

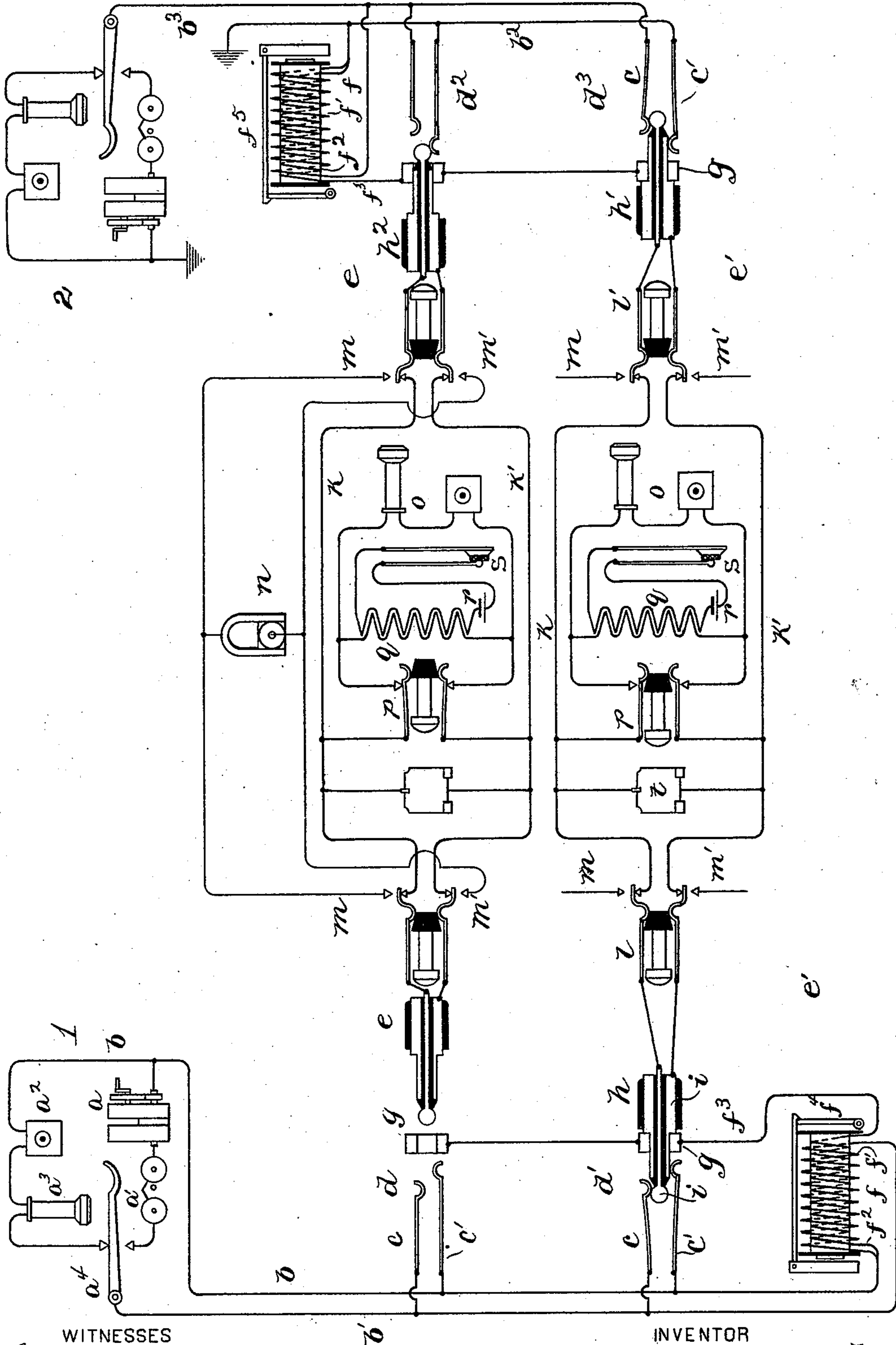
(No Model.)

C. E. SCRIBNER.

MULTIPLE SWITCHBOARD SYSTEM FOR TELEPHONE EXCHANGES.

No. 563,320.

Patented July 7, 1896.



WITNESSES

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# UNITED STATES PATENT OFFICE.

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## MULTIPLE-SWITCHBOARD SYSTEM FOR TELEPHONE-EXCHANGES.

SPECIFICATION forming part of Letters Patent No. 563,320, dated July 7, 1896.

