

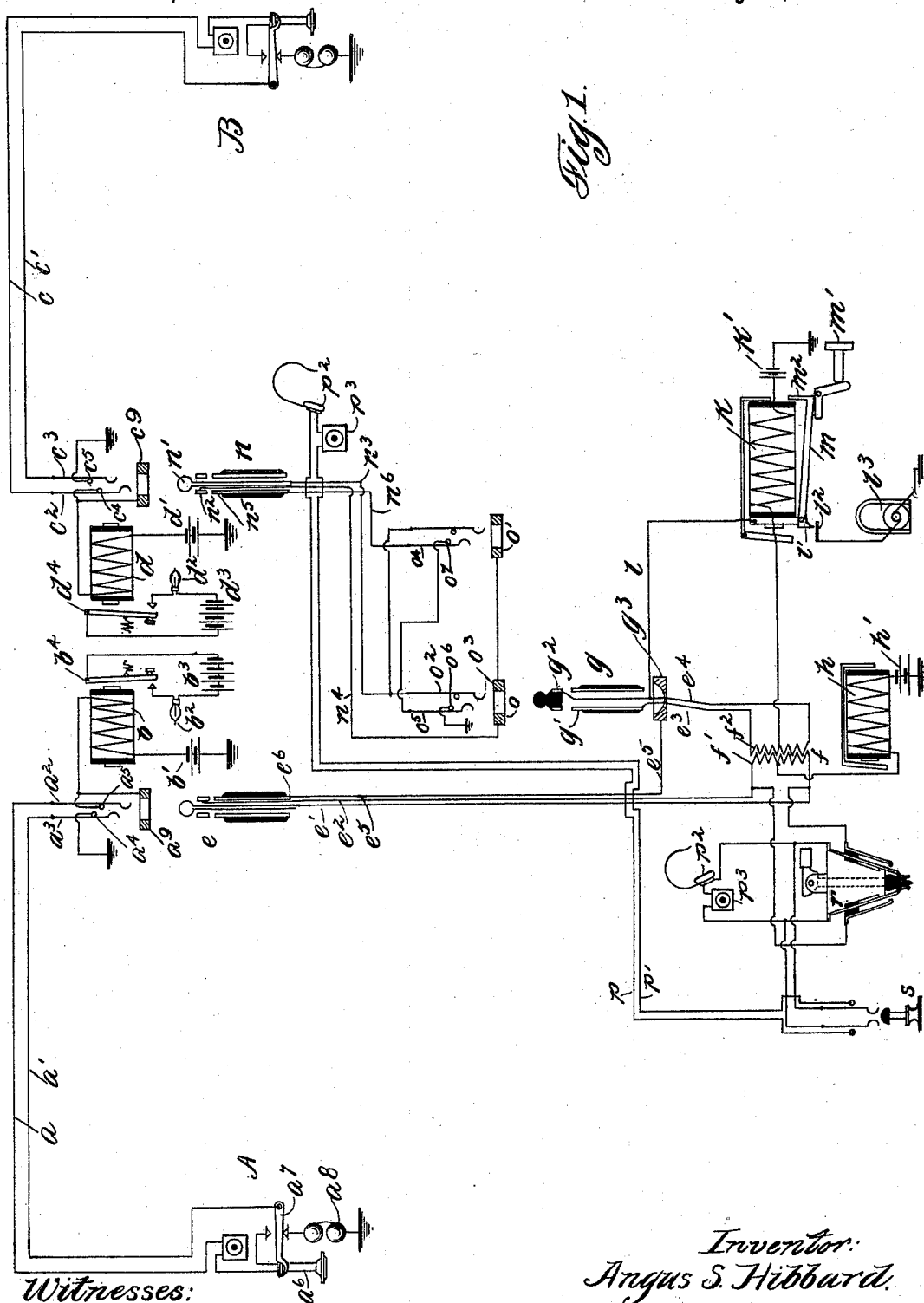
(No Model.)

2 Sheets—Sheet 1.

A. S. HIBBARD.
TELEPHONE SYSTEM.

No. 542,052.

Patented July 2, 1895.



Witnesses:

George L. Cragg
W. Clyde Jones.

Inventor:
Angus S. Hibbard.
By Baitant Brown
Attorneys.

