

No. 667,463.

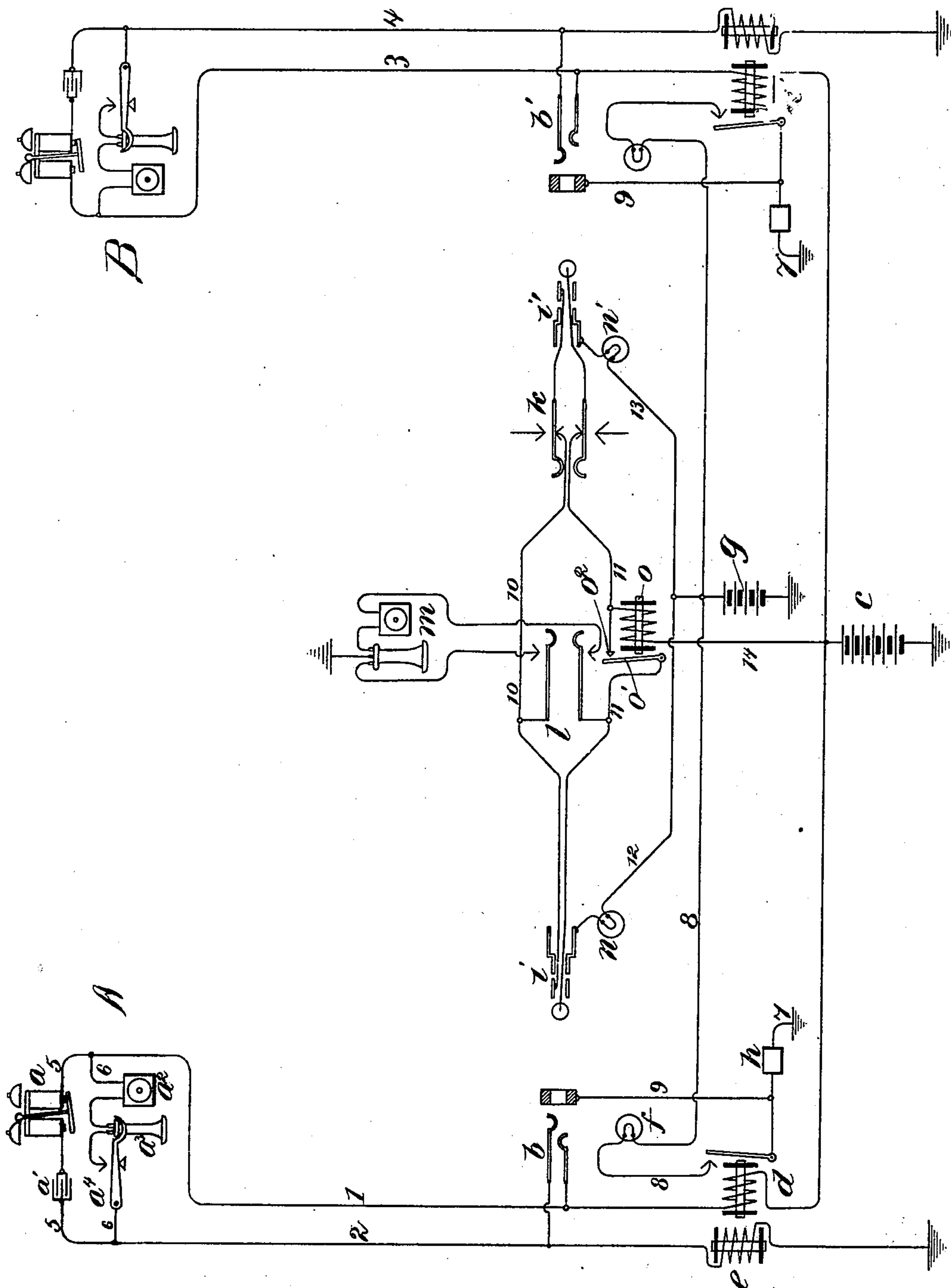
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C. E. SCRIBNER.

SIGNALING APPARATUS FOR TELEPHONE SWITCHBOARDS.

(Application filed June 7, 1899.)

(No Model.)



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UNITED STATES PATENT OFFICE.

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SIGNALING APPARATUS FOR TELEPHONE-SWITCHBOARDS.

SPECIFICATION forming part of Letters Patent No. 667,463, dated February 5, 1901.

Application filed June 7, 1899. Serial No. 719,705. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. SCRIBNER, 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 Signaling Apparatus for Telephone-Switchboards, (Case No. 416^a), of which the following is a full, clear, concise, and exact description.

10 The invention applies to telephone-lines equipped with supervisory signals in a telephone-switchboard, which serve to indicate the condition of the apparatus at the substations. Its purpose is to cause the supervisory
15 signals of two united lines to act independently at certain stages during the connection between the lines and jointly at other times, as will be explained at length in the specification hereinafter.