Application filed March 5, 1892. Serial No. 423,920. (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 Multiple-Switchboard Systems for Telephone-Exchanges, (Case No. 297,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to switchboard systems for telephone-exchanges, more particularly to the individual annunciators or signal-receiving apparatus at the exchange.

The object of my invention is to provide a system in which the individual annunciator shall be prevented from operating after a connection has been made to line without the annunciator having been disconnected from the line-circuit.

In telephone-exchanges it is usual to provide a signal-receiving device at the central station or exchange for each line of the exchange, whereby the attention of the attendant may be directed to the line connecting with any particular substation; but when a connection has been established between two lines it is necessary that the signal-receiving device of the two lines be disconnected or otherwise rendered inoperative in order that subsequent calling-signals sent from the substations or calling-signals sent from the exchange to the substations may be prevented from operating the individual annunciators of both lines, and thus causing confusion at the different switchboards upon which they may be situated.

The signaling-current which has been found most suitable for use in connection with long telephone-lines is that of alternating or rapidly-pulsating character.

My invention is adapted for use with such currents. Generally, it consists in an electromagnetic annunciator, having its electromagnetic helix included in the line-circuit at the exchange, and having an additional coil or helix surrounding the same core, and means for short-circuiting this additional or extra coil when a connection is made to the line.

It is well known in the art that alternating or pulsating currents may be caused to traverse the coils of electromagnets, to energize

them, but that when a closed conductor of suitable size and resistance is provided encircling the same core the alternating or pulsating current in the electromagnetic helix induces a counter-current in the closed conductor, which, therefore, has a magnetizing effect opposite in direction to that of the electromagnet-coil, upon the core of the magnet, and the magnetization of the core is very considerably reduced or almost entirely prevented. I have utilized this principle in constructing my improved switchboard system. The pulsating or alternating signaling-currents sent from a substation to an exchange find circuit through the electromagnet-coils of the particular annunciator of that line, magnetizing the core of the magnet and releasing or actuating an indicator in the usual way, as long as the line remains disconnected; but when a connection is established to the line the normally open extra coil upon the annunciator is short-circuited and the magnetizing effect upon the core of the annunciator of subsequent signaling-currents traversing the annunciator-coil will be neutralized and the annunciator will remain unresponsive.

I believe my invention to be of wider application, however, than in connection with telephone-switchboard apparatus, since it may be applied in many cases in which it is desired to prevent the operation of an electromagnetic device by alternating or pulsating currents without opening the circuit containing the energizing-helix of such device. I am aware that it has been common heretofore to prevent the magnetization or inductive influence of cores of induction-coils by inclosing them in tubes of conducting material; but I believe myself to be the first to provide a normally open coil encircling the core of the magnet in combination with means for closing the circuit of the extra coil when it is desired to prevent the operation of the electromagnet.

In the practical construction of the telephone-exchange system embodying my invention, I provide spring-jacks of well-known form, each having three insulated contact-pieces, which may comprise two line-springs and a test-ring. The different line-springs are connected to the different sides of the line-circuit respectively, and the test-rings are electrically connected together. The operat-



ing-coil or magnetizing-coil of the individual annunciator I include in a bridge-wire between the different sides of the line-circuit. The extra coil or opposing coil is connected at one end to one side of the line-circuit, and at its other end to the conductor joining the test-rings of the different spring-jacks belonging to one line. A loop-plug is used in connection with these spring-jacks having two contact-pieces one of which is adapted to make contact with one of the line-springs of the spring-jack into which it may be inserted, and the other to cross together the remaining line-spring and the test-ring. The terminal of the opposing coil is connected to that side of the line-circuit which is connected with the contacts of the spring-jacks which are adapted to be thus crossed with the test-rings. Hence when a connecting-plug is inserted into any spring-jack of the line the opposing coil of the individual annunciator of that line is short-circuited through a path made up of a portion of one side of the line-circuit, to the line-spring of the jack into which the loop-plug is inserted, thence through the corresponding contact-piece of the loop-plug to the test-ring of the jack and to the conductor returning to the other terminal of the opposing coil. In connection with this exchange system I have provided means for testing at any spring-jack of any board to determine whether the contact-pieces described are short-circuited or crossed together at any other spring-jack of the line tested. This means may consist in a testing-plug adapted to be applied to or inserted partially into the spring-jack to be tested, having two contact-pieces arranged to make connection with those contact-pieces which are short-circuited or crossed together by the loop-plug, a telephone-receiver in circuit between the two contact-pieces of the testing-plug, and a source of telephonic undulatory current in a parallel circuit with the telephone-receiver. This source of telephonic current normally has circuit through the telephone-receiver, but when the terminal contacts of the testing-plug are applied to the contact-pieces of a spring-jack which are short-circuited the telephonic current is shunted from the telephone-receiver, producing silence therein. The cessation of the sound in the receiving-telephone is thus an indication to the operator testing that the line tested is already in use. One of the ordinary loop-plugs of an operator's outfit may be employed as the testing-plug and the operator's telephone may be employed as the testing-receiver. This testing system forms the subject-matter of my application, Case No. 291, Serial No. 421,174, filed February 11, 1892, and hence I do not consider it necessary to describe it further in connection with this invention.