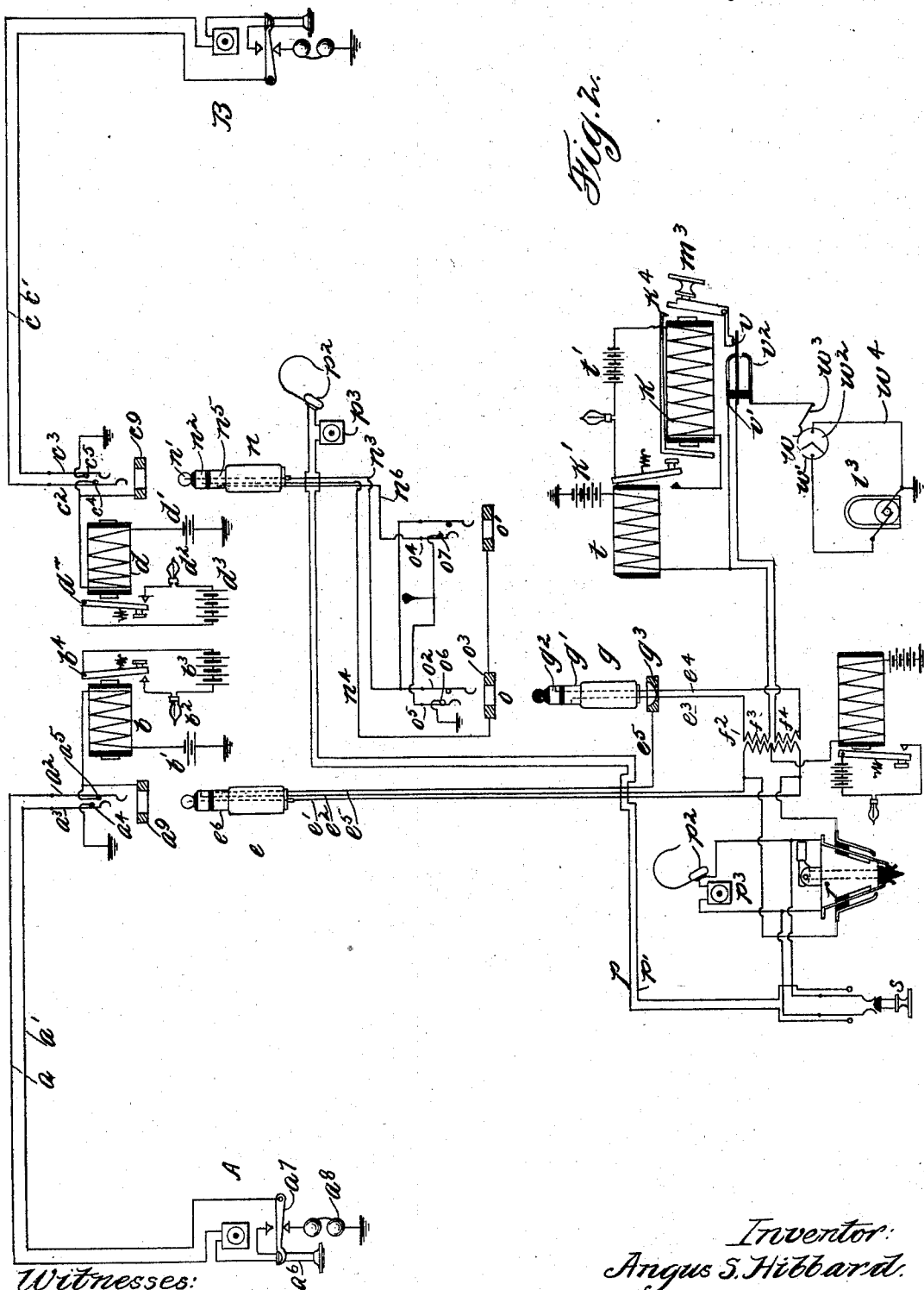
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George A. Bragg.
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By Bartlett Brown
Attorneys.

UNITED STATES PATENT OFFICE.

ANGUS S. HIBBARD, OF CHICAGO, ILLINOIS.

TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 542,052, dated July 2, 1895.

Application filed February 21, 1895. Serial No. 539,188. (No model.)

