

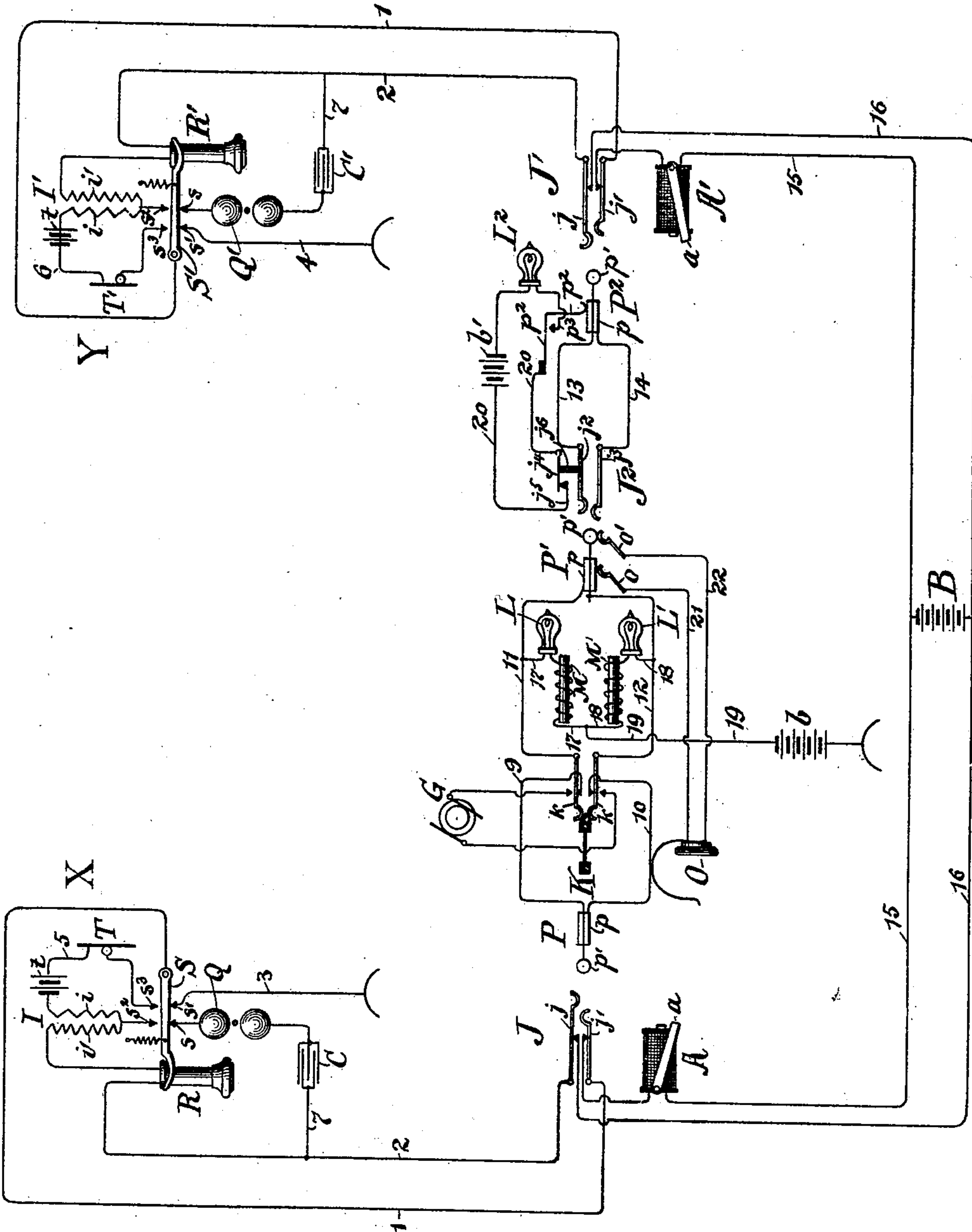
No. 646,696.

Patented Apr. 3, 1900.

W. D. GHARKY.
TELEPHONE EXCHANGE SYSTEM.

(No Model.)

(Application filed Apr. 21, 1899.)



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UNITED STATES PATENT OFFICE.

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TELEPHONE-EXCHANGE SYSTEM..

SPECIFICATION forming part of Letters Patent No. 646,696, dated April 3, 1900.

Application filed April 21, 1899. Serial No. 713,879. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM D. GHARKY, a citizen of the United States, and a resident of the city and county of Philadelphia, in the State of Pennsylvania, have invented a certain new and useful Improvement in Telephone-Exchange Systems, of which the following is a specification, reference being had to the accompanying drawing, forming a part hereof, wherein the same letters and figures of reference indicate the same parts throughout.

My invention relates to systems of telephony wherein subscribers' stations are connected to a central office or offices by metallic circuits and are there adapted to be interconnected by operators through the medium of office-circuits; and it relates particularly to those systems in which interconnection of the lines of subscribers located upon different board-sections or at different central stations is effected by means of transfer or trunk lines.

My invention has for its object the simplification and at the same time improvement of the system of signals between the subscribers and the central office and between the operators.

It consists, essentially, in an arrangement of the circuits such that a preliminary call from a subscriber who desires connection with another is effected over his metallic circuit, whereby certain supervisory signals are brought into distinctive relation with the calling and the called subscriber, respectively, a portion only of each subscriber's metallic circuit being used in connection with these supervisory signals, and finally whereby when a clearing-out signal has been received by the answering operator, who alone has control of the lines, said operator may communicate a signal for disconnection to the trunk operator automatically and as an incident to the disconnection of her own portion of the connective office-circuits.

In the accompanying drawing the figure is a diagram showing two subscribers' stations, together with the necessary circuits and apparatus at the central office for interconnecting the same either directly or through a trunk-line.

X and Y in the drawing are two subscribers' stations, each connected with the central of-

fice by the line-wires 1 2. At the station X, I provide the usual apparatus, consisting of a transmitter T, a receiver R, an induction-coil I, and a bell Q, together with a switch-hook S. At the station Y the corresponding parts are indicated by the same letters with an exponent. The connections at station Y will therefore be understood from the description of those at station X as follows: The line-wire 1 passes from a central office to station X and is there connected to the body of the switch-hook S. This switch-hook has two down and two up contacts. The down contact s is connected through the bell-magnet Q and a suitable condenser C by wire 7 to the line-wire 2. The other down contact s' is connected by wire 3 to ground. The up contact s^2 is connected to one end of each of the windings i and i' of the induction-coil I, the other end of the winding i' being connected to the receiver R, and thence directly to the line-wire 2. The winding i is connected through local battery t by wire 5 to the transmitter T, and thence to the other up contact s^3 . By this arrangement it will be observed that when the switch-hook is down the line-circuit is broken as regards continuous currents, the line-wire 1 is connected to ground, and the line-circuit is completed for alternating currents through the condenser C and bell Q.

At the central office the line-wires 1 and 2 are connected, respectively, to the springs $j j'$ of the spring-jack J or J'. The jack-springs j and j' normally rest upon contact-anvils, from which wires 15 and 16 lead to the opposite poles of a main battery B. Included in the wire 15 leading from each jack is the line-annunciator A A', provided in each case with the normally retired or retracted signal a . The signals a will remain retired as long as the subscribers' hook-switches are down; but upon the occurrence of a call by a subscriber X, for instance, his hook-switch in rising closes the metallic circuit through the receiver R and the winding i' of the induction-coil. Current from the main battery B will then immediately flow through annunciator-magnet A to line and back by wire 16 to the battery. The signal a will thereby be attracted and lifted into view. When the operator plugs in, in answer to the call, the jack-

springs are lifted from their anvils, and thenceforth during the ensuing connection the annunciator A has no connection with the united circuits.

5 Interconnection of subscribers whose line-terminals are located upon the same section is effected by means of the plugs P and P', interconnected themselves by the cord conductors 9 10 and 11 12. These cord conductors
10 are normally continuous, being joined together by the springs *k* and their resting-anvils of the ringing-key K. When this key is depressed, however, these springs *k* are spread apart to leave the terminals of conductors 9 10
15 and to connect the generator G, through the conductors 11 12, with the plug P'.

Although I do not limit myself to the use of any particular kind of listening-in apparatus, I preferably employ a plug-seat switch,
20 which as long as the plug P' is in its seat will connect the operator's telephone with the cord-circuit. This is conventionally shown in the drawing as a pair of springs *o o'*, connected by wires 21 and 22 to the operator's
25 telephone O and touching the tip and the sleeve contacts, respectively, of the plug P'.

In telephone systems as ordinarily designed the cord-circuits are so arranged that the tips of each pair of plugs are connected together,
30 and the sleeves of the same pair of plugs are connected together. In carrying out my present invention I find it necessary to abandon this practice, connecting the tip *p'* of one plug P to the sleeve *p* of the other plug P' and connecting the tip *p'* of the latter to the sleeve *p*
35 of the former. Across the two conductors 11 12 I provide a bridge 17 18, containing two incandescent lamps or lamp-controlling relays L and L' and two corresponding impedance-coils M and M'. From a point between the
40 coils and lamps I lead a wire 19 through the battery *b* to ground.

In the interconnection of subscribers whose line-terminals are located upon different
45 board-sections I employ trunk-lines, one of which is conventionally represented in the drawing. A jack J² is located at one board and connected by conductors 13 14 to a plug P² at another board. The use of this trunk-line is apparent at a glance, its sole function
50 being to extend the cord conductors to a point within convenient reach of the wanted line-terminal. In connection with each trunk-line I employ a signaling-circuit and a signal L² for clearing-out purposes. This circuit
55 consists of conductors 20 and switch-springs *j⁴ j⁵* and *p² p³* and contains a battery *b'* and a lamp or other signal L², the latter being located at the connecting end of the trunk-line.
60 The spring *j⁴* normally rests upon spring-contact *j⁵*, but has an insulated connection to the spring *j²* of the jack J² such that when a plug is inserted in said jack the springs *j⁴ j⁵* are separated. The springs *p² p³* are located in
65 the seat of the plug P², the springs being kept apart as long as the plug is in its seat.

The operation of my system thus described

is as follows: Supposing subscriber X desires to converse with subscriber Y, he removes his telephone-receiver R from the switch-hook, 70 whereupon the latter rises under the influence of its spring and completes the line and local circuits. Current then flows from the main battery B through wire 15, annunciator A, line-wire 1, to and through the talking apparatus, back over line-wire 2, and by wire 16 to the battery. This flow of current causes the display of the signal *a*. The operator, perceiving the signal, inserts the plug P in the jack J, the ringing-key K being in the 80 position shown in the drawing, whereby the subscriber's line is immediately prolonged through conductors 11 12, plug P', and conductors 21 22 to the operator's head telephone O. Having ascertained the number desired, 85 the operator picks up the plug P' and inserts it in the jack J² of a trunk-line leading to the board upon which the Y terminal is located. The insertion of the plug separates the springs *j⁴ j⁵*, and coincidentally with such in- 90 sertion the operator communicates the proper instruction to the trunk operator over the ordinary instruction-circuit. (Not shown.) The trunk operator then picks up the plug P² and inserts it in the jack J' of the wanted 95 line. As she does this she completes a circuit from ground at battery *b*, through wire 19, coil M', lamp L', wire 18, conductor 12, tip *p'* of plug P', jack-spring *j²*, conductor 13, tip *p'* of plug P², jack-spring *j'* of jack J', line- 100 wire 1, switch-hook *s'*, and wire 4 to ground. The lamp L' will therefore glow, indicating to the answering operator that the trunk operator has completed the connection, and the former thereupon depresses the ringing-key K, 105 which disconnects the plugs P and P' and puts generator-current from the machine G upon the latter plug, and thereby upon the wanted subscriber's line. This alternating current finds its way to the bell Q' through the inter- 110 posed condenser C' and the wire 8. It will be observed that the operation of the ringing-key does not in any wise disturb or interfere with the operation of the lamp L'. Moreover, the lamp L does not glow, not only because 115 it is cut off during the ringing from one circuit X and from ground at the other station Y by condenser C', but because with a ringing-key, as shown, it would be connected to conductor 1 of the line to station X, and at 120 that station the ground has been removed by the rising of the switch-hook. The lamp L' will continue glowing until subscriber Y in answer to the call removes his telephone-receiver R' from the switch-hook S', which in 125 rising under the influence of its spring disconnects the ground-wire 4 from the line-wire 1, and thereby breaks the lamp-circuit.

If during the progress of the conversation one of the subscribers should wish to leave 130 the instrument and in leaving should hang up his receiver, his lamp, and his lamp alone, will thereupon glow. The function of this is to apprise the operator, so that she may call

back the recalcitrant subscriber if he remains away too long, and if he says that the conversation was finished to indicate to her that the other subscriber had probably left his instrument without hanging up his receiver. A perfect control of the lines under all conditions is thus attained. When both subscribers shall have hung up their receivers, both the lamps will simultaneously glow.

10 The direct means by which the individual control of the supervisory signals is obtained is the crossing of the plug cord conductors from tip to sleeve and from sleeve to tip. One of the lamps is in a path to ground from 15 each of these cord conductors, and by virtue of the cross connection each cord conductor, and therefore each lamp, is brought into direct connection with the same one of the individual subscriber's pair, which is connected to the jack, into which the particular plug whose tip is connected with said conductor is inserted. The ground connection at each subscriber's station is thus made to 20 line-wire 1 when the switch-hook is down, the line-wire 2 never being grounded, as the condenser C prevents the passage of continuous current when the switch-hook is down and the ground being removed when the switch-hook is up.

30 Of course if the plugs P and P' were interchangeably used for answering and for calling confusion might arise; but as I invariably use the plug P' for calling it is settled once for all that the lamp L', connected to the tip 35 of that plug, will respond to the called line only, while the lamp L will respond to the calling line.

Upon seeing both lamps glow the answering operator pulls out the plugs P and P' and 40 restores them to their seats. The withdrawal of plug P' permits the springs j^4 and j^5 to come together, and as the plug P² is out of its seat and the springs p^2 p^3 are therefore together the circuit 20 is completed, and the 45 lamp L² apprises the trunk operator that it is time to disconnect. She therefore withdraws the plug P² and replaces it in its seat, and as by this action the springs in the seat are separated the lamp L² thereupon becomes dark, 50 and all parts of the system are again in their normal condition of disuse and ready for another call.

Having described my invention, what I claim, and desire to secure by Letters Patent 55 of the United States, is—

1. In a telephone-exchange system, subscribers' stations, a central station, and individual metallic circuits connecting the former to the latter; an operator's connective 60 circuit at the central station consisting of two conductors so connected to their terminal devices that when any connection is completed they will be in reversed relation to the component wires of the connected subscribers' 65 pairs, a signal connected between each side of the connective circuit and a generator, and means at each subscriber's station for con-

necting and disconnecting the other side of said generator to a given one of the pair of line-wires, substantially as described. 70

2. In a telephone-exchange system, subscribers' lines, each consisting of two members or limbs, connected in the same unvarying relation to contact-terminals at the central office and to switching mechanism at the 75 subscribers' stations, means at each station to determine a flow of current for signaling, over one limb only and not the other, the limb thus carrying current being the same in every case, central-station connective circuits having 80 contact-terminals adapted to cooperate with the line-terminals, each contact of one terminal being connected to the opposite contact of the other terminal, and independent signal devices, each connected to one side only 85 of the connective circuit and a common return-conductor connecting the circuits of said signals to all subscribers' stations; whereby subscribers' lines when connected for conversation have their current-carrying limbs re- 90 spectively joined to opposite sides of the connective circuit, each to its own independent signal, substantially as described.

3. In a telephone-exchange system subscribers' stations and a central station, double- 95 conductor line-circuits between the former and the latter, connected in the same relative order as regards their individual conductors to line-jacks at the central station, connecting 100 cords and plugs at the central station arranged in pairs, the tip and sleeve of one plug of each pair being connected respectively to the sleeve and tip of the other, a supervisory signal connected to each side of 105 each plug-cord circuit, and means at each subscriber's station for determining the flow of signal-current in one only of his line-wires, the particular wire so selected being the same in every case, substantially as described.

4. In a telephone-exchange system a central station and two subscribers' stations, each 110 connected with the central station by a metallic circuit, the respective limbs of the metallic circuits being connected to spring-jacks in the same order, an answering and a calling 115 plug having each a tip and a sleeve adapted to cooperate with the respective springs of the spring-jacks, a cord-circuit consisting of two conductors respectively connecting the sleeve of one plug with the tip of the other, 120 and the tip of the former with the sleeve of latter, a bridge across the cord-circuit containing impedance and two signals, said bridge being connected from a point between the 125 signals to one side of a current-generator, and switching devices at the subscribers' stations, whereby they may each connect the same one of their pairs of line-wires to the other side of said generator, substantially as described.

5. In a telephone-exchange system two subscribers' stations, a central station, and line- 130 wires 1 and 2 extending from each of the former to the latter and there connected in the same relative order to the respective

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springs of line spring-jacks, an answering
and a connecting plug having tip and sleeve
contacts to coöperate with the spring-jacks, a
pair of cord conductors connecting the sleeve
5 of each plug to the tip of the other, a bridge
connection across said cord conductors con-
nected from its middle point to a current-gen-
erator and ground and including in each half
a signal and an impedance-coil, together with
10 a switch at the subscriber's station with a
ground contact and a connection to line-wire

1, whereby each subscriber may ground his
line-wire 1 and affect a given one of the sig-
nals only, at pleasure, substantially as de-
scribed.

15
In testimony whereof I have hereunto set
my hand, in the presence of two witnesses,
this 18th day of April, A. D. 1899.

WM. D. GHARKY.

Witnesses:

ANDREW V. GROUPE,
EDWARD E. CLEMENT.