My invention is illustrated in the accompanying drawing. Therein I have shown two substations connected by metallic and grounded-circuit lines, respectively, to an ex-

change, spring-jacks upon each of two sections of multiple switchboard, and an individual annunciator upon one of the switchboards, connected with the line-circuit from each of the substations. The two telephone-lines are shown joined into a continuous loop by means of loop-plugs and a cord-circuit of the ordinary character. An additional cord-circuit is shown, one of the loop-plugs being shown in position of testing a spring-jack of one of the telephone-lines.

The substations, for example substation 1, are provided with the usual signaling and communicating apparatus, comprising a calling-generator  $a$ , adapted to send alternating currents, a call-bell  $a'$ , and a telephone transmitter  $a^2$  and receiver  $a^3$ , in two different branches from one side  $b$  of the line-circuit, and a gravity-switch  $a^4$ , connected to the other side  $b'$  of the line-circuit, arranged to include the calling apparatus or the telephone apparatus alternately in the line-circuit, according to the position of the switch. The line  $b b'$  is extended to the exchange, where the two sides thereof are connected to the line-springs  $c'$  and  $c$  of two spring-jacks  $d d'$  upon two sections  $e e'$  of multiple switchboard. An individual annunciator  $f$  of the character hereinbefore generally described has its main or energizing coil  $f'$  included in a branch between the different sides of the line-circuit. The extra or opposing coil  $f^2$  is connected by a conductor  $f^3$  with the test-rings  $g$  of the spring-jacks  $d d'$ . The annunciator is otherwise of the ordinary character, having an armature adapted to be attracted by the core of the annunciator and when attracted to release the shutter or indicator  $f^4$ , to attract the attention of the attendant operator. The annunciator  $f$  may be considered as being placed upon a section  $e'$  of the switchboard near the spring-jack  $d'$  of its line upon the same board.

The substation apparatus at station 2 is of the same character as that at station 1, and is connected by lines  $b^2 b^3$  with similar spring-jacks  $d^2 d^3$  upon the two sections of switchboard  $e e'$ , its individual annunciator  $f^5$  being placed upon the section  $e$  of switchboard, so as to be under the care of another attendant operator. The line-circuit to this station is shown as grounded, the side  $b^2$  of the line being continued through earth from the exchange to the substation instead of through a metallic line-wire.

The operators at the boards  $e e'$  are each provided with a pair of connecting-plugs  $h h'$ , each having two contact-pieces, a tip  $i$  and sleeve  $i'$ , adapted to connect with the line-spring  $c$  and with the line-spring  $c'$  and the test-ring  $g$ , respectively, of the spring-jack into which it may be inserted. The like contact-pieces of the two connecting-plugs are connected together by cord-strands or flexible conductors  $k k'$ . Calling-keys of well-known character  $l l'$  are included in the conductors joining the two plugs of a pair, each



key being adapted to disconnect both contact-pieces of one of the plugs from the corresponding contact-pieces of the other plug and to connect them to wires  $m m'$ , which form the terminals of the calling-generator  $n$ , arranged to send alternating or pulsating currents. A telephone set  $o$  is provided for each operator, connected with the contact-points of a key  $p$ , whose contact-springs are connected to the different sides of the cord-circuit respectively, whereby the telephone set  $o$  is connected into a bridge connection between the different sides of the cord-circuit when the plunger of the listening-key  $p$  is depressed. The secondary of the induction-coil  $q$  is connected in a parallel circuit with the telephone set  $o$ , the primary of the induction-coil being included in a local circuit with a battery  $r$  and a microphone  $s$ , which is kept in continuous slight vibration by suitable means. This induction-coil  $q$  constitutes the source of telephonic current before described as a part of the testing system, the constant vibration of the microphone  $s$  acting to impress undulations upon the current in the local circuit and thus inductively to produce a continuous slight undulating current in the secondary of the induction-coil. This slight current normally finds circuit through the operator's telephone set  $o$ , producing a slight rustling sound in the receiver thereof. A clearing-out annunciator  $t$  is included in a closed bridge connection between the different sides of the cord-strand.