To all whom it may concern:

Be it known that I, ANGUS S. HIBBARD, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Telephone Systems, (Case No. 5,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to a telephone system, my object being, in general, to facilitate the making of connections between the subscribers and to lessen the time required in making such connections.

In accordance with my invention the telephone-lines of the subscribers extend to divided boards at the central station—that is, the lines of a group of subscribers, say three hundred, will terminate upon one board at the central station, while another group of subscribers' lines will terminate upon a second board, and so on, the subscribers being thus divided into groups, the lines of each group terminating upon a separate board. An operator is stationed at each of the divided boards to answer the calls of the subscribers whose lines terminate at a particular board, and these operators I designate for convenience the B operators. In addition to the B operators a number of operators, whom I designate as the A operators, are stationed at intermediate boards, the boards of the A operators being connected with the boards of the B operators by local trunk-lines. In the preferred form of my invention I provide at each of the divided boards a series of local-trunk-line plugs, say twelve in number, the local trunk-lines being extended to the board of an A operator, where they terminate in connecting-plugs. Likewise at each of the divided boards a series of plugs is provided, connected through local trunk-lines with a second A operator, a third set of plugs being connected with a third operator, and so on, as many A operators being thus connected with each of the divided boards as may be found necessary in handling the connections.

When a call is received at one of the divided boards, the B operator stationed thereat inserts one of the local-trunk-line plugs into the spring-jack of the calling subscriber, thus

extending the line of the calling subscriber to the plug of the particular A operator chosen. The A operator chosen will be determined by the number of connections that she may already have under control, as will be evidenced by the number of idle plugs at the divided board which belong to her set. The B operator is thus enabled to distribute the work at will among the several A operators.

In the arrangement of the spring-jacks and individual annunciators at the several divided boards I preferably arrange the indicators in the form of small incandescent lamps situated just above the spring-jack, the lamps being lighted when the subscriber removes his telephone from the hook to thereby convey the signal for connection to the B operator. The B operator, without listening in, merely inserts one of the local-trunk-line plugs into the spring-jack indicated by the lighting of the lamp, thus extending the connection to an A operator, who bridges her telephone into circuit and receives the number of the called subscriber and completes the connection.

At each of the divided boards is provided a series of plugs connected with incoming local-trunk-lines, the local trunk-lines being extended to spring-jacks multiplied upon the boards of the A operators. The A operator, having received the number of the called subscriber, places herself in communication by means of an order-wire with the B operator stationed at the board at which the line of the called subscriber terminates and inquires of her as to which of the incoming trunk-lines she may employ in completing the connection. Being informed, she inserts the plug over which the line of the calling subscriber has been extended into the spring-jack of the incoming trunk-line, and the B operator at the board of the called subscriber inserts the plug of the particular incoming line chosen into the spring-jack of the called subscriber, the connection between the calling and the called subscriber being thus completed.

In connection with each of the outgoing local trunk-lines—that is, the lines extending from plugs at the divided boards to plugs at the intermediate boards or plugs of the A operators—is provided an indicator, adapted to be actuated when the B operator at the board

of the calling subscriber inserts the local-trunk-line plug into the spring-jack of the calling subscriber, the attention of the A operator being thus called to the fact that a connection is desired through the trunk-line to which the particular indicator belongs. The lamp of the calling subscriber remains lighted until the A operator, having received the number of the called subscriber, lifts the local-trunk-line plug from its socket for the purpose of extending the circuit. The lifting of the plug from its socket opens the lamp-circuit, thus extinguishing the lamp and informing the B operator that the A operator has responded and is attending to the call. In the circuit of the outgoing local trunk-line is inserted a repeating-coil, and between the opposite sides of the repeating-coil and ground are provided indicators adapted to be actuated by the connected subscribers, the indicator being individual to the subscribers, due to the interposition of the repeating-coil. The subscribers may thus send in clearing-out signals independently, the A operator being the one who receives the signals for disconnection. Upon the removal of the outgoing-trunk-line plug from the spring-jack of the incoming-trunk-line circuit connections are operated which serve to close circuit through the lamp of the called subscriber, thus informing the B operator at that board that a disconnection is desired. The replacement of the plug in its socket serves to close circuit through the lamp of the calling subscriber, thus informing the B operator at that board that a disconnection is desired. The B operator, noting the signals for disconnection, removes the trunk-line plug from the spring-jack.

