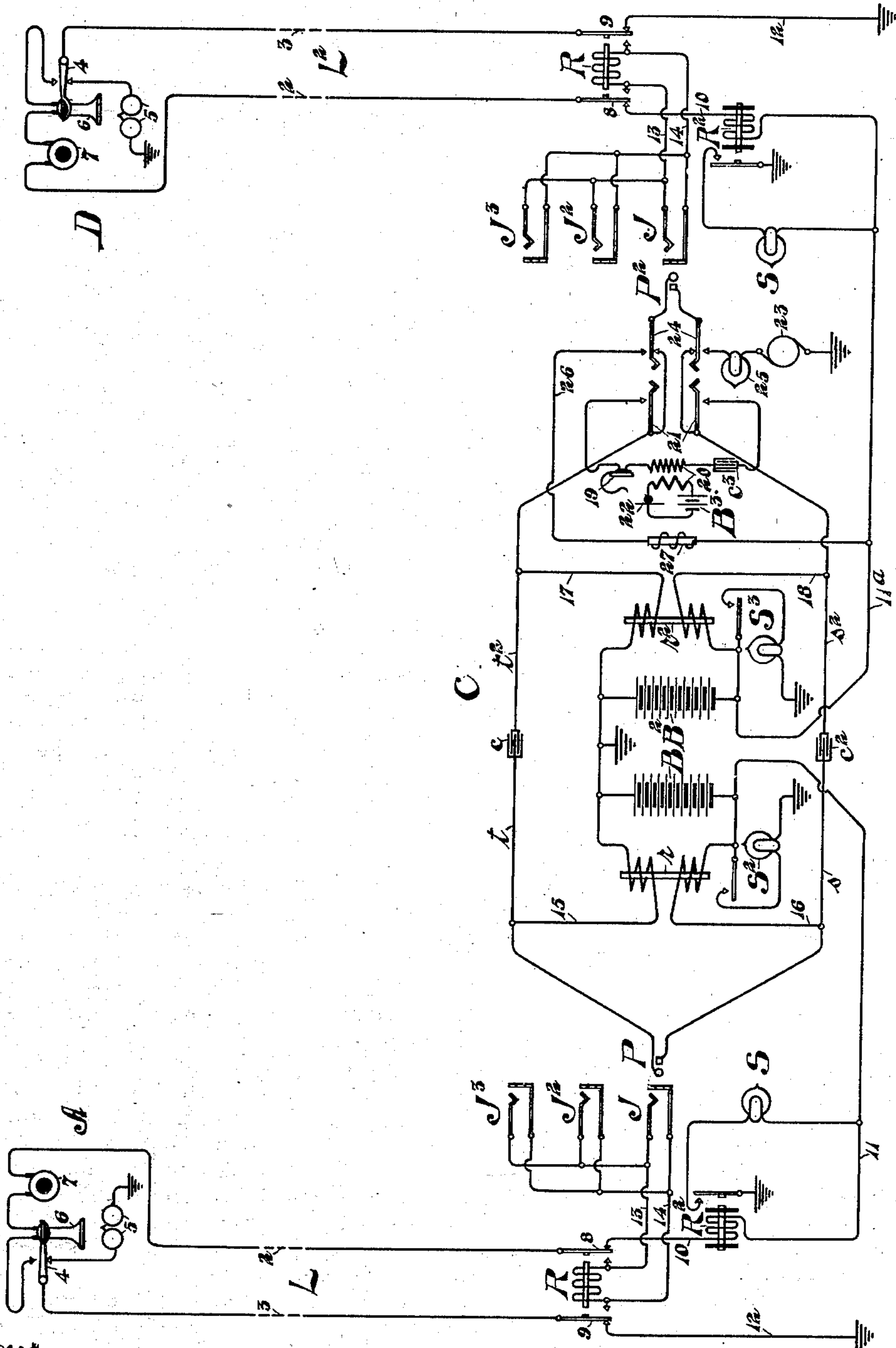


No. 749,306.

