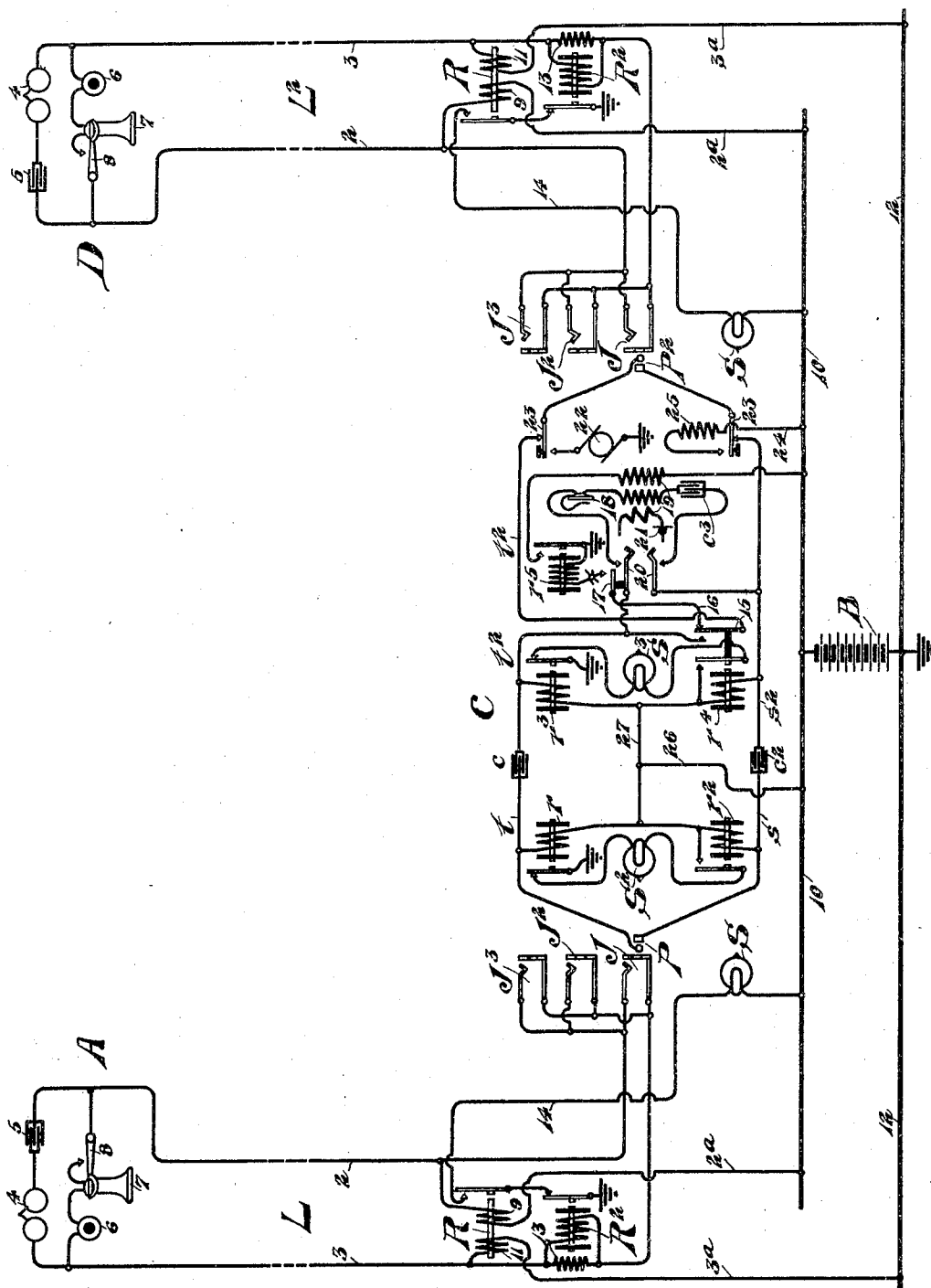


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W. W. DEAN.
TELEPHONE SYSTEM.
APPLICATION FILED SEPT. 14, 1903.



Witnesses.
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UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 794,348, dated July 11, 1905.

Application filed September 14, 1903. Serial No. 173,022.

To all whom it may concern:

Be it known that I, WILLIAM W. DEAN, a citizen of the United States of America, and a resident of Chicago, county of Cook, and State of Illinois, have invented a new and useful Improvement in Telephone Systems, of which the following is a specification.