I will describe my invention more in detail, with reference to the accompanying drawings, in which—

Figure 1 illustrates, diagrammatically, two subscribers' lines and the intermediate trunk-lines for connecting the two lines for conversation. Fig. 2 represents a modification of the A operator's apparatus.

Like letters refer to like parts throughout both figures.

The line of subscriber A extends in two limbs a' to the central station, where the limbs terminate in line-springs $a^2 a^3$, respectively. The line-spring a^3 normally rests against a contact a^4 , connected to ground, while the line-spring a^2 normally rests against the contact a^5 , extending through the coil b of a relay and a battery b' to ground. A lamp b^2 and source of current b^3 are included in a local circuit adapted to be closed by the armature b^4 of the relay when the coil is energized. When the telephone-receiver a^6 of the subscriber rests upon the hook a^7 , the limb a' is grounded through a bell or call device a^8 . The removal of the telephone-receiver from the hook disconnects the limb a' from ground and closes together the two limbs $a a'$ through the telephone receiver and transmitter.

The line of the subscriber B extends in two

limbs $c c'$ to line-springs $c^2 c^3$, resting, respectively, upon contacts $c^4 c^5$, connected to ground, the former through the relay-coil d and battery d' , a lamp d^2 and battery d^3 being included in the local circuit of the relay, which is adapted to be closed by the armature d^4 . At the board at which the line of the subscriber A terminates is provided a plug e , the tip and sleeve-strands $e' e^2$ of which extend to the opposite ends of the winding f' of the repeating-coil f . The ends of the winding f^2 are connected by strands $e^3 e^4$ with the collar g' and sleeve g^2 , respectively, of the plug g . The plug g normally rests in a socket g^3 , with which the collar g' makes electrical contact, the socket g^3 being connected by a strand e^5 with a collar e^6 , provided on the plug e , the collar e^6 being adapted to make contact with a ring a^9 , provided upon the subscriber's spring-jack, the ring a^9 being electrically connected with one side of the battery b' . From the middle of the winding f of the repeating-coil a circuit extends to ground through an indicator h and a battery h' , the connection being preferably made at the middle of the winding f' to balance the line. Likewise from the middle of the winding f^2 a circuit extends to ground through the indicator k and battery k' . A ringing-circuit extends from the strand e^4 through a conductor l , normally-open contact-points $l' l^2$, and generator l^3 to ground, the contact-point l' being carried upon a pivoted lever m , adapted to be raised by the depression of a key m' , the lever m , which is made of magnetic material, being thus brought within the field of the electromagnet of indicator k and maintained in this position so long as current passes through the indicator k . The lever m carries a target m^2 , which is brought into view when the lever is raised. At the board at which the line of subscriber B terminates I have illustrated a plug n , the tip n' and sleeve n^2 of which are connected by the limbs $n^3 n^4$ of a local trunk-line with spring-jacks $o o'$, multiplied at the boards of the several A operators, the limb n^3 being connected with a line-spring o^2 of each spring-jack, while the limb n^4 is connected with a thimble or ring o^3 . The plug is provided with a collar n^5 , adapted when inserted in one of the spring-jacks to make contact with the ring or thimble o^3 . The collar n^5 is connected by a conductor n^6 with auxiliary line-springs $o^4 o^5$, provided at the spring-jacks of the A operators, the springs normally resting upon the back contacts $o^6 o^7$, connected to ground, the insertion of a plug in the spring-jack serving to raise the plug out of engagement with its back contact. Between the A operator and the B operator stationed at the board of the called subscriber extend the limbs $p p'$ of an order-wire, the operators being provided with head-telephones p^2 and transmitters p^3 . The A operator is provided with a listening-key r , by means of which she may bridge her telephone into circuit with the calling subscriber, and with a series of order-

wire buttons *s*, by means of which she may connect her telephone into circuit with the order-wire extending to the B operator with whom she desires to converse.