In the operation of the system shown, when a subscriber, as, for example, subscriber at station 1, desires to communicate with another station connected to the same exchange, he sends a signaling-current to the exchange over lines  $b b'$  by rotating the calling-generator  $a$ , the switch  $a^4$  being in position to connect the generator with the line  $b'$ . The signaling-current finds circuit at the exchange through the operating-coil  $f'$  of the individual annunciator  $f$  of that line. The opposing coil  $f^2$  is at this stage on open circuit, the test-rings  $g$ , which form one terminal of it, being insulated and disconnected from all else. The core of the annunciator  $f$  is therefore magnetized. It attracts its armature and releases shutter  $f^4$ , indicating the reception of the signal to the attendant operator at board  $e'$ . The operator at this board now inserts a plug  $h$  into the jack  $d'$  of the lines from station 1 at her board, and depresses the plunger of her listening-key  $p$ . Her telephone set  $o$  is thus looped into circuit with the apparatus at substation 1, and, the subscriber at substation 1 having removed his telephone from the hook, the operator and subscriber are enabled to communicate. The circuit may be very briefly traced over line  $b'$  to the line-spring  $c$  of jack  $d'$ , thence to the tip of plug  $h$  through the ringing-key  $l$  to conductor  $k$ , thence from the key  $p$  to the telephone set  $o$ , returning through key  $p$  to conductor  $k'$ , through ringing-key  $l$  to sleeve

$l'$  of plug  $h$ , thence to spring  $c'$  of the spring-jack  $d'$ , thence returning to substation 1 over line  $b$ . Having learned with what line subscriber at station 1 desires connection, say line to substation 2, the operator proceeds to test the jack of the line called for at her board  $e'$ , to determine whether it is already in use or not. This process of testing may be most readily followed by reference to the cord-circuit at board  $e$ , one plug of which is shown in position of testing a spring-jack of lines to station 2. The operator, fixing her attention upon the slight rustling noise in her telephone-receiver, inserts plug  $h^2$  into the spring-jack until the tip of the plug makes contact with the longer line-spring of the spring-jack, the sleeve at the same time making contact with the test-ring thereof.

If the line tested be in use, as is the case in the diagram, the current from the induction-coil  $q$  finds circuit through the two contact-pieces of the listening-key  $p$  to the corresponding conductors  $k k'$  of the cord-circuit, thence to the tip and sleeve, respectively, of the plug  $h^2$ , and thence through a portion of the line  $b^2$  and of the conductor joining the test-rings of the spring-jacks of that line to the spring-jack into which a plug is inserted, thence through the sleeve of that plug. The secondary of the induction-coil is thus short-circuited and the telephonic current is wholly shunted from the telephone set  $o$ , producing silence therein. If, however, the telephone-line tested were not in use, circuit would exist from the tip and sleeve of the plug, respectively, through the opposing coil  $f^2$  of the individual annunciator of the line, but this circuit would be of considerable resistance and self-induction, and would not materially reduce the loudness of the sound in the telephone-receiver. Assume that the operator at board  $e'$ , making such a test, finds lines to station 2 to be not in use. She then inserts plug  $h'$  entirely into the jack  $d^3$ . The two substations 1 and 2 are thus looped together into a continuous circuit, which may be traced from substation 1, as before, as far as the conductors  $k k'$ , thence through the ringing-key  $l'$  to the plug  $h'$ , thence to the line-contacts of the spring-jack  $d^3$ , thence over the lines  $b^2 b^3$  to substation 2. The operator now depresses the plunger of ringing-key  $l'$ , thus forcing the contact-springs thereof away from the contact-pieces, connecting it to the cord-circuit, and against the terminals of the calling-generator  $n$ , whereby the generator is looped into circuit with the line to station 2. A portion of the calling-current thus sent to the line is shunted through the operating-coil  $f'$  of the individual annunciator  $f^5$ , but on account of the presence of the plug  $h'$  in the spring-jack  $d^3$  the circuit of the opposing coil  $f^2$  of the annunciator is completed through a path including a portion of the line  $b^2$  to the line-spring  $c'$  of jack  $d^3$ , the sleeve of plug  $h'$ , the test-ring  $h$  of jack  $d^3$ , the conductor joining the test-rings, and the conductor  $f^3$ . The