My invention relates to improvements in telephone systems, and more particularly in the type known as "two-wire" telephone systems. In telephone systems of this class the salient feature is the provision of only two wires for each subscriber extending throughout the multiple switchboard, and this without sacrificing any of the advantages of a common battery at the central office, a suitable busy-test, and the operation in the desired manner of the line, cut-off, and supervisory relays. In one notable system of lines of this type the external line-circuit is normally disconnected from the switchboard-section of the line and is connected with the line-signaling device and the central common battery, while a cut-off relay is legged to ground from the switchboard-section and is adapted when a connection is established with the line to be energized to disconnect said external portion of the line from said signaling device and said battery and to connect it with the switchboard-section, thus placing the line in condition for conversation. In another class of two-wire systems the line and cut-off relays are located in the path of current in the line when the subscriber calls the central office, only the line-relay being responsive to the current in the line at that time; but when a connection is established with the line the said cut-off relay is caused to operate and serves to cut off the signal, and perhaps the battery connection. Both of these systems have been subjected to adverse criticism. The former, for instance, has been objected to on account of the cut-off relay-contacts in the talking-circuit of the line, on account of the great number of contacts, both forward and back, required for the cut-off relays, and also by reason of the click caused in the calling-subscriber's receiver when the cut-off relay sev-

ers the normal battery connection of the line at the time the operator plugs in to answer the call. The latter system has likewise been criticised by reason of these same objections and also on account of the marginally-adjusted or differentially-wound cut-off relays in the line, which are more or less difficult to adjust and maintain in working condition.

My present invention, which, as stated, is of the two-wire type, includes a line-circuit to which the foregoing criticisms do not apply. For instance, there need be no relay-contacts in the talking-circuit of the line, the cut-off relay may be extremely simple in construction, since only an ordinary relay with one contact is required, and the line is clickless, since the cut-off relays do not sever the normal battery connection, and the potential remains practically constant on the line during the operation of establishing connections with calling-lines. Other features of novelty and advantage will appear from the detailed description and claims.

My invention is illustrated by the aid of the accompanying drawing, in which the figure is a diagram of a telephone system to which the said improvements are applied.

In the figure, L and L² indicate subscribers' telephone-lines extending in two limbs 2 and 3 from their respective substations A and D to the central office C. At the substations each line is provided with an ordinary polarized signaling-bell 4 and a condenser 5, preferably in a permanent bridge of the line conductors, and with a transmitter 6 and receiver 7 in a second bridge, whose normal discontinuity is maintained by the switch-hook 8. This apparatus is intended merely to typify any usual or desired common-battery outfit. At the central office each line is provided with an answering-jack J, a plurality of multiple jacks, such as J² and J³, in any number, and a line-signal S. A line-relay R for each line is provided with a winding 9, included in a preferably permanent conductor 2^a, extending from the line conductor 2 to the common-battery lead or wire 10, leading to the live pole of the central common battery B, and also a

winding 11 in a similar conductor 3^a, extending from the line conductor 3 to the common ground wire or lead 12, to which the opposite pole of the battery is also connected. This relay controls, through its normally open contacts, one point in the local circuit of the line-signal S. A cut-off relay R² is included in the line conductor 3 between the line-relay and the spring-jacks or connection-terminals and controls, through its normally closed contacts, a second point in the local circuit of said line-signal. The said cut-off relay is shunted by a suitable non-inductive resistance 13 or is otherwise made non-inductive to the voice-currents in any well-known manner. The line-signal is connected upon one side with the battery-lead 10 and upon the other with a conductor 14, extending to the front contact of the line-relay R. The spring of this relay is joined to one of the said normally closed contacts of the cut-off relay R², the other of which contacts is grounded. Thus the battery and line-relay connections with the line are preferably permanent, for which reason it is preferred to split the winding of the line-relay R into the two coils 9 and 11 and to place the battery between them. Thus a balanced circuit results, and the said coils 9 and 11 present sufficient impedance to the voice and other varying currents as to prevent them from being short-circuited. These windings 9 and 11 may have three hundred ohms resistance each. It is also to be noticed that the cut-off relay, which may be of small resistance—say ten ohms—is a simple relay of ordinary construction and is provided with only one contact. It is therefore correspondingly cheap and easy to keep in good working condition. Only the local circuit of the lamp-signal is opened by the cut-off relay, the battery connection remaining intact, as before explained.