In the drawings I have illustrated but one order-wire, but it will be understood that a number of order-wires are provided extending from the A operator's board to the boards of all the B operators with whom it will be necessary to converse. Likewise I have shown but one outgoing trunk-line extending between the board of the calling subscriber and the A operator; but in practice a number of such trunk-lines—say twelve in number—is provided. Likewise a number of incoming trunk-lines are provided between the board of the called subscriber and that of the A operator. When the lines of the calling and the called subscribers terminate at the same board, the B operator thereat will insert the plugs of both the outgoing and the incoming trunk-lines.

I will now describe the operation of connecting two subscribers for conversation. Supposing that subscriber A wishes to converse with subscriber B he removes his telephone from its hook, thus completing the circuit of the battery *b'* through coil *b* of the relay, contact *a⁵*, spring *a²*, limbs *a a'* of the telephone-line, spring *a³*, contact *a⁴* to ground and back to opposite side of the battery. The circuit of battery *b³* through lamp *b²* is thus closed and the lamp is lighted, indicating to the B operator that subscriber A desires a connection. The B operator, having decided which of the A operators' lines she will choose for extending the circuit, inserts plug *e* into the spring-jack of the called subscriber. This closes the circuit of battery *b'* through coil *b* of the relay, ring *a⁹*, collar *e⁶* of the plug, strand *e³*, socket *g³* to the metallic butt-piece of the plug *g*, which is connected to strand *e²*, thence through half of winding *f²*, through the coil of indicator *k*, battery *k'* to ground. The light *b²* thus remains lighted and the indicator *k* is actuated to convey to the A operator information that a connection is desired through the trunk-line to which said indicator belongs. The A operator then takes up the plug indicated by the signal, thus indicating to the B operator that the call is received, depresses key *r*, bridging in her telephone-set, and inquires the number of the called subscriber. The A operator then presses the order-wire button, thus connecting her telephone-set in circuit with the telephone-set of the B operator at the board of the called subscriber B and inquires as to which trunk-line she shall employ in making the connection. The B operator indicates the line by number and the A operator inserts the plug *g* into the spring-jack of that line. The removal of the plug *g* from the socket *g³* opens the circuit of battery *b'*, thus extinguishing lamp *b²* and indicating to the B operator at the board of the calling subscriber that the

connection has been extended. The B operator at the board of the called subscriber inserts the plug *n* into the spring-jack of the called subscriber. The A operator then sends a ringing-current through the bell of subscriber B by depressing the key *m'*, the circuit of generator *l³* being thus closed through contact *l² l'*, conductor *l*, sleeve *g²*, spring *o²*, limb *n³* of trunk-line, tip *n'*, spring *c³*, limb *c'*, and the bell of subscriber B to ground. The depression of key *m'* raises lever *m*, thus displaying target *m²*, the ringing-circuit being thus maintained closed by the attraction of lever *m* by the magnetic field of indicator *k*. During this time the current of battery *k'* is closed through indicator *k*, strand *e⁴*, sleeve *g²*, limb *n³* of trunk-line, limb *c²* of the telephone-line, and through bell of subscriber B to ground, the coil of indicator *k* being thus energized until the subscriber B removes his telephone from the hook, which opens the circuit of battery *k'*, de-energizing the coil of indicator *k* and permitting the targets *m²* and *k³* to fall to indicate that subscriber B has responded. Subscribers A and B are thus in conversation.

The indicator *k* is exclusively under the control of subscriber B and may be actuated by replacing his telephone upon the hook. Likewise the indicator *h* may be controlled by subscriber A by placing his telephone upon the hook. The subscribers have thus individual clearing-out indicators and may both send in the clearing-out signal by placing their telephones on the hook. If one of the subscribers desires a reconnection, by moving his telephone up and down on the hook he can open and close the circuit through the battery and his clearing-out indicator, thus notifying the operator that a reconnection is desired.