20 In the process of establishing connection between two telephone-lines it is expedient for the operator to know whether the telephone of a calling-line is in position for use, and when the telephone at the answering or
25 called station is removed from its switch in response to a signal previously transmitted. After being assured that both substation telephones are in use the operator need be no further concerned with the united lines until
30 the telephones are replaced upon their switch-hooks after the termination of conversation. The present organization of signals is designed to maintain the independent operation of the two supervisory signals associated with
35 the two lines, so that each shall denote the condition of its own line until the called subscriber has responded by removing his telephone from its switch, after which the signals shall be controlled jointly by the two
40 lines, so that neither shall be displayed until both telephones are no longer in use, when the response of both may constitute a signal for disconnection. This is accomplished by means of a relay connected with the circuit
45 of the called line and controlling the continuity of the connection therefrom to the calling-line. The actuation of the relay is determined by the removal of the telephone from its switch at the called station and completes
50 the connection to the other line only after that event. Hence until the called subscriber

has responded the two lines, although united at the switchboard, are not in actual connection with each other, so that the signals associated with them may operate independently; but after the response of the called
55 subscriber the lines become connected together in a continuous circuit, and both signals are affected by the conditions of current imposed by either line and become displayed
60 only when both lines are returned to their normal conditions.

A system of signals in common use in which my invention may be readily applied comprises a relay with a source of current
65 in a bridge of each line-circuit, a line-signal controlled by each relay, spring-jacks or terminal sockets connected with each line, pairs of plugs and plug-circuits for uniting spring-jacks, a supervisory signal associated with
70 each plug, and circuit connections for rendering the line-signal inoperative and substituting a supervisory signal therefor when a plug is inserted into a spring-jack. The telephone-line is normally interrupted at the sub-
75 station as to continuous currents, but becomes closed through the substation-telephone when the latter is removed from its switch-hook. In this system the act of bringing the telephone into position for use per-
80 mits a current to flow through the circuit, which excites the relay and brings about the display of the corresponding line-signal. The insertion of a plug into the spring-jack of a line in response to this signal effaces the line-
85 signal and connects with the line a supervisory signal, which remains hidden until the telephone is replaced upon its switch. In applying my invention to this organization of signals the circuit-controlling relay before
90 mentioned is associated with the plug-circuit, being placed in a bridge of the circuit together with a source of current. Its switch-contacts are interposed in a conductor of the plug-circuit and act to interrupt the circuit
95 when the relay is not excited. After the required connection has been made between two lines and the usual call-signal has been transmitted to the called subscriber the supervisory signal associated with the line of
100 the latter will remain displayed until the circuit is completed through the telephone at

that substation. Then the circuit-controlling relay will close the break in the plug-circuit, after which the signal-controlling relays of both lines will receive current as long as the circuit remains closed at either station and will maintain the concealed condition of the supervisory signals. When the circuits are broken at both substations, the signal-controlling relays will become inert simultaneously and will permit the display of both supervisory signals. This will be interpreted as a signal for the removal of the connection between the lines. The attached drawing is a diagram of such a system of signals, including the present invention.

Two substations A and B are shown connected by lines 1 2 and 3 4, respectively, with apparatus at the central station. The appliances at the substation comprise a polarized bell *a* in a permanently-closed branch 5 of the line-circuit, together with the condenser *a'* and a transmitting-telephone *a²* and receiving-telephone *a³* in a branch 6 of the line, which is normally open at a telephone-switch *a⁴*. At the central station the line-circuit connects with the line-contacts of a spring-jack *b* in the switchboard, and the conductors are led to the free and grounded terminals, respectively, of a battery *c*, which may be common to the different lines of the exchange. The signal-controlling relay *d* is interposed in the extension of line conductor 1 to the battery, while an impedance-coil *e* is included in the other line conductor 2 to maintain the electrostatic balance of the line and prevent the shunting of telephone-currents. The relay controls a local circuit 7 8 of a battery *g*, which circuit includes a signal-lamp *f*, the switch-contacts being adapted to close the circuit to light the lamp when the relay becomes excited. The grounded conductor 7, which leads to the relay, includes a resistance-coil *h* and is connected from a point intermediate of the relay and the resistance-coil with the thimble of the spring-jack *b* by a wire 9. The usual pairs of plugs *i* and *i'*, with their plug-circuits 10 11, are provided for uniting the lines by means of their spring-jacks. The conductors of the plug-circuit include the switch-contacts of the ringing-key *k* for looping a generator of signaling-current into circuit with plug *i'* and are connected with the switch-contacts of a listening-key *l*, controlling the circuit to the operator's telephone *m*. Besides the usual line connections in the plugs *i* and *i'* each plug has a sleeve which is adapted to register with the thimble of a spring-jack. These contact-pieces are connected through wires 12 and 13 with the free pole of battery *g*, and supervisory signal-lamps *n* and *n'* are included in the wires 12 and 13, respectively. The lamp *n* should be placed near and associated with the plug *i*, and the lamp *n'* should bear a similar relation to plug *i'*.