Each operator is, as usual, provided with a plurality of cord-circuits, one only being fully shown and which includes an answering-plug P and a calling-plug P², each having tip and sleeve contacts adapted to register with the corresponding contact-surfaces of the spring-jacks of the lines. The tip-contacts of the two plugs are connected by the flexible strands *t* and *t*² and the interposed condenser *c*, while their sleeve-contacts are similarly joined by the strands *s* and *s*² and the interposed condenser *c*². Supervisory relays *r* and *r*² are bridged across the answering end of the cord-circuit, the former including normally closed contacts and the latter normally open contacts of the local circuit of the supervisory signal S² that is associated with the answering-plug P, while a similar pair of supervisory relays *r*³ and *r*⁴ are bridged across the calling end of the cord-circuit and similarly control the local circuit of the supervisory signal S³ associated with the calling-plug P². The live pole of the battery B is connected with intermediate points of the bridges of said supervisory relays

through the medium of branch conductors 26 and 27. These relays may each have about five hundred ohms resistance.

The supervisory relay *r*⁴ is provided with an extra movable contact 15, which serves in its forward position to complete the strand *t*² of the cord-circuit for conversation and in its normal position to open the said strand and connect the forward portion thereof with the conductor 16, leading to an extra contact 17, upon the operator's listening-key. The operator's receiver 18, the secondary of her induction-coil 19, and a suitable condenser *c*³ are adapted to be bridged across the calling end of the cord-circuit by means of the springs of any suitable listening-key 20, her transmitter 21 and the primary of her induction-coil being at the same time charged from any suitable source of current, which may be the battery B. When the springs 20 are operated to so connect the operator's head-telephone in the cord-circuit, the extra contact 17 of the listening-key engages its outer contact and connects the conductor 16 with the high-resistance and high-impedance test-relay *r*⁵, which is preferably common to all of the cord-circuits at the operator's position. The said test-relay controls, through its normally open contacts, a local circuit, including the tertiary winding of said induction-coil 19. Thus the test-relay is normally isolated from the cords and in case of trouble on some of the cords is not thrown out of use for the whole position.

A ringing-generator 22 is adapted to be connected between ground and the tip side of the line in the operation of the ringing-keysprings 23, and at the same time the strand *s*² is severed by the sleeve-spring 23 and the forward portion thereof is connected with the conductor 24, united to the battery-wire 10, and which includes a resistance 25.

In the operation of the system the subscriber A, for example, desiring a connection takes up his receiver, thereby completing a path for current over his metallic line from the battery B, the current in this path being through the windings 9 and 11 of the line-relay R, which attracts its armature and closes the local circuit of the line-signal S to operate the same. Upon observing this signal the operator inserts the answering-plug P of her cord-circuit into the answering-jack J of the line and connects her telephone set with the cord-circuit to receive the order. The insertion of the plug P connects the cut-off relay R² in a local circuit with the battery B, said circuit including the conductors 26 and 27, winding of the supervisory relay *r*², the strand *s* of the cord-circuit, the sleeve line conductor 3, the winding of the cut-off relay R², thence the winding 11 of the line-relay R, and conductors 3^a and 12 to the opposite pole of the battery. This operates the said cut-off relay R², which opens the local circuit of the line-signal S to retire the same. The actuation