When the subscribers are through conversation, they hang up their telephones, thus actuating the clearing-out annunciators *h* and *k* and informing the A operator that they desire disconnection. The A operator then removes plug *g* from the spring-jack *o* and replaces it in the socket *g³*. The removal of the plug *g* from spring-jack *o* permits the springs *o⁵* to come in contact with contact *o⁶*, thus closing circuit from ground through contact *o⁶*, spring *o⁵*, contact *o⁷*, spring *o⁴*, strand *n⁶*, collar *n⁵* of the plug *n*, ring *c⁹*, relay *d*, and battery *d'* to ground. The relay *d* is thus actuated to close the local circuit through lamp *d²*, thus informing the B operator that a disconnection is desired, whereupon the B operator removes the plug *n* from the spring-jack of the called subscriber. The replacement of the plug *g* in its socket *g³* closes circuit from battery *b'* through relay *b*, ring *a⁹*, collar *e⁶* of plug *e*, strand *e³*, socket *g³* to the metallic butt-piece of plug *g*, strand *e²*, socket *g³* to the coil *f²*, indicator *k*, battery *k'* to ground. The circuit is thus closed through lamp *b²* and the lamp lighted to indicate to the B operator at

the board of the calling subscriber that the plug e is to be withdrawn from the spring-jack of the calling subscriber.

While the generator $\mathcal{B}$ is connected in circuit for sending a ringing-current through the called subscriber's bell a derived current passes through strand e^4 , half of winding f^2 of the repeating-coil, indicator k , and battery k' to ground, current thus traversing the repeating-coil to cause a buzz in the telephone of the calling subscriber to notify him that the call has been sent to the called subscriber. Upon the cessation of the buzz the calling subscriber will know that the called subscriber has removed his telephone from its hook.

In Fig. 2 I have illustrated a modification of the A operator's apparatus. The apparatus upon the side of the repeating coil f toward the calling subscriber is substantially that illustrated in Fig. 1, but the indicator adapted to be controlled by the called subscriber is somewhat differently connected. The winding f^2 of the repeating-coil is made in two sections $f^3 f^4$, connected respectively to the opposite strands $e^3 e^4$, one of the sections f^3 being connected through a relay t and battery k' to ground. In the local circuit of the relay is included a battery t' and indicator k . The end of the section f^4 of the repeating-coil is connected with the spring v of a switch, said spring being normally closed against a contact v' , connected with the section f^3 of the repeating-coil. The spring v when moved out of contact with contact v' by the depression of key m^3 engages a contact v^2 , which is connected to ground through a calling-generator $\mathcal{B}$. The armature of the indicator k carries a hook k^4 , adapted to engage the end of key m^3 when depressed and hold the same in its depressed position until the indicator is actuated, whereupon the key is released. While the key is held depressed generator $\mathcal{B}$ is closed in circuit. In circuit with the generator $\mathcal{B}$ I provide a rotating commutator w , having two segments $w' w^2$, upon which bears a brush w^3 . One segment w' is connected with the generator, while the other w^2 is connected to the ground by a shunt-circuit w^4 . During a part of the time the generator is in circuit and during the rest of the time the generator is on open circuit; but the circuit from the contact v^2 is completed to ground through the shunt w^4 . A path to ground for the current from battery k' is thus afforded without the necessity of passing through the conductor containing the generator $\mathcal{B}$.

When the B operator at the board of the calling subscriber inserts plug e , circuit is closed through strand e^5 , relay t , and battery k' , thus actuating indicator k and calling the attention of the A operator. In ringing, the key m^3 is depressed, thus closing the generator $\mathcal{B}$ in circuit through contact v^2 and spring v and the section f^4 of the repeating-coil f to the strand e^4 and through the bell of the called subscriber to ground. The hook k^4 engages

the key m^3 and maintains the same depressed until the called subscriber removes his telephone from his hook, when the indicator k is actuated to release the key m^3 and permit the spring v to break contact with contact v^2 , circuit being closed upon the removal of the called subscriber's telephone from its hook from ground through battery k' , relay t , section f^3 of the repeating-coil, strand e^3 through the telephone of the called subscriber and back to strand e^4 through section f^4 of the repeating-coil, spring v , contact v^2 to ground through the shunt-circuit w^4 upon each revolution of the commutator w . Since, in ringing, the current from the generator $\mathcal{B}$ passes through the section f^4 of the repeating-coil, the called subscriber will hear a buzz in her telephone, thus informing her that the called subscriber has been called, and upon the cessation of the buzz will know that the called subscriber has removed his telephone.

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

1. The combination with telephone lines extending in groups to divided boards of an exchange, of two or more intermediate boards, trunk lines extending between the divided boards and the several intermediate boards adapted to be connected with the telephone lines to extend the circuits at will to any one of the intermediate boards, and means at the intermediate boards for uniting two trunk lines; whereby the connection between any two lines may be completed through any one of said intermediate boards at will.