In applying the present invention to the foregoing system of circuits and signals a branch 14 is led from the conductor 11 of the

plug-circuit to the free pole of common battery *c*, and in this wire is included the magnet-winding of a relay *o*. The switch-contacts *o' o²* of this relay are interposed in the wire 11, the arrangement being such that while the relay is not excited the continuity of this conductor is interrupted. In procuring a connection with a correspondent the mere removal of the telephone from its switch at the substation (A, for example) preparatory for use effects the display of line-signal *f* by completing the line-circuit of battery *c*, and thus bringing about the closure of the local circuit, including the lamp. In responding to this signal the operator will insert plug *i* into the spring-jack *b* and will depress the listening-key and bring her telephone into connection with the plug-circuit 10 11, thus placing herself in communication with the calling subscriber. The insertion of the plug into the spring-jack will bring the supervisory signal *n* into parallel circuit with the line-signal *f*, whereby the line-signal will be extinguished, while the supervisory signal will remain unlighted, it being understood that the current from battery *g* through the resistance-coil *h* will be insufficient to illuminate both lamps in parallel. Having learned the order in the usual way, the operator will insert plug *i'* into the spring-jack *b'* of line to station B and will manipulate the calling-key *k* to ring the bell at the latter station. The relay *d'* of that line will still be inert, since no complete circuit for battery *c* over the line 3 4 will as yet exist. Hence there will be a circuit of battery *g* through wire 13 to plug *i'*, thence to the test-ring, and through wires 9 and 7 of subscriber B's central-office apparatus. The current in this circuit will illuminate the supervisory signal *n'*, indicating to the operator that the telephone at station B has not yet been removed from its switch. When this act has been performed, however, the relay will become excited and will close its local circuit 7 8, including its line-lamp, thus bringing the latter into a closed parallel circuit with the supervisory lamp *n'* and extinguishing the latter signal, as before, the line signal remaining dark. The obscuring of signal *n'* will indicate the response of the signaled subscriber. Until the circuit has thus become closed at the substation the relay *o* will obviously not be excited, and hence will preserve the interruption in the conductor 11 of the plug-circuit. This break in the continuity of the circuit will of course maintain the independence of operation of the two relays *d* and *d'*, since current through either relay has no path to the other line, and hence is not determined by the position of the switch at the station of that line. When, however, the telephone has been removed from the switch at station B, the battery *c* will find circuit through relay *o* and conductor 11 through the line-wires 3 4 of that line, and thence to ground at the central station. This relay being then excited will attract its armature and

close the break in the conductor 11 of the plug-circuit. From that moment the three relays d , d' , and o will respond together to currents in either line, since the three instruments will be in parallel bridges of a closed circuit including battery c . As long as this circuit remains closed at either extremity—that is, at either station A or station B—the relays d and d' will each maintain the darkened condition of the line-lamp and the supervisory lamp which each controls, while the relay o will preserve the continuity of the circuit. This condition will obtain until, presumably at the termination of conversation, both substation-telephones shall have been replaced on their switches. The current in the circuit will then be interrupted, and each of the relays d and d' will break the circuit through the corresponding line-signal f or f' , whereby in the case of each the current will be diverted through the correspondingsupervisory signal n or n' . Thus both supervisory signals will become simultaneously lighted. The illumination of these two lamps may be taken by the operator as a signal for disconnection.

To retrace the entire operation as viewed by the attendant: The display of line-signal f will indicate a call. In answering this call the displayed signal will become effaced, the corresponding supervisory signal remaining inert. After completing the desired connection and transmitting the call-signal the supervisory lamp n' will remain lighted until the called subscriber responds. Then both supervisory signals, as well as both line-signals, will remain concealed or dark until the termination of conversation, when both supervisory signals n and n' will become lighted. Thus this contrivance provides a simple and efficient means of imparting to the operator all the necessary information in the course of a communication between subscribers, each signal being limited to a distinct use and having but one meaning.

I claim as my invention and desire to secure by Letters Patent—

1. The combination with a telephone-circuit between two stations, provided with means for breaking the circuit at either station, of a signal-controlling instrument normally responsive to current in one of the lines, and a pair of switch-contacts actuated by an electromagnet responsive to currents through one of the lines, adapted to alter the circuit connections to make the said signal-controlling instrument responsive to current in both lines, substantially as described.

2. The combination with two telephone-lines united in a circuit, each provided at its substation with a switch adapted to alter the circuit connections of the line, of a signaling instrument together with a source of current in a bridge of the circuit, and a pair of switch-contacts actuated by an electromagnet responsive to currents in the line, con-

trolling an interruption in the circuit, substantially as described.