of supervisory relay r^2 closes the local circuit of supervisory lamp S^2 ; but it is prevented from lighting, as hereinafter explained. At the same time current from the live pole of the battery B is feeding out to the telephone-line through conductors 10 and 2^a and the winding 9 of the line-relay R and likewise through the supervisory relay r and over the tip-strand t and the line conductor 2 to the junction of conductors 2^a and 2, from whence the current from both paths flows to the substation and back to the central office over line conductor 3 to the junction of conductors 3 and 3^a , where it joins the current in the said local circuit and flows back through winding 11 of relay R and conductors 3^a and 12 to the other pole of the battery. The current in this path over the line-circuit serves to charge the transmitter at the substation and at the same time operates the supervisory relay r , which opens the circuit and prevents the actuation of the supervisory signal S^2 . In this connection of the cord-circuit with the calling-line the potential upon the line is not varied sufficiently to annoyingly operate the calling-subscriber's telephone. The battery B is permanently connected with the line, and its circuit is not broken and again made during the operation. Thus whatever change of potential that may take place is so small as to be negligible in its effect upon the receiver and the line is "clickless." Upon learning the number of the party wanted the line is tested in the usual manner by touching the tip of the calling-plug to the test-ring of the multiple jack of the line that is before the operator. Normally the test-rings are connected with ground through the winding 11 of the line-relay R, and since the tip of the plug is also normally grounded through the test-relay r^5 the application of the tip of the plug to the said test-ring results in no click, and the operator is informed that the line is idle. If the line is busy, however, the potential of the test-rings is altered, since the sleeve-contact of the inserted plug is connected to the live pole of the battery B through the corresponding sleeve-strand s or s^2 and the supervisory relay r^2 or r^4 . The touching of the tip of the testing-plug to one of the test-rings therefore results in a flow of current through the test-relay r^5 , which is energized to close the local circuit of the tertiary winding of the induction-coil 19, thereby causing a click in the operator's receiver. If the line is found idle, the calling-plug P^2 is inserted in the multiple jack and the ringing-key springs are operated. The depression of the sleeve ringing spring 23 maintains the connection of the battery B with the line conductor 3, and hence through the cut-off relay R^2 , so that the said relay is maintained operated during ringing. The ringing-current is sent out over the tip side of the line through the call-bell at the substation in case the bell is connected in a bridge of the

metallic line, and thence back to the central office and through said sleeve strand and spring 23, the conductors 24 and 10, and the battery B to ground. After the subscriber has been called, but before his response, sleeve supervisory relay r^4 is actuated, as described with reference to line L, over a local circuit, including the cut-off relay R^2 and the winding 11 of the line-relay R. The circuit of the supervisory signal S^3 is thus closed, and the operator is informed that the subscriber has not yet responded. The tip-strand t^2 of the cord-circuit is also now completed through contact 15 of relay r^4 , so that thereafter the operator's listening-key may be actuated to connect the telephone in circuit without connecting the test-relay with the cord-circuit and without opening the strands of the same. When the called subscriber responds, current flows over the paths heretofore traced, including the telephone-line, and actuates the supervisory relay r^3 , which retires the supervisory signal S^3 . The subscribers are now in conversation and current is flowing from the battery B, through the windings of the line-relays R, to feed the substation devices upon the lines. The greater portion of the current is fed to the lines through the line-relays, since the tip supervisory relays are of considerably higher resistance than the windings 9 of the line-relays that are in parallel with them, while all of the current in line conductor 3 flows through the coil 11 of said relay R. Not a great amount of current is used in the local circuit including the cut-off relay R^2 , because the resistance of the relays in series therein is high, although such current must be sufficient at all times to operate the low-wound cut-off relay. The voice-currents, it is well understood, travel over the line conductors 2 and 3, the respective cord-circuit strands connected therewith, and are inductively transmitted from one end of the cord-circuit to the other by the condensers c and c^2 . Thus there are no relay-contacts in the talking-circuit of the line. The cut-off relays are shunted by the non-inductive resistances to avoid retarding the voice-currents, and the relays R and r and r^2 must present sufficient retardation to prevent short-circuiting the voice-currents. The ringing apparatus can be readily adapted for ringing a plurality of parties on the line where the bells are legged to ground from the opposite sides thereof. The location of the cut-off relays between the line-relays and the connection-terminals avoids any marginal or differential adjustment, and it is not necessary or desirable to normally disconnect the switch-board-section from the external line-circuit. At the termination of the conversation when the parties return their receivers to the hooks the tip supervisory relays r and r^3 in the cord-circuit are deenergized and the supervisory lamps are lighted to indicate the fact to the operator that the conversation has terminated.

The cord-circuit is then taken down and all parts are returned to normal condition. The central battery may have a potential of about twenty-four volts and is preferably of the

5 While I have described my invention with particular reference to one commercial method of carrying the same into effect, I would have it understood that the invention is not to be
10 limited in all respects to the particular system shown, since various modifications and changes may be made therein without departing from the scope or principle thereof. Thus the line and cut-off relays may be combined in any way
15 and many other changes may be made; but,

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

1. In a telephone system, the combination
20 with a telephone-line, of connection-terminals therefor, a line-signal-controlling magnet and a common source of current connected with the line at the central office, operators' connective means at the central office to estab-
25 lish connections with the lines of the system for conversational purposes through the medium of said connection-terminals, said connection-terminals being conductively associated with the line during such connections, means under the control of the subscriber to permit a flow of current over the line from said source to operate said magnet and thereby the line-signal, and a cut-off magnet for the line in series in the line between said line-signal-controlling magnet and said connection-terminals and adapted to be operated when a connection is established with the line by said connective means to render the line-signal inoperative, substantially as described.