opposing current is generated in this closed circuit by the alternating currents in the coil  $f'$ , and the core of annunciator  $f^5$  remains practically unmagnetized, and does not affect its armature to release the shutter. When the subscriber at station 2 has responded to the signal and has removed his telephone from the switch-hook, the two subscribers are in communication. The operator at board  $e'$  may communicate with either, since her telephone set  $o$  is in a bridge connection between the different sides of the circuit. When she has ascertained that the two subscribers have actually engaged in conversation, she raises the plunger of her key  $p$ , disconnecting her telephone set from the line-circuit. When the subscribers have completed their conversation, either one of them may send a clearing-out signal, or signal for disconnection to the exchange, by replacing his telephone upon the switch  $a^4$  and rotating the generator  $a$ . The signaling-current finds circuit, as before, to the exchange, where a portion of it passes through the operating-coil of the individual annunciator of the line. The annunciator, however, is not operated on account of its opposing coil being short-circuited, as described. Another portion of the current finds a shunt-circuit through the contact-pieces of the loop-plug to the cord-circuit, thence through the clearing-out annunciator  $t$  in the bridge connection between the different sides thereof, operating the clearing-out annunciator  $t$  and indicating the disconnection-signal to the attending operator. Still another portion of the current finds further circuit to the contact-pieces of the plug  $h'$  and thence over lines  $b^2 b^3$ , but the individual annunciator of that line also remains unresponsive. The operator now disconnects the two subscribers by removing the loop-plugs from the spring-jacks, whereby the apparatus is returned to its normal position, and the individual annunciators are rendered responsive to signaling-currents from their substations.

I do not desire to limit myself to the precise construction herein described. Various modifications will readily suggest themselves to one skilled in the art.

As before stated, I do not consider that the means herein provided for rendering individual annunciators unresponsive should be limited to its use in connection with a telephone-exchange system. It is obvious that the same general device may be applied in many different instances in which it is desired to render an electromagnetic device unresponsive to alternating or pulsating currents without opening the circuit of the device.

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

1. The combination with the core of an electromagnet, of the magnetizing-helix thereof, an additional normally-open-circuited coil

encircling the same core and means for closing the circuit of said additional coil in short circuit, substantially as described.

2. The combination with a magnetizing-helix and a source of pulsating or alternating currents included in a closed circuit therewith, of mechanism adapted to be actuated by the magnetic field of said magnetizing-helix, an additional normally-open-circuited helix inclosing the lines of force of the said magnetizing-helix, and means for completing the circuit of the normally-open-circuited coil in short circuit to prevent the actuation of the said mechanism, substantially as described.

3. The combination with an electromagnet comprising a core of magnetic material and a magnetizing-helix encircling the said core, of a source of pulsating or alternating current in circuit with the magnetizing-coil, and a normally-open-circuited helix encircling the said core, and means for short-circuiting the said helix, whereby the magnetization of the said core may be prevented at will while the circuit containing the magnetizing-helix remains closed, substantially as described.

4. The combination with an electromagnet comprising a core of magnetic material and a magnetizing-helix therefor, and having an armature adapted to be actuated by the magnetization of said core, and a source of pulsating or alternating current in circuit with the said magnetizing-helix, of a normally-open-circuited helix encircling the said core, and means for closing the circuit of the normally open helix in short circuit to prevent the actuation of the said armature, substantially as described.

5. The combination with an individual annunciator having a core of magnetic material and a magnetizing-coil encircling the said core included in a telephone-line, of an indicating device adapted to be actuated by the magnetization of said core, a normally-open-circuited helix encircling the said core, and means for closing a local short circuit made up in part of said line about the helix when connection is established with the line, substantially as described.

6. The combination with a telephone-line of an individual annunciator having a magnetizing-helix included in the line-circuit, indicating mechanism adapted to be actuated by said magnetizing-helix when energized, and a source of alternating or pulsating current adapted to be included in circuit with said magnetizing-coil to actuate said mechanism, an additional normally-open-circuited helix arranged coaxially with said magnetizing-helix, means for short-circuiting the said normally-open-circuited helix, substantially as described.