3. The combination with a circuit between substations, provided with switches at the substations for interrupting the circuit, of a signaling instrument together with a source of current in a bridge of the circuit, and a relay with a source of current in another bridge of the circuit, said relay controlling a break in the circuit, whereby the display of the signal is determined at first by the switch at one of the stations and thereafter by the switches at both stations, substantially as described.

4. The combination with two telephone-lines united in a circuit, provided at their substations with switches controlling the circuit, of a signaling instrument together with a source of current in a bridge of the circuit, and a relay in another bridge of the circuit together with a source of current, the switch-contacts of the relay being interposed in the circuit on the side distant from the point of connection of the signaling instrument therewith, whereby the closing of the switch at one of the substations affects the signal and causes the relay to complete the circuit between the substations, substantially as described.

5. The combination with two telephone-lines provided with switches controlling their circuits at the substations, united into a complete circuit, of two signaling instruments in different branches of the circuit together with a source or sources of current, and a pair of switch-contacts controlled by an electromagnet in a bridge of the circuit, interposed in the telephone-circuit between the two bridges containing the signaling instruments, substantially as described.

6. The combination with two telephone-lines, each provided at its substation with a switch adapted to close the line, a plug-circuit uniting the lines, and a signal-controlling instrument in a branch from each line, of a relay together with a source of current in a branch from the plug-circuit, the switch-contacts of said relay being interposed in the plug-circuit, whereby the signal-controlling instruments are permitted to act each in response to the condition of its own line until one of said circuits has been closed, substantially as described.

7. The combination with a "calling" and a "called" telephone-line, united in a circuit, each equipped at its substation with a switch controlling its circuit there, of an instrument for each line normally responsive to current in its own line, controlling a supervisory signal, and a pair of switch-contacts actuated by an electromagnet responsive to current in the called line, adapted to alter the circuit connections intermediate of the signal-controlling instruments to make both said instruments responsive to current in either line, substantially as described.

8. The combination with a "calling" and a "called" telephone-line, united by a plug-circuit, each provided at its substation with a switch for closing its circuit while the telephone is in use, of a relay in a branch from each line together with a source of current, and a supervisory signal for each line adapted to be displayed when the relay is not excited, and a relay in a branch from the plug-circuit also with a source of current, the switch-contacts of said last-mentioned relay being interposed in the plug-circuit between the point of connection of their controlling magnet with the line and the signal-controlling relay of the calling-line, to interrupt the said circuit when the relay is not excited; whereby the signals may respond each to current in its own line until the circuit has been closed at the substation of the called line, as described.

9. The combination with two telephone-lines extending from substations and united at a central office, of a supervisory signal associated with one of the lines at the central office, means controlled at the substation with whose line the signal is associated, for determining the actuation of said supervisory signal, circuit-changing mechanism adapted to electrically associate said supervisory signal with the other telephone-line, whereby said signal is rendered responsive to currents in both lines, and means, controlled in the use of the telephone at the first-mentioned substation, for operating the circuit-changing mechanism, substantially as set forth.

10. The combination with two telephone-lines extending from substations and united at a central office, of a supervisory signal adapted to respond to current in either line, a source of current and means at each of the subscribers' stations for determining the flow of current in the telephone-lines, and circuit-changing mechanism at the central office controlled by current in one of the lines for rendering said signal irresponsive to current in the other line, substantially as set forth.

11. The combination with two telephone-

lines extending from substations and united at a central office, of a supervisory signal at the central office, a source of current and means, controlled in the use of the telephone at one of the substations, for determining the flow of current through said supervisory signal, and switching mechanism at the central office, similarly controlled by said substation apparatus, for electrically associating the signal with the other telephone-line, whereby said signal is made responsive to current in both of the lines, substantially as set forth.

12. The combination with two telephone-lines extending from substations and adapted to be connected together at a central office, of a source of current and means at the substation for determining the flow of current in the lines, a signal associated with one of the lines and normally responsive to current in that line, and means, brought into action by current in the called line, for rendering the signal responsive to current in both lines, substantially as set forth.

13. The combination with two telephone-lines extending from substations and adapted to be connected together at a central office, of a source of current common to the lines and means at the substations for determining the flow of current in the lines, a signal-controlling device serially associated with one of the lines and normally responsive only to current in that line, and circuit-changing mechanism controlled by current in one of the lines for connecting both lines in parallel with said signal-controlling device, whereby the latter is rendered responsive to current from said source in both lines and irresponsive to such current in either line alone, substantially as described.

In witness whereof I hereunto subscribe my name this 27th day of May, A. D. 1899.

CHARLES E. SCRIBNER.

Witnesses:

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DE WITT C. TANNER.