40 2. In a telephone system, the combination with a telephone-line, of connection-terminals therefor, a line-signal-controlling magnet and a common source of current connected with the line at the central office, operators' connective means at the central office to establish connections with the lines of the system for conversational purposes through the medium of said connection-terminals, said connection-terminals being conductively associated with
50 the line during such connections, means under the control of the subscriber to permit a flow of current over the line from said source to operate said magnet and thereby the line-signal, and a cut-off magnet for the line having its actuating-winding connected in one side of the line between said line-signal-controlling magnet and said connection-terminals and adapted to be operated when a connection is established with the line by said connective means to render the line-signal inoperative, substantially as described.

65 3. In a telephone system, the combination with a telephone-line, of connection-terminals therefor, a line-signal-controlling magnet and a common source of current connected with

the line at the central office, operators' connective means at the central office to establish connections with the lines of the system for conversational purposes through the medium of said connection-terminals, said connection-terminals being conductively associated with the line during such connections means under the control of the subscriber to permit a flow of current over the line from said source to operate said magnet and thereby the line-signal, and a cut-off magnet for the line connected wholly in one of the line conductors between said line-signal-controlling magnet and said connection-terminals and adapted to be operated when a connection is established with the line by said connective means to render the line-signal inoperative, substantially as described.

4. In a telephone system, the combination with a telephone-line, of connection-terminals therefor permanently connected with the line conductors, a line-signal-controlling magnet and a common source of current connected with the line at the central office, operators' connective means at the central office to establish connections with the lines of the system for conversational purposes through the medium of said connection-terminals, means under the control of the subscriber to permit a flow of current over the line from said source to operate said magnet and thereby the line-signal, and a cut-off magnet for the line located between said line-signal-controlling magnet and said connection-terminals and adapted to be operated when a connection is established with the line by said connective means to render the line-signal inoperative, substantially as described.

5. In a telephone system, the combination with a telephone-line, of connection-terminals therefor permanently connected with the line conductors, a line-signal-controlling magnet and a common source of current connected with the line at the central office, operators' connective means at the central office to establish connections with the lines of the system for conversational purposes, means under the control of the subscriber to permit a flow of current over the line from said source to operate said magnet and thereby the line-signal, and a cut-off magnet in series in the line between said line-signal-controlling magnet and said connection-terminals and adapted to be operated when a connection is established with the line by said connective means to render the line-signal inoperative, substantially as described.

6. In a telephone system, the combination with a telephone-line, of connection-terminals therefor permanently connected with the line conductors, a line-signal-controlling magnet and a common source of current connected with the line at the central office, operators' connective means at the central office to establish connections with the lines of the sys- 130

tem for conversational purposes, means at the substation controlled by the subscriber to permit a flow of current over the line from said source to operate said magnet and thereby the line-signal, and a cut-off magnet having its actuating-winding in series in one side of the line between the said line-magnet and connection-terminals and adapted to render the line-signal inoperative when a connection is established with the line by said connective means, substantially as described.

7. In a telephone system, the combination with a telephone-line, of connection-terminals therefor, having contacts associated with the respective line conductors of the telephone-line, operators' connective means at the central office to establish connections with the line through the medium of said terminals for conversational purposes, a line-signal-controlling magnet and a central common source of current permanently connected with the telephone-line, a line-signal controlled by said magnet, means under the control of the subscriber to permit a flow of current from said source over the telephone-line to operate said magnet and thereby the line-signal, and a cut-off magnet located between said line-signal-controlling magnet and the connection-terminals and adapted to be operated when a connection is established with said line by said connective means to render the line-signal inoperative, substantially as described.

8. In a telephone system, the combination with a telephone-line, of connection-terminals therefor, to which the voice-currents may pass directly from the substation of the line, operators' connective means at the central office to establish connections with the line through the medium of said terminals for conversational purposes, a line-signal-controlling magnet and a central common source of current permanently connected with the telephone-line, a line-signal controlled by said magnet, means under the control of the subscriber to permit a flow of current from said source over the telephone-line to operate said magnet and thereby the line-signal, and a cut-off magnet in series in the line between the said line-signal-controlling magnet and the connection-terminals and adapted to be operated when a connection is established with the line by said connective means to render the line-signal inoperative, substantially as described.