PATENTED JAN. 12, 1904.

A. D. T. LIBBY.
TELEPHONE SYSTEM.
APPLICATION FILED DEC. 3, 1902.

NO MODEL.



Witnesses.
R. H. Burford
Gazelle Rector

Inventor:-
Albion D. T. Libby.
by Robert Lewis Ames
Attorney.

UNITED STATES PATENT OFFICE.

ALBION D. T. LIBBY, OF CHICAGO, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 749,306, dated January 12, 1904.

Application filed December 3, 1902. Serial No. 133,673. (No model.)

To all whom it may concern:

Be it known that I, ALBION D. T. LIBBY, a citizen of the United States, 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 telephone systems, more particularly of the type in which the cut-off relays of the lines are bridged across the same or otherwise connected with the talking-circuits, and are therefore actuated over the talking-circuits. It is necessary in these lines, as well as in the ordinary type, to maintain the cut-off relays actuated during the calling of the wanted subscribers. The calling-keys are arranged to open the connection of the central battery with the lines at the time of ringing to prevent the ringing-current from going back over the lines of the calling subscribers, and thus proving an annoyance to them by causing noise in their telephones. The cutting off of the battery, however, unless auxiliary means are provided, deenergizes the cut-off relays and prevents the desired operation during ringing. One such means is to employ an auxiliary generator or generators which is normally disconnected from the lines and cord-circuits, but which during ringing is temporarily connected therewith and is arranged to hold up the said relays. This is objectionable for several reasons, among which may be mentioned the extra expense involved in the cost and running of the extra generators, the additional space required for the installation, and a greater complication throughout.

My invention is designed to accomplish the desired result with much less complication than heretofore and with greater economy and efficiency.

The invention is illustrated in the accompanying drawing, in which the figure represents a diagram of two subscribers' lines and the central-office apparatus involved in establishing connections for conversation.

Two line-circuits L and L² are shown ex-

tending in two limbs 2 and 3 from their respective substations A and D to the central office C. At the substation the sleeve line conductor 3 terminates in a hook-switch 4, which is normally grounded through a signaling-bell 5. A receiver 6 and transmitter 7 are adapted to be connected in series between the line conductors when the receiver is removed from the hook-switch 4, at which time also the grounded bell is disconnected from the conductor 3. This apparatus at the substation is intended merely to typify any of the usual common battery transmission sets, as it is evident that any other suitable arrangement may be employed in so far as the features of my invention are concerned.

At the central office the line conductors 2 and 3 terminate, respectively, in springs 8 and 9 of a cut-off relay R, the normal contact of spring 8 being connected by conductor 10 with the winding of the line-relay R², which is joined through the medium of conductor 11 with the live pole of the charging-battery B and the other pole of which is grounded. The normal contact of spring 9 of the cut-off relay is grounded, as indicated by the conductor 12. The line-relay R² controls the local circuit of the line-signal S, which in this instance is in the form of a small incandescent lamp. Each line is also provided with an answering-jack J and with a suitable number of multiple jacks J² and J³, the tip and sleeve contacts of which are respectively connected by means of conductors 13 and 14 with the forward contacts of the springs 8 and 9 of the cut-off relay R. The winding of this relay is bridged between the said conductors 13 and 14, as shown.

The operator's outfit comprises a plurality of cord-circuits, one only being shown, and which is provided with an answering-plug P and a calling-plug P², each having tip and sleeve contacts adapted to register with the like contacts of the spring-jacks or connection-terminals of the lines, and the tip-contacts of which are connected together through the medium of the tip-strands *t* and *t*² and the inter-

posed condenser c , while the sleeve-contacts are joined by the strands s and s^2 and the interposed condenser c^2 . From the tip and sleeve-strand of the answering-plug conductors 15 and 16 extend to the opposite poles of the battery B, as shown, and each includes one of the differential windings of the supervisory relay r , which is adapted to control through its normally open contacts the local circuit of the supervisory lamp S^2 , associated with the answering-plug P. The strands t^2 and s^2 of the calling-plug P^2 are likewise connected by means of conductors 17 and 18 with the opposite poles of a second charging-battery B^2 , and, as before, these conductors include the differential windings of the supervisory relay r^2 , which controls through its normally open contacts the local circuit of the supervisory lamp S^3 , energized also from the battery B^2 .