7. The combination with a telephone-line extending from a substation to a central station, including a source of alternating or pulsating current, connected at the central station to the different contact-pieces of a group



of spring-jack switches, and including a magnetizing-helix of an individual annunciator having a core of magnetic material adapted to be magnetized by said helix, and indicating mechanism arranged to be actuated by the magnetization of said core, of a normally-open-circuited helix encircling the said core, and having its terminals connected to contact-pieces upon each of the spring-jacks, adapted to be crossed together by the operation of establishing a connection with the line, substantially as described.

8. The combination with a telephone-line circuit extending from a substation to a central station, connected to spring-jack switches at the central station and including a magnetizing-coil of an individual annunciator having a core adapted to be magnetized by said magnetizing-coil and indicating mechanism adapted to be actuated by the magnetization of said core, of a normally-open-circuited helix encircling said core, having its terminals connected to contact-pieces upon each of the spring-jacks of the line, a loop-plug inserted in one of said spring-jacks having contact-pieces connected with the line-contacts of the jack and a contact-piece crossing together the terminals of said normally-open-circuited coil, whereby the individual annunciator is rendered unresponsive to alternating or pulsating currents in the line-circuit, substantially as described.

9. In combination with a telephone-line extending from a substation to a central station, connected to the line-contacts of spring-jacks at the central station and including the magnetizing-coil of an individual annunciator having a core of magnetic material adapted to be magnetized by said magnetizing-coil and indicating mechanism arranged to be actuated by the magnetization of said core, and a normally-open-circuited helix encircling the said core, contact-pieces constituting the terminals of said helix upon the different spring-jacks, a loop-plug adapted to be inserted into one of said spring-jacks having contact-pieces adapted to connect with the different line-contacts of the spring-jack, and a contact-piece adapted to cross together the terminals of said open-circuited helix, an annunciator included in a circuit between the line-contacts of the loop-plug, and a source of alternating or pulsating current at the substation adapted to be included in the line-circuit, whereby signals may be sent over the line-circuit to actuate said individual annunciator when said line is disconnected, and whereby said individual annunciator will be rendered unresponsive to said signaling-currents, and a separate annunciator will be included in circuit to respond thereto when connection is made to the line by means of the loop-plug, substantially as described.

10. The combination with a telephone-line circuit extending from a substation to a central station and provided with signal-receiv-

ing apparatus normally included in the line-circuit and a source of alternating current adapted to be included in the line-circuit at the substation connected to the different line-contacts of several spring-jack switches at the central station, and including thereat a magnetizing-coil of the individual annunciator having a core adapted to be magnetized by said magnetizing-coil and indicating mechanism arranged to be actuated by said core when magnetized, of a normally-open-circuited helix encircling the said core, contact-pieces constituting normally-separated terminals of said helix upon each of the spring-jacks, a loop-plug adapted for insertion into any spring-jack and having two contact-pieces arranged to connect with the line-contacts of the spring-jack when so inserted and a contact-piece arranged to cross together the normally-separated terminals of said helix, and a source of alternating current included in a circuit between the different line-contacts of the loop-plug, whereby signals may be sent from the substation to the exchange to cause the individual annunciator thereat to respond, and signals may be sent from the exchange to the substation over the same lines without causing the said annunciator to respond and without disconnecting the same from the line-circuit, substantially as described.

11. The combination with two telephone-lines extending from two substations to a central station, each provided with a source of alternating current adapted to be included in the line-circuit, connected each to several spring-jack switches at the exchange and each including the magnetizing-coil of an individual annunciator having a core of magnetic material and indicating apparatus adapted to be actuated thereby when magnetized, of normally-open-circuited helix encircling the said core and connected to normally-separated contact-pieces upon the different spring-jacks of its particular line, two loop-plugs, one inserted in a spring-jack of each line, each having contact-pieces connecting with the different line-springs of the spring-jack into which it is inserted, and a contact-piece crossing together the normally open terminals of the said helix, conductors joining the like line contact-pieces of the two plugs, and a clearing-out annunciator connected between the different line-contacts of the plugs, whereby the individual annunciators of both lines are rendered unresponsive to signals sent from either substation, and a clearing-out annunciator is connected with the circuit to respond thereto, substantially as described.

In witness whereof I hereunto subscribe my name this 13th day of February, A. D. 1892.

CHARLES E. SCRIBNER.

Witnesses:

FRANK R. MCBERTY,  
DE LANCEY A. CAMERON.