9. In a telephone system, the combination with a telephone-line, of connection-terminals therefor permanently connected therewith, operators' connective means at the central office to establish connections with the line for conversation through the medium of said terminals, a line-signal-controlling magnet and a central common source of current permanently connected with the telephone-line, a line-signal controlled by said magnet, means controlled by the subscriber to permit a flow

of current from said source over the telephone-line to operate said magnet and thereby the line-signal, and a cut-off magnet located between the said line-signal-controlling magnet and the connection-terminals and adapted to be operated when a connection is established with the line by said connective means to render the line-signal inoperative, substantially as described.

10. In a telephone system, the combination with a telephone-line, of connection-terminals therefor permanently connected therewith, operators' connective means at the central office to establish connections with the line for conversation through the medium of said terminals, a line-signal-controlling magnet and a central common source of current permanently connected with the telephone-line, a line-signal controlled by said magnet, means controlled by the subscriber to permit a flow of current from said source over the telephone-line to operate said magnet and thereby the line-signal, and a cut-off magnet in series in the line between the said line-signal-controlling magnet and the connection-terminals and adapted to be operated when a connection is established with the line by said connective means to render the line-signal inoperative, substantially as described.

11. In a telephone system, the combination with a telephone-line, of connection-terminals therefor having contacts associated with the respective line conductors, a line-relay and a common source of current connected with the line at the central office, operators' connective means at the central office to establish connections with the lines of the system for conversational purposes, means at the substation to permit a flow of current over the line to operate said magnet and thereby the line-signal, and a cut-off magnet located in the line between the said magnet and said connection-terminals and adapted to be actuated to render the line-signal inoperative during connections established by said connective means with said connection-terminals, and means for rendering said cut-off magnet non-inductive to voice-currents in the telephone-line, substantially as described.

12. In a telephone system, the combination with a telephone-line, of connection-terminals therefor permanently connected with the line, a line-relay and a common source of current connected with the line at the central office, operators' connective means at the central office to establish connections with the lines of the system for conversational purposes, means at the substation to permit a flow of current over the line to operate said magnet and thereby the line-signal, and a cut-off magnet located in the line between the said line-magnet and said connection-terminals and adapted to be actuated to render the line-signal inoperative during connections established by said connective means with said connection-terminals,

and means for rendering said cut-off magnet non-inductive to voice-currents in the telephone-line, substantially as described.

13. In a telephone system, the combination
5 with a telephone-line, of connection-terminals therefor permanently connected with the line, a line-relay and a common source of current connected permanently with the line at the central office, operators' connective means at
10 the central office to establish connections with the lines of the system for conversational purposes, means at the substation to permit a flow of current over the line to operate said magnet and thereby the line-signal, and a cut-off magnet located in the line between the said line-magnet and said connection-terminals and adapted to be actuated to render the line-signal inoperative during connections established by said connective means with said connection-terminals, and means for rendering said
20 cut-off magnet non-inductive to voice-currents in the telephone-line, substantially as described.

14. In a common-battery telephone system,
25 the combination with a plurality of telephone-lines having two wires only extending throughout the multiple switchboard and conductively associated with the line-wires during conversation, a common source of current permanently connected with said lines, line-signals at the central office for said lines, means controlled by the subscribers for permitting current to flow over said lines from said source to cause the operation of said signals, cut-off
30 magnets for the lines connected with the talking-circuits thereof operators' connective means at the central office for establishing connections with the lines for conversation and at the same time operating the cut-off magnets and retiring or preventing the operation of the line-signals of the respective lines with which connection is established, said connection being accomplished without severing the said battery connections with the lines, where-
40 by when the connection is established with a calling-subscriber's line the potential upon the line remains practically constant and the subscriber is not annoyed by the noise in his receiver, substantially as described.

15. In a common-battery telephone system,
50 the combination with telephone-lines having only two wires extending throughout the switchboard and associated respectively with the two line-wires, of a line-signal-controlling magnet and a central common source of current permanently connected with each line, a line-signal controlled by each said magnet, cut-off magnets connected with the talking-circuits of the lines, operator's connective
60 means to establish connections with the lines for conversational purposes, and means actuated when connections are so established to operate said cut-off magnets and thereby prevent the operation of the line-signals, said
65 current source being adapted to feed current

out through the said permanent connections and line-relays to the telephone-lines during connections for the operation of the substation-transmitters, substantially as described.

16. In a telephone system, the combination
70 with a telephone-line, of connection-terminals therefor, operators' connective means at the central office to establish connections with the line for conversation through the medium of the said terminals, a line-relay and a central
75 common source of current connected with the telephone-line, said relay having two windings, one connected to each side of the line, and said source of current being connected between said windings, and a cut-off relay in series in the line between said line-relay and connection-terminals and adapted to be actuated when connection is established with the line to render the line-signal inoperative, substantially as described.
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17. In a telephone system, the combination with a telephone-line, of connection-terminals permanently connected therewith, operators' connective means at the central office to establish connections for conversation with said line
90 through the medium of the connection-terminals, a line-relay and a common source of current permanently connected with the line at the central office, said line-relay having two windings, one connected with each side of the telephone-line, and the said source of current being connected between said windings, a cut-off relay between said line-relay and the connection-terminals, and means for operating said cut-off relay from said source when a connection is established with the line to render the line-signal inoperative, said source serving also to furnish current to the line for the operation of the substation-transmitter, substantially as described.
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18. In a telephone system, the combination with a line, of connection-terminals for the line in the form of spring-jacks permanently connected therewith, a line-relay and a central common source of current connected with the line, a line-signal controlled by said relay, a cut-off relay in series in the line between the line-relay and the spring-jacks, a cord-circuit to establish connections with the line for conversation, and means for including said cut-off relay in a local circuit when the cord-circuit is connected with one of the spring-jacks to thereby operate said cut-off relay to render the line-signal inoperative, substantially as described.
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19. In a telephone system, the combination with a telephone-line, connection-terminals therefor permanently connected therewith, a cord-circuit to establish connections for conversation with said terminals and the line, a line-relay and a source of current connected with the line, a line-signal controlled by said relay, a cut-off relay between the line-relay and the connection-terminals, said cut-off relay being included in a local circuit with said
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source when the cord-circuit is connected with the line, said cut-off relay being then actuated to render the line-signal inoperative, and a supervisory-signal-controlling magnet associated with the cord-circuit and placed in the path of current from said source over the telephone-line during connections, substantially as described.

20. In a telephone system, the combination with a telephone-line, of connection-terminals therefor conductively associated therewith during conversations, a line-relay and a source of current connected with the line, a cord-circuit to establish connections with the line through the medium of said connection-terminals for conversation, a cut-off relay between the line-relay and the connection-terminals, and means for connecting said cut-off relay in a local circuit with said source when the cord-circuit is connected with the line to thereby operate the cut-off relay to render the line-signal inoperative, substantially as described.

21. In a telephone system, the combination with a telephone-line having connection-terminals conductively associated therewith during connections for conversation, of a line-relay and a central common source of current connected with the line, a line-signal controlled by the relay, a cut-off relay in series in the line between the line-relay and the connection-terminals, a cord-circuit to establish connections for conversation with the line, a pair of supervisory relays associated with the cord-circuit, a supervisory signal controlled by said relays, means for including said cut-off relay and one of the supervisory relays in a local circuit when the cord-circuit is con-

nected with the line to thereby operate the cut-off relay to render the line-signal inoperative and to operate the supervisory relay to place the supervisory signal in condition to operate, and means for including the other supervisory relay in the path of current over the telephone-line to thereafter place the supervisory signal under the control of the subscriber, substantially as described.

22. In a telephone system, the combination with a telephone-line having spring-jacks permanently connected therewith, of a line-relay and a central common source of current connected with the line, a line-signal controlled by the relay, a cut-off relay in series in the line between the line-relay and the connection-terminals, a cord-circuit, a supervisory signal, a pair of supervisory relays bridged across the cord-circuit to control said supervisory signal, a connection from the bridge between the relays to said source, whereby when the cord-circuit is connected with the line one of said supervisory relays and the cut-off relay are included in a local circuit and are operated to cut in the supervisory signal and the other supervisory relay is placed in the path of current over the telephone-line and therefore under the control of the subscriber to control the operation of the supervisory signal, substantially as described.

Signed by me at Chicago, county of Cook, State of Illinois, this 12th day of September, 1903.

WILLIAM W. DEAN.

Witnesses:

GAZELLE BEDER,
ROBERT LEWIS AMES.