The operator's receiver 19, the secondary of her induction-coil 20, and a condenser c^3 are adapted to be bridged between the two strands t^2 and s^2 by means of the listening-springs 21 of a suitable listening and ringing key. Her transmitter 22 and the primary of her induction-coil 20 are shown in a local circuit with a small battery B^3 ; but it will be apparent that any other suitable source of current may be employed. An alternating-current ringing-generator 23 is employed to call the wanted subscriber and is connected between the ground and the sleeve-spring 24 of the ringing and listening key. A suitable non-inductive resistance, which may be a lamp 25, is included in the ringing-circuit. The outer contact of the tip-spring 24 of the ringing-key is connected by conductor 26 with the battery-lead 11^a , extending to the live pole of the battery B^2 , and said conductor includes a suitable retardation-coil 27. The line L^2 is provided with apparatus similar to that of the line L and which is designated by the corresponding reference characters.

The operation is as follows: The subscriber A desiring a connection with the subscriber D takes up his receiver and closes the line conductors 2 and 3 together at the substation, thereby completing the path for current from the battery B over the conductor 11 through the line-relay R^2 , conductor 10, and thence over the tip line conductor 2 and through the substation instruments and back to the central office over a sleeve line conductor 3 and thence through the grounded branch 12. The line-relay responds to this current and closes the local circuit of the signal-lamp S, which is lighted to indicate the subscriber's call, upon seeing which the operator inserts the answering-plug P of her cord-circuit in the answering-jack J of the line. The insertion of this plug closes a path for current from the battery B over both strands t and s of the cord-circuit and the switchboard-conductors 13 and 14 of the line and through the cut-off relay R. This relay therefore operates to

disconnect the line-relay R^2 to render the line-signal S inoperative and to also connect the switchboard-section of the line with the external line-circuit, thus placing the line in condition for conversation. The current now flows from the battery B through the supervisory relay r and over the metallic line to the substation as well as through the cut-off relay R, with the result that the magnetic effects through the coils of the relay r are neutralized and the relay does not attract its armature and the local circuit of the supervisory lamp S^2 is not closed. Upon learning the connection desired by the calling subscriber the line is tested by means of the tip of the calling-plug P^2 . If the line is busy, a cord-circuit similar to the one shown and connected with the same batteries is inserted in one of the jacks of the line, so that all of the test-rings thereof and which are connected with the sleeve sides of the line are thereby connected with the live pole of the battery B or B^2 . Upon touching the tip of the plug P^2 to one of the test-rings, therefore, a complete path for current is provided from the test-terminals over the tip-strand t^2 of the testing cord-circuit and through conductor 17 to ground. This varies the charge of potential upon the operator's condenser to such an extent as to cause a surge of current through her bridge and produces a click in her receiver. If the line is idle, however, the test-rings are entirely insulated, so that no path for current is completed when the line is tested and no click is received. Upon finding the line in this condition the plug P^2 is inserted and the ringing-key 24 operated. The operation of this ringing-key connects the alternating-current generator 23 between the sleeve-spring and ground, and the tip-spring is connected with the conductor 26, leading to the live pole of the battery B^2 through the retardation-coil 27. At the same time the springs 24 open the strands of the cord-circuit through their normal contacts to prevent the passage of the ringing-current back over the cord-circuit and through the instrument of the waiting calling subscriber. The severance of this circuit, however, does not de-energize the cut-off relay R of the line L^2 for the reason that steady current for maintaining the same operated is furnished from the live pole of the battery B^2 over the conductors 11^a and 26 and thence through the switchboard-cable 13, the winding of the cut-off relay R, switchboard-cable 14, and thence over the sleeve-spring 24 of the ringing-key and through the ringing-generator 23 to ground. The current flowing over this path is sufficient to maintain the cut-off relay R operated during ringing, and at the same time the ringing-current from the generator 23 is not short-circuited through this path by reason of the presence therein of the retardation-coil 27, which serves to effectually prevent its passage