2. The combination with a telephone line, terminating upon a divided board of the exchange, of an intermediate board, a trunk line extending between said divided board and said intermediate board and adapted to be connected with said telephone line to extend the circuit to the intermediate board, a telephone line terminating upon a second divided board, a trunk line extending between said second divided board and said intermediate board and adapted to be connected with said telephone line to extend the circuit to the intermediate board, means at the intermediate board for uniting the two trunk lines, and a pair of indicators at the intermediate board, one under control from each of said telephone lines, substantially as described.

3. The combination with a telephone line, terminating upon a divided board of the exchange, of an intermediate board, a trunk line extending between said divided board and said intermediate board, and adapted to be connected with said telephone line to extend the circuit to the intermediate board, a telephone line terminating upon a second divided board, a trunk line extending between said second divided board and said intermediate board and adapted to be connected with said telephone line to extend the circuit to the intermediate board, means at the intermediate board for uniting the two trunk lines, signal-

ing apparatus at the intermediate board controlled by the subscribers whose lines are connected together, and signaling apparatus at the divided boards adapted to be actuated by the disconnection of the trunk lines at the intermediate board, substantially as described.

4. In a telephone system, the combination with a telephone line terminating upon a divided board of an exchange, of an intermediate board, a trunk line adapted to be connected with said telephone line to extend the circuit to the intermediate board, said trunk line terminating in a plug at the intermediate board normally resting in a socket, a second telephone line terminating upon a divided board, a trunk line adapted to be connected with said telephone line to extend the circuit to the intermediate board, said trunk line terminating in a switch at the intermediate board into which the plug of the first trunk line is adapted to be inserted to complete the connection, signaling apparatus at the divided boards, means for actuating the signaling apparatus at one of said boards by the removal of said trunk line plug from the trunk line switch, and means for actuating the signaling apparatus at the second board by the replacing of the plug in its socket, substantially as described.

5. The combination with a telephone line extending to a board of the exchange, of a trunk line extending from a plug at said board to a plug at an intermediate board, a repeating coil interposed between the plugs, an indicator in a ground branch from the trunk on the side of the repeating coil toward the plug at the intermediate board, a socket in which said plug normally rests to make electrical connection between said trunk line and said socket, a third wire extending from said socket to a contact terminal on the plug at the board at which the telephone line terminates, said terminal adapted when the plug is inserted in the switch of the telephone line to complete the circuit of a battery through said indicator to call the attention of the operator at the intermediate board.

6. In a telephone system, the combination with a repeating coil interposed between the calling and the called subscriber, of a generator adapted to be connected in circuit with

the called subscriber, and a key for throwing said generator into circuit adapted when depressed to connect one coil of said repeating coil in series with the generator, whereby a buzz in the telephone of the calling subscriber is produced, substantially as described.

7. In a telephone system, the combination with means for connecting the two telephone lines together, of a battery and a calling generator adapted to be connected in circuit, and a commutator for intermittently opening the circuit of the generator and closing a shunt about the same to afford a path for the battery current, substantially as described.

8. In a telephone system, the combination with two telephone lines connected together, of a repeating coil interposed between the telephone lines, a key adapted when depressed to include a calling generator in circuit and simultaneously open the repeating coil circuit, and an electromagnet adapted to maintain said key depressed until the called subscriber removes his telephone from its hook, substantially as described.

9. The combination with a telephone line extending to the board of an exchange, of an indicator at said board adapted to respond to calling currents sent from the sub-station, a trunk line adapted to be connected with the line to extend the circuit to a switching board, and means controlled by the change of said trunk line from a position of use to a position of disuse for operating said indicator to convey a signal to disconnect the trunk line, substantially as indicated.

10. The combination with telephone lines extending in groups to divided boards, of call receiving indicators therefor at said divided boards adapted to be actuated from the sub-stations, two or more intermediate boards, and means for extending the line of a calling subscriber at will from the divided board to the particular intermediate board that may be selected for answering the call, substantially as described.

In witness whereof I hereunto subscribe my name this 9th day of February, A. D. 1895.

ANGUS S. HIBBARD.

Witnesses:

GEO. S. IREDELL,
W. CLYDE JONES.