terminal and to disconnect said contact from the line, means controlled by said switching mechanism and the connection of said cord circuit to said terminal adapted to energize the said second electromagnet and switching mechanism associated with said second electromagnet adapted when said magnet is energized to prevent the display of said signal and to connect said contact of said terminal to the line.

21. In a telephone exchange system, the combination of a telephone line connecting a substation with a switching terminal at the central office, a source of current at the central office adapted to furnish current for talking and signaling purposes, a switch at the substation for controlling the flow of current over the said line through the substation, at the central office a cord circuit adapted to make connection with said switching terminal, an electromagnet associated with said line having an energizing winding and source of current in circuit therewith responsive to



currents controlled by the substation switch, a second electromagnet associated with said line having an energizing winding and source of current in circuit therewith and normally disconnected from said terminal and from said line, a local signaling circuit containing an electrically operated signal and controlled by said two electromagnets, switching mechanism associated with said first electromagnet normally adapted to cause the display of said signal when said magnet is energized, to connect the energizing winding of said second electromagnet to a contact of said terminal and to disconnect said contact from the line, means controlled by said switching mechanism and the connection of said cord circuit to said terminal adapted to energize the said second electromagnet, switching mechanism associated with said second electromagnet adapted when said magnet is energized to prevent the display of said signal and to connect said contact of said terminal to the line, means whereby the operator may determine the idle or busy condition of a tested line, a signal controlling electromagnet associated with said cord circuit and under the control of the substation switch when the telephone line is switched for conversation, a second signal controlling electromagnet associated with said cord circuit and energized over circuits established by the connection of the cord circuit to the telephone line and a supervisory signal jointly controlled by said two electromagnets.

22. In a telephone exchange system, the combination of a telephone line connecting a substation with a switching terminal at the central office, a source of current at the central office adapted to furnish current for talking and signaling purposes, a switch at the substation for controlling the flow of current over the said line through the substation, at the central office a cord circuit adapted to make connection with said switching terminal, an electromagnet associated with said line having an energizing winding and source of current in circuit therewith responsive to currents controlled by the substation switch, a second electromagnet associated with said line having an energizing winding and source of current in circuit therewith and normally disconnected from said terminal and from said line, a local signaling circuit containing an electrically operated signal and controlled by said two electromagnets, switching mechanism associated with said first electromagnet normally adapted to cause the display of said signal when said magnet is energized, to connect the energizing winding of said second electromagnet to a contact of said terminal and to disconnect said contact from the line, means controlled by said switching mechanism and the connection of said cord circuit to said terminal adapted to energize the said second electromagnet, switching

mechanism associated with said second electromagnet adapted when said magnet is energized to prevent the display of said signal and to connect said contact of said terminal to the line and means whereby the operator may determine the idle or busy condition of a tested line.

23. In a telephone exchange system, the combination of a telephone line connecting a substation with a switching terminal at the central office, a source of current at the central office adapted to furnish current for talking and signaling purposes, a switch at the substation for controlling the flow of current over the said line through the substation, at the central office a cord circuit adapted to make connection with said switching terminal, an electromagnet associated with said line having an energizing winding and source of current in circuit therewith responsive to currents controlled by the substation switch, a second electromagnet associated with said line having an energizing winding and source of current in circuit therewith and normally disconnected from said terminal and from said line, a local signaling circuit containing an electrically operated signal and controlled by said two electromagnets, switching mechanism associated with said first electromagnet normally adapted to cause the display of said signal when said magnet is energized, to connect the energizing winding of said second electromagnet to a contact of said terminal and to disconnect said contact from the line, means controlled by said switching mechanism and the connection of said cord circuit to said terminal adapted to energize the said second electromagnet, switching mechanism associated with said second electromagnet adapted when said magnet is energized to prevent the display of said signal and to connect said contact of said terminal to the line, means whereby the operator may determine the idle or busy condition of a tested line and a signal controlling electromagnet associated with said cord circuit and under the control of the substation switch when the telephone line is switched for conversation.

24. In a telephone exchange system, the combination of a telephone line connecting a substation with a switching terminal at the central office, a source of current at the central office adapted to furnish current for talking and signaling purposes, a switch at the substation for controlling the flow of current over the said line through the substation, at the central office a cord circuit adapted to make connection with said switching terminal, an electromagnet associated with said line having an energizing winding and source of current in circuit therewith responsive to currents controlled by the substation switch, a second electromagnet associated with said line having an energizing winding



and source of current in circuit therewith and normally disconnected from said terminal and from said line, a local signaling circuit containing an electrically operated signal and  
 5 controlled by said two electromagnets, switching mechanism associated with said first electromagnet normally adapted to cause the display of said signal when said magnet is energized, to connect the ener-  
 10 gizing winding of said second electromagnet to a contact of said terminal and to disconnect said contact from the line, means controlled by said switching mechanism and the connection of said cord circuit to said termi-  
 15 nal adapted to energize the said second electromagnet, switching mechanism associated with said second electromagnet adapted when said magnet is energized to prevent the display of said signal and to connect said  
 20 contact of said terminal to the line and a signal controlling electromagnet associated with said cord circuit and under the control of the substation switch when the telephone line is switched for conversation.

25 25. In a telephone exchange system, the combination of a telephone line connecting a substation with a switching terminal at the central office, a source of current at the central office adapted to furnish current for  
 30 talking and signaling purposes, a switch at the substation for controlling the flow of current over the said line through the substation, at the central office a cord circuit adapted to make connection with said  
 35 switching terminal, an electromagnet associated with said line having an energizing winding and source of current in circuit therewith responsive to currents controlled by the substation switch, a second electro-  
 40 magnet associated with said line having an energizing winding and source of current in circuit therewith and normally disconnected from said terminal and from said line, a local signaling circuit containing an elec-  
 45 trically operated signal and controlled by said two electromagnets, switching mechanism associated with said first electromagnet normally adapted to cause the display of said signal when said magnet is energized,  
 50 to connect the energizing winding of said second electromagnet to a contact of said terminal and to disconnect said contact from the line, means controlled by said switching mechanism and the connection of  
 55 said cord circuit to said terminal adapted to energize the said second electromagnet, switching mechanism associated with said second electromagnet adapted when said magnet is energized to prevent the display of said sig-  
 60 nal and to connect said contact of said terminal to the line, a signal controlling electromagnet associated with said cord circuit and under the control of the substation switch when the telephone line is switched  
 65 for conversation, a second signal controlling

electromagnet associated with said cord circuit and energized over circuits established by the connection of the cord circuit to the telephone line and a supervisory signal jointly controlled by said two electro- 70 magnets.

26. In a telephone exchange system, the combination of a telephone line connecting a substation with a terminal at the central office, a cord circuit at the central office for 75 making connection with said terminal, and a source of current associated therewith, a signal for said line, a line relay and source of current in circuit therewith associated with said line and normally adapted to display 80 said signal when the line circuit is closed at the substation to energize said relay, a cut-off relay and source of current in circuit therewith associated with said line and adapted to prevent the display of said signal 85 when said relay is energized, a normally open contact in a circuit extending from said relay to said terminal, means controlled by said line relay, adapted to close said contact when said line relay is energized and 90 means associated with said cord circuit adapted to energize said cut-off relay over a circuit established by the closure of said contact and the connection of said cord circuit with said terminal. 95

27. In a telephone exchange system, the combination of a telephone line connecting a substation with a terminal at the central office, a cord circuit at the central office for making connection with said terminal, and a 100 source of current associated therewith, a signal for said line, a line relay and source of current in circuit therewith associated with said line and normally adapted to display said signal when the line circuit is closed at 105 the substation to energize said relay, a cut-off relay and source of current in circuit therewith associated with said line and adapted to prevent the display of said signal when said relay is energized, a normally open 110 contact in a circuit extending from said relay to said terminal, means controlled by said line relay, adapted to close said contact when said line relay is energized, means associated with said cord circuit adapted to energize 115 said cut-off relay over a circuit established by the closure of said contact and the connection of said cord circuit with said terminal, means whereby the operator may determine the idle or busy condition of a tested line and a signal 120 controlling electromagnet associated with said cord circuit and under the control of the substation switch when the telephone line is switched for conversation.

28. In a telephone exchange system, the 125 combination of a telephone line connecting a plurality of substations with the central office and provided with a terminal thereat, at the central office a cord circuit for making connection with said terminal, and a source 130



of current associated therewith, a signal for said line, a line relay and source of current in circuit therewith associated with said line and normally adapted to display said signal  
 5 when the line circuit is closed at a substation to energize said relay, a cut-off relay and source of current in circuit therewith associated with said line and adapted to prevent the display of said signal when said relay is  
 10 energized, a normally open contact in a circuit extending from said relay to said terminal, means controlled by said line relay, adapted to close said contact when said line relay is energized, means associated with said  
 15 cord circuit adapted to energize said cut-off relay over a circuit established by the closure of said contact and the connection of said cord circuit with said terminal, means where-  
 20 by the operator may determine the idle or busy condition of a tested line, a signal controlling electromagnet associated with said cord circuit and under the control of the sub-  
 25 station switch when the telephone line is switched for conversation and means where- by the operator may selectively signal each of said plurality of substations.

29. In a telephone exchange system, the combination of a telephone line connecting a plurality of substations with the central of-  
 30 fice and provided with a terminal thereat, at the central office a cord circuit for making connection with said terminal, and a source of current associated therewith, a signal for  
 35 said line, a line relay and source of current in circuit therewith associated with said line and normally adapted to display said signal when the line circuit is closed at a substation to energize said relay, a cut-off relay and  
 40 source of current in circuit therewith associated with said line and adapted to prevent the display of said signal when said relay is energized, a normally open contact in a cir-  
 45 cuit extending from said relay to said terminal, means controlled by said line relay, adapted to close said contact when said line relay is energized, means associated with said cord circuit adapted to energize said cut-off  
 50 relay over a circuit established by the closure of said contact and the connection of said cord circuit with said terminal and means whereby the operator may selectively signal each of said plurality of substations.

30. In a telephone exchange system, the combination of a telephone line connecting a  
 55 plurality of substations with the central office and provided with a terminal thereat, at the central office a cord circuit for making connection with said terminal, and a source of current associated therewith, a signal for  
 60 said line, a line relay and source of current in circuit therewith associated with said line and normally adapted to display said signal when the line circuit is closed at a substation to energize said relay, a cut-off relay and  
 65 source of current in circuit therewith asso-

ciated with said line and adapted to prevent the display of said signal when said relay is energized, a normally open contact in a circuit extending from said relay to said terminal, means controlled by said line relay, 70  
 adapted to close said contact when said line relay is energized, means associated with said cord circuit adapted to energize said cut-off relay over a circuit established by the closure of said contact and the connection of said 75  
 cord circuit with said terminal, a signal controlling electromagnet associated with said cord circuit and under the control of the sub- station switch when the telephone line is  
 80 switched for conversation and means where- by the operator may selectively signal each of said plurality of substations.

31. A telephone system comprising a tele- phone line extending from a substation to a central office, a two-contact connection ter- 85  
 90 minal therefor, a two-strand cord and plug for making connection to said line, a signal associated with said line, means for suppressing said signal, and means under the control of the subscriber for placing said sup-  
 95 pressing means under the control of the operator by closing a circuit extending out over one line limb and back over the other.

32. A telephone system comprising a tele- phone line extending from a substation to a 95  
 100 central office, a two-contact connection terminal therefor, a two-strand cord and plug for making connection to said line, a signal associated with said line, means for displaying said signal, means for effacing said signal  
 105 and means under the control of the subscriber for placing said effacing means under the control of the operator.

33. A telephone system comprising a tele- phone line extending from a substation to a 105  
 110 central office, a two-contact connection terminal therefor, a two-strand cord and plug for making connection to said line, a signal associated with said line, means under the control of the subscriber for displaying said  
 115 signal, means for effacing said signal, and means under the control of the subscriber for placing said effacing means under the control of the operator.

34. A telephone system comprising a tele- 115  
 120 phone line extending from a substation to a central office, a two-contact connection terminal therefor, a two-strand cord and plug for making connection to said line, a signal associated with said line, means for display-  
 125 ing said signal, means for effacing said signal, means under the control of the subscriber for actuating said displaying means and means under the control of the subscriber for plac-  
 130 ing said effacing means under the control of the operator.

35. A telephone system comprising a tele- phone line extending from a substation to a central office, a two-contact connection ter-  
 135 minal therefor, a two-strand cord and plug



for making connection to said line, a signal associated with said line, means for displaying said signal, means for effacing said signal, means under the control of the subscriber for actuating said displaying means and means under the control of the subscriber for simultaneously placing said effacing means under the control of the operator.

36. A telephone system comprising a telephone line extending from a substation to a central office, a two-contact connection terminal therefor, a two-strand cord and plug for making connection to said line, signal-controlling electromagnets, means under the control of the subscriber for energizing one of said electromagnets, means responsive to said energization to display a signal and to place the second electromagnet under the control of the operator and means responsive to the energization of said second electromagnet to efface said signal.

37. A telephone system comprising a telephone line extending from a substation to a central office, a two-contact connection terminal therefor, a two-strand cord and plug for making connection to said line, a signal-controlling electro-magnet, a second signal-controlling electromagnet normally beyond the control of the operator, means under the control of the subscriber for energizing the former electromagnet, means responsive to said energization to display a signal and to complete a path for current from said terminal connection through the winding of said second electromagnet, means under the control of the operator for completing a circuit including said path to energize said second electromagnet and means responsive to such energization to efface said signal.

38. A telephone system comprising a telephone line extending from a substation to a central office, multiple connection terminals therefor, a signal associated with said line, means for suppressing said signal, an impedance associated with said line at a point intermediate of the connections of said terminals to said line and the substation, and means under the control of the operator for completing a circuit through said impedance and placing said suppressing means under the control of the subscriber.

39. A telephone system comprising a telephone line extending from a substation to a central office, multiple terminals therefor, a grounded branch connected to one limb of said line intermediate of the connections of said terminals to said line and the substation, means under the control of the operator for closing a circuit at one of said terminals through said grounded branch, an impedance included in said grounded branch whereby all of the said multiple terminals are maintained at substantially the same potential, means for holding conversation over said

line, and means for breaking said grounded branch when said line is switched for conversation.

40. A telephone system comprising a telephone line extending from a substation to a central office, multiple connection terminals therefor, a signal associated with said line, means for suppressing said signal, means under the control of the operator for closing a circuit at one of said terminals over the connecting limb to a point beyond the points of connection of the other terminals to said limb to partially establish the conditions necessary to the operation of said signal suppressing means, an impedance in said circuit beyond said points of connection whereby all of said terminals are maintained at substantially the same potential, and means under the control of the subscriber for completing the condition necessary to the operation of said signal-suppressing means.

41. A telephone system comprising a telephone line extending from a substation to a central office, two-contact multiple connection terminals therefor, a two strand cord and plug for making connection to said terminals, a signal associated with said line, electromagnetically actuated means for suppressing said signal, an impedance associated with said line beyond the points of connection of the connection terminals thereto, means operative upon the connection of a plug to a connection terminal to close a circuit through said impedance to render thereby the multiple terminals of like potential and to establish part of the conditions necessary to the energization of said signal-suppressing means, and means under the control of the subscriber for establishing the remainder of said conditions and modifying the connections of said impedance.

42. A telephone system comprising a telephone line extending from a substation to a central office, a two-contact connection terminal therefor, a two-strand cord and plug for making connection to said terminal, a signal associated with said line, electromagnetically actuated means for suppressing said signal, means under the control of the operator for completing a portion of the circuit necessary to the energization of said electromagnetically actuated means, and means under the control of the subscriber for completing the remainder of said circuit.

43. A telephone system comprising a telephone line extending from a substation to a central office, a two-contact connection terminal therefor, a two-strand cord and plug for making connection to said terminal, a signal associated with said line, electromagnets for controlling said signal, means responsive to the energization of one of said electromagnets to suppress said signal, means under the control of the operator for completing a portion of the circuit necessary



to the energization of said suppressing electromagnet, means responsive to the energization of the other electromagnet to complete the remainder of said circuit, and means  
5 for energizing said other electromagnet.

44. A telephone system comprising a telephone line extending from a substation to a central office, a two-contact connection terminal therefor, a two-strand cord and plug  
10 for making connection to said terminal, a signal associated with said line, electromagnets for controlling said signal, means responsive to the energization of one of said electromagnets to suppress said signal, a  
15 source of current, means under the control of the operator for connecting said source of current to said terminal, means responsive to the energization of the other electromagnet to connect the winding of said first electro-  
20 magnet to said terminal to cause its energization, and means for energizing said second electromagnet.

45. A telephone system comprising a telephone line extending from a substation to a  
25 central office, a two-contact connection terminal therefor, a two-strand cord and plug for making connection to said terminal, a signal associated with said line, electromagnets for controlling said signal, means re-  
30 sponsive to the energization of one of said electromagnets to suppress said signal, a source of current, means under the control of the operator for connecting said source of current to said terminal, means responsive  
35 to the energization of the other electromagnet to connect the winding of said first electromagnet to said terminal to cause its energization, and means under the control of the subscriber for energizing said second electro-  
40 magnet.

46. A telephone system comprising a telephone line extending from a substation to a central office, an impedance connected to one limb of said line, means for removing  
45 said impedance from said line and means under the control of the subscriber for placing said impedance-removing means under the control of the operator.

47. A telephone system comprising a tele-  
50 phone line extending from a substation to a central office, a signal associated with said line, an impedance connected to one limb of said line, means for removing said impedance from said line, means under the control of the  
55 subscriber for displaying said signal and placing said impedance-removing means under the control of the operator.

48. A telephone system comprising a telephone line extending from a substation to a  
60 central office, a signal associated with said line, an impedance connected to one limb of said line, means under the control of the subscriber for displaying said signal, means for effacing said signal, means for removing  
65 said impedance from said line and means

under the control of the subscriber for placing said signal-effacing means and impedance-removing means under the control of the operator.

49. A telephone system comprising a tele- 70  
phone line extending from a substation to a central office, an impedance connected to one limb of said line, two electromagnets, means responsive to the energization of one of said electromagnets to remove said im- 75  
pedance from said line, means responsive to the energization of said second electromagnet to place the energization of said first electromagnet under the control of the op-  
erator, and means for energizing said second 80  
electromagnet.

50. A telephone system comprising a telephone line extending from a substation to a central office, an impedance connected to one limb of said line, two electromagnets, 85  
means responsive to the energization of one of said electromagnets to remove said impedance from said line, means responsive to the energization of said second electromagnet to place the energization of said first electro- 90  
magnet under the control of the operator, and means under the control of the subscriber for energizing said second electromagnet.

51. A telephone system comprising a tele- 95  
phone line extending from a substation to a central office, an impedance connected to one limb of said line, two electromagnets, means responsive to the energization of one of said electromagnets to remove said im- 100  
pedance from said line, means responsive to the energization of said second electromagnet to display a signal and to place the energization of said first electromagnet under the control of the operator, and means for ener- 105  
gizing said second electromagnet.

52. A telephone system comprising a telephone line extending from a substation to a central office, a signal associated with said line, an impedance connected to one limb of 110  
said line, two electromagnets, means responsive to the energization of one of said electromagnets to efface said signal, when displayed, and to remove said impedance from said line, means responsive to the ener- 115  
gization of said second electromagnet to display said signal and to place the energization of said first electromagnet under the control of the operator, and means for energizing  
said second electromagnet. 120

53. A telephone system comprising a telephone line extending from a substation to a central office, a signal associated with said line, an impedance connected to one limb of  
said line, two electromagnets, means respon- 125  
sive to the energization of one of said electromagnets to efface said signal, when displayed, and to remove said impedance from said line, means responsive to the energiza-  
tion of said second electromagnet to display 130



said signal and to place the energization of said first electromagnet under the control of the operator, and means under the control of the subscriber for energizing said second 5 electromagnet.

54. A telephone system comprising a telephone line extending from a substation to a central office, an impedance connected to one limb of said line, means for removing said 10 impedance from said line and means under the control of the operator for placing said impedance-removing means under the control of the subscriber.

55. A telephone system comprising a telephone line extending from a substation to a central office, an impedance connected to one limb of said line, electromagnetically actuated means for removing said impedance from said line, means under the control of the 20 operator for establishing part of the conditions necessary to the energization of said electromagnetically actuated means, and means under the control of the subscriber for establishing the remainder of said conditions.

56. A telephone system comprising a telephone line extending from a substation to a central office, an impedance connected to one limb of said line, electromagnetically actuated means for removing said impedance from said line, means under the control of the 30 operator for completing a portion of the circuit necessary to the energization of said electromagnetically actuated means, and means under the control of the subscriber for completing the remainder of said circuit.

57. A telephone system comprising a telephone line extending from a substation to a central office, an impedance connected to one limb of said line, two electromagnets, means 40 responsive to the energization of one of said electromagnets to remove said impedance from said line, means under the control of the operator for completing a portion of the circuit necessary to the energization of said impedance-removing electromagnet, means 45 responsive to the energization of the other electromagnet to complete the remainder of said circuit, and means for energizing said other electromagnet.

58. A telephone system comprising a telephone line extending from a substation to a central office, an impedance connected to one limb of said line, two electromagnets, means 50 responsive to the energization of one of said electromagnets to remove said impedance from said line, means under the control of the operator for completing a portion of the circuit necessary to the energization of said impedance-removing electromagnet, means 55 responsive to the energization of the other electromagnet to complete the remainder of said circuit, and means under the control of the subscriber for energizing said other electromagnet.

59. A telephone system comprising a tele-

phone line extending from a substation to a central office, a signal associated with said line, an impedance connected to one limb of said line, means for suppressing said signal, means for removing said impedance from 70 said line, and means under the control of the operator for placing the said signal-suppressing means and impedance-removing means under the control of the subscriber.

60. A telephone system comprising a telephone line extending from a substation to a central office, a signal associated with said line, an impedance connected to one limb of said line, electromagnetically actuated means for suppressing said signal and removing said 80 impedance from said line, means under the control of the operator for establishing part of the conditions necessary to the energization of said electromagnetically actuated means, and means under the control of the 85 subscriber for establishing the remainder of said conditions.

61. A telephone system comprising a telephone line extending from a substation to a central office, a signal associated with said 90 line, an impedance connected to one limb of said line, electromagnetically actuated means for suppressing said signal and removing said impedance from said line, means under the control of the operator for completing a por- 95 tion of the circuit necessary to the energization of said electromagnetically actuated means, and means under the control of the operator for completing the remainder of said circuit.

62. A telephone system comprising a telephone line extending from a substation to a central office, a signal associated with said line, an impedance connected to one limb of said line, two electromagnets, means respon- 105 sive to the energization of one of said electromagnets to suppress said signal and to remove said impedance from said line, means under the control of the operator to complete a portion of the circuit necessary to the 110 energization of said signal-suppressing and impedance-removing electromagnet, means responsive to the energization of the other electromagnet to complete the remainder of said circuit and means for energizing said 115 other electromagnet.

63. A telephone system comprising a telephone line extending from a substation to a central office, a signal associated with said line, an impedance connected to one limb of 120 said line, two electromagnets, means responsive to the energization of one of said electromagnets to suppress said signal and to remove said impedance from said line, means under the control of the operator to complete 125 a portion of the circuit necessary to the energization of said signal-suppressing and impedance-removing electromagnet, means responsive to the energization of the other electromagnet to complete the remainder of said 130



circuit and means under the control of the subscriber for energizing said other electromagnet.

64. A telephone system comprising a line  
5 extending in two limbs between two stations, a signal associated therewith, electromagnetically actuated means for normally controlling the display of said signal, electromagnetically actuated means for destroying said  
10 control, controlling means for said latter electromagnetically actuated means under the control of said former electromagnetically actuated means and means for interrupting the continuity of one of said line  
15 limbs upon the actuation of said control means.

65. A telephone system comprising a line extending in two limbs between two stations, a signal associated with said line, a relay for  
20 normally controlling the display of said signal, a second relay for destroying said control, controlling means for said second relay under the control of said first relay and means for interrupting the continuity of one  
25 of said line limbs upon the actuation of said control means.

66. A telephone system comprising a line extending in two limbs between two stations, a signal associated with said line, a relay for  
30 normally controlling the display of said signal, a second relay for destroying said control, means for closing a break-point in the circuit of said second relay in response to the energization of said first relay and means for  
35 interrupting the continuity of one of said line limbs upon the actuation of said latter means.

67. A telephone system comprising a telephone line extending between two stations, a signal associated therewith, electromagnetically  
40 actuated means for normally controlling the display of said signal, electromagnetically actuated means for destroying said control, means under the several control of both stations to establish a portion of an energizing circuit for said latter means, and  
45 means under the sole control of one station to complete said circuit.

68. A telephone system comprising a telephone line extending from a substation to a  
50 central office, a line signal associated therewith, electromagnetically actuated means for normally controlling the display of said signal, electromagnetically operated means for destroying said control, means under the  
55 several control of the subscriber and operator for establishing a portion of an energizing circuit for said latter means, and means under the sole control of the operator for completing said circuit.

69. A telephone system comprising a telephone line extending from a substation to a  
60 central office, a line signal associated therewith, a line relay for normally controlling the display of said signal, a cut-off relay for  
65 destroying said control, means under the sev-

eral control of the subscriber and operator for establishing a portion of an energizing circuit for said cut-off relay, and means under the sole control of the operator for completing said circuit.

70. A telephone system comprising a telephone line extending from a substation to a central office, a line signal at said central office, a line relay controllable over said line to cause the display of said signal, a cut-off relay for destroying said control, means responsive to the actuation of said line relay by said control to complete a portion of a circuit local to the central office for energizing said cut-off relay, and means under the sole  
70 control of the operator for completing said local energizing circuit.

71. A telephone system comprising a telephone line extending from a substation to a central office, a line signal associated therewith, a line relay for normally controlling the display of said signal, a cut-off relay for destroying said control, means under the several control of the subscriber and operator for actuating said line relay, means actuated  
85 by said line relay for establishing a portion of an energizing circuit for said cut-off relay, and means under the sole control of the operator for completing said circuit.

72. A telephone system comprising a telephone line extending from a substation to a central office, a line signal associated therewith, a line relay for controlling the display of said signal, normally included in circuit with said line and under the control of the  
95 subscriber, a cut-off relay in a branch from said line and operative to destroy said control by interrupting the circuit of said line relay, a link-circuit for making connection to said line, means for holding conversation  
100 over said line and link-circuit, means operative after the connection of said link-circuit to said line both to complete an energizing circuit for said line relay and to close a portion of an energizing circuit for said cut-off relay, and means actuated by said line relay to complete the said cut-off relay circuit.

73. A telephone system comprising a telephone line extending from a substation to a central office, a line signal associated therewith, a line relay for controlling the display of said signal, normally included in circuit with said line and under the control of the subscriber, a cut-off relay in a branch from said line and operative to destroy said control by interrupting the circuit of said line relay, a link-circuit for making connection to said line, means for holding conversation over said line and link-circuit, means operative after the connection of said link-circuit  
115 to said line both to complete an energizing circuit for the line relay including a portion of one connected line limb and to close a portion of an energizing circuit for said cut-off relay including a portion of the other con-  
120  
125  
130



nected line limb, and means actuated by said line relay for completing said cut-off relay circuit.

74. A telephone system comprising a telephone line extending between two stations, a signal associated with said line at one of said stations, electromagnetically actuated means for normally controlling the display of said signal, electromagnetically actuated means for destroying said control, means under the several control of both stations to complete a portion of a circuit local to the station at which the signal is located for energizing said latter means, and means under the sole control of one station to complete said local energizing circuit.

75. A telephone system comprising a telephone line extending from a substation to a central office, a line signal associated therewith, electromagnetically actuated means for normally controlling the display of said signal, electromagnetically actuated means for destroying said control, means under the several control of the subscriber and operator for completing a portion of a circuit local to the central office for energizing said latter means, and means under the sole control of the operator for completing said local energizing circuit.

76. A telephone system comprising a telephone line extending from a substation to a

central office, a line signal associated therewith, a line relay for normally controlling the display of said signal, a cut-off relay for destroying said control, means under the several control of the subscriber and operator for completing a portion of a circuit local to the central office for energizing said cut-off relay, and means under the sole control of the operator for completing said local energizing circuit.

77. A telephone system comprising a telephone line extending from a substation to a central office, a line signal associated therewith, a line relay for normally controlling the display of said signal, a cut-off relay for destroying said control, means under the several control of the subscriber and operator for actuating said line relay, means actuated by said line relay in response to the exercise of either control for completing a portion of a circuit local to the central office for energizing said cut-off relay, and means under the sole control of the operator for completing said circuit.

In witness whereof, I hereunto subscribe my name this 12th day of November, A. D., 1904.

ALFRED H. DYSON.

Witnesses:

H. G. WEBSTER,  
L. D. KELLOGG.