and to confine it to its intended path over the sleeve line conductor 3 of the line L^2 and through the grounded signaling-bell 5 at the substation. After calling the subscriber and before his response a path for current is provided from the battery B^2 over the conductor 18 and through one winding of the supervisory relay r^2 and thence over the sleeve-strand of the cord-circuit, the sleeve-conductors 14 and 3 of the line L^2 , and through the bell 5 of the substation to ground. This serves to unbalance the magnetic effects in the two coils of relay r^2 and energizes the same to cause it to close the local circuit of the supervisory lamp S^3 associated with the plug P^2 , which is lighted to indicate the fact to the operator that the called subscriber has not yet responded. Upon the response of the called subscriber the ground through the bell 5 at the substation is removed, and the metallic circuit is completed for current from the battery B^2 , with the attending result that the relay r^2 is rendered neutral, and the local circuit of the supervisory lamp S^3 is opened to extinguish the same. The subscribers are now in conversation, and the batteries B and B^2 are furnishing current to the respective substations with which they are associated for transmission purposes. The windings of the supervisory relays r and r^2 are preferably placed upon the opposite ends of their cores or otherwise separated, so that although the magnetic effects produced by the steady current flowing therethrough during conversation are neutralized the magnetic effects due to rapidly-varying voice-currents are not neutralized, but cause sufficient impedance to prevent the voice-currents from being short-circuited through the bridges of the cord-circuit in which they, together with the batteries, are located.

Although the electrical dimensions of the several devices employed are not of the essence of my invention and may be varied considerably, good results have been obtained with an impedance-coil 27 of two hundred and ninety ohms and the other parts of the usual or desired dimensions. It will be understood that any suitable ringing and listening key may be provided, but preferably one in which the movement of a single lever serves to simultaneously operate the opposite springs. Although but one type of line-circuit has been described, I do not desire to so confine the invention, but hold it to include all the uses and applications to which it may be found capable and particularly apply to those line-circuits in which the cut-off relays are energized by current flowing over a portion of the talking-circuit.

I claim—

1. In a telephone system, the combination with a telephone-line, of a line-signaling device therefor, a cut-off relay for the line adapted when actuated to render said line-signaling device inoperative, a cord-circuit to establish

connections with the line, a steady current source associated with said cord-circuit and adapted during a connection to furnish current over a portion of the talking-circuit for the operation of said cut-off relay, a ringing-generator adapted to be connected with the line to call the subscriber located thereon, means to open the cord-circuit during calling to prevent the ringing-current from flowing back over the same, an auxiliary path for current completed from said source through said cut-off relay during calling, and means in said auxiliary path to permit the passage of steady current and to prevent the passage of the ringing-current, substantially as described.

2. In a telephone system, the combination with a telephone-line, of a line-signaling device therefor, a cut-off relay for the line adapted when actuated to render said line-signaling device inoperative, a cord-circuit to establish connections with the line, a steady current source associated with said cord-circuit and adapted during a connection to furnish current over a portion of the talking-circuit for the operation of said cut-off relay, a ringing-generator adapted to be connected with the line to call the subscriber located thereon, means to open the cord-circuit during calling to prevent the ringing-current from flowing back over the same, an auxiliary path for current completed from said source through said cut-off relay during calling, and a retardation-coil in said auxiliary path to prevent the passage of ringing-current and to permit the passage of steady current, substantially as described.

3. In a telephone system, the combination with a telephone-line, of a line-signaling device therefor, a cut-off relay for the line adapted when actuated to render said line-signaling device inoperative, a cord-circuit to establish connections with the line, a steady current source connected therewith and adapted to furnish current over a portion of the talking-circuit during a connection for the operation of said cut-off relay, a ringing-generator adapted to be connected with the line to call the subscriber located thereon, means to open the normal connection with said source during calling, an auxiliary path for current completed from said source through said cut-off relay during calling, and a retardation-coil in said auxiliary path, substantially as described.

4. In a telephone system, the combination with a telephone-line, of a line-signal therefor, a cut-off relay bridged between the line conductors and adapted when actuated to render the line-signal inoperative, a cord-circuit to establish connections with the line, a source of steady current bridged across the cord-circuit and adapted during a connection to furnish current over the talking-circuit for the operation of said cut-off relay, a ringing-generator adapted to be connected with the cord-circuit to call the wanted subscriber, the cord-

circuit being opened between said source and the cut-off relay at the time of calling the subscriber, an auxiliary path for current from said source through said cut-off relay completed during calling to maintain the same operated, and a retardation-coil in said auxiliary path to prevent the passage thereover of the ringing-current, substantially as described.

5. In a telephone system, the combination with a telephone-line, of a line-signal therefor, a cut-off relay bridged between the line conductors and adapted when actuated to render the line-signal inoperative, a cord-circuit to establish connections with the line, a source of steady current bridged across the cord-circuit and adapted during a connection to furnish current over the talking-circuit for the operation of said cut-off relay, a ringing-generator, a key located in the cord-circuit between the bridge containing said source and the calling-plug, said key being arranged to sever the cord-circuit when the ringing-generator is connected with the calling-plug, an auxiliary path for current from said source completed by said key during calling through said cut-off relay to maintain the same operated, and a retardation-coil in said auxiliary path to prevent the passage thereover of the ringing-current, substantially as described.

6. In a telephone system, the combination with a telephone-line, of a connection-terminal normally disconnected therefrom, a relay for connecting said connection-terminal with the line, a central source of current adapted to be connected in the metallic circuit for talking purposes, means for operating said relay from said source when connection is made with the line by current flowing over a path including a portion of the talking-circuit, means for sending a calling-current over the line of the called subscriber only and at the same time maintaining said relay in operated condition from said source, and means for preventing the short-circuiting of the ringing-current through said source, substantially as described.

7. The combination with a telephone-line, of a connection-terminal normally disconnected therefrom, a relay for connecting said connection-terminal with the line, a charging source of electricity, a calling source of electricity, said charging source being adapted to energize said relay when connection is made with the line, a ringing-key for connecting said calling source with the line of a called subscriber and for disconnecting the normal path for current from said charging source, an auxiliary path for current from said charging source completed by the ringing-key during calling, and a retardation-coil in said auxiliary path, substantially as described.

8. In a telephone system, the combination with a telephone-line, of a line-signal therefor, a cut-off relay bridged between the line conductors and adapted when actuated to ren-

der the line-signal inoperative, a cord-circuit to establish connections with the line, a source of steady current connected with the cord-circuit and adapted during a connection to furnish current over the talking-circuit for the operation of said cut-off relay and for conversational purposes, a ringing-generator adapted to be connected with one side of the cord-circuit to call the wanted subscriber, an auxiliary path for current from said source adapted to be connected with the other side of the cord-circuit during calling, the cord-circuit itself being at this time severed, a retardation-coil in said auxiliary path to prevent the passage thereover of the ringing-current and to confine it to the called line entirely, substantially as described.

9. In a telephone system, the combination with a telephone-line, of a line-signal operated by current from the central office when the subscriber is calling, a magnet to render said signal inoperative when a connection is established with the line for conversation, a central source of current adapted to be connected in the line for talking, said magnet being operated from said source during a connection by current over a portion of the talking-circuit, a calling-generator for sending ringing-current over the line of the called subscriber only, means for simultaneously sending continuous current through said magnet to maintain the same actuated during calling, and a retardation-coil in the path of the latter current to prevent the passage thereover of the ringing-current, substantially as described.

10. The combination with a telephone-line, of a charging source of continuous current to furnish current for talking, a line-signal, a magnet adapted to be energized from said source to render the said signal inoperative, the magnet-circuit including a portion of the talking-circuit, a calling-generator, means to connect said generator with the line and to open the circuit of said source through said magnet, means for temporarily sending continuous current through said magnet during ringing to maintain the same actuated, and a retardation-coil included in the path of said temporary current to prevent the passage thereover of the ringing-current, substantially as described.

11. The combination with a telephone-line, of a charging source of continuous current to furnish current over the line for talking, a line-signal, a magnet adapted to be energized from said source during a connection to render said signal inoperative, a cord-circuit to establish connections with the line for talking, a calling-generator, means to connect said generator with the line and to open the cord-circuit, means for temporarily sending continuous current through said magnet during ringing to maintain the same operated, and a retardation-coil included in the path of said temporary current to prevent the passage

thereover of the ringing-current, substantially as described.

12. The combination with a telephone-line, of a charging source of continuous current, a magnet adapted to be energized by said charging source when connection is made with the line, a calling-generator, a ringing-key adapted to connect said calling-generator with the line and to open circuit through said magnet, means controlled by the ringing-key for temporarily sending a continuous current through said magnet during the time the calling-generator is connected with the line, and a retardation-coil in the path of said temporary current to prevent the passage thereof of the ringing-current, substantially as described.

13. The combination with a telephone-line, of a relay associated therewith, a cord connector for uniting said line with another telephone-line, a charging source of continuous current adapted to be connected with said line to send current through said relay, a calling-generator adapted to produce a non-continuous current, a ringing-key adapted to connect said calling-generator with the line and to open the circuit of said charging source through said relay, means for temporarily sending a continuous current through said relay to energize the same during the time the calling-generator is in circuit, and a retardation-coil included in the path of said latter current to prevent the passage thereof of the ringing-current, substantially as described.

14. The combination with a telephone-line, of a connection-terminal normally disconnected therefrom, a relay for connecting said connection-terminal with the line, a charging source of continuous current adapted to energize said relay, a calling-generator, a ringing-key adapted to connect said calling-generator with the line and to open the circuit of said charging source through said relay and means for temporarily sending a continuous current through said relay during the time the calling-generator is connected in circuit, and a retardation-coil included in the path of said temporary continuous current, substantially as described.

15. The combination with a telephone-line, of a relay in a bridge between the two limbs of said line, a charging source of electricity adapted when connection is made with the line to energize said relay, a calling-generator, a ringing-key adapted to connect said calling-generator with the line and to open the circuit of said charging source through said relay, means to temporarily send continuous current through said bridged relay during ringing by the actuation of said ringing-key, and a retardation-coil included in the path of said latter temporary current to prevent the passage of ringing-current, substantially as described.

16. The combination with a telephone-line,

of a relay associated therewith, a cord connector for uniting said line with another telephone-line, a charging source of continuous current adapted to be connected with said cord connector through said relay and furnishing current for talking purposes, a calling-generator adapted to produce a non-continuous current, a ringing-key adapted to connect said calling-generator with the line and to open the circuit of said charging source through said relay, means for temporarily sending a continuous current through said relay to energize the same during the time the calling-generator is in circuit, and a retardation-coil included in the path of said latter temporary current to prevent the passage of the ringing-current, substantially as described.

17. The combination with a telephone-line, of a line-signal therefor, a magnet to render said line-signal inoperative during a connection, a source of current connected with the line during a connection to energize said magnet over a path including a portion of the talking-circuit and to furnish current for talking purposes, a calling-generator, a ringing-key adapted to connect said calling-generator with the line and to open the circuit of said charging source through said magnet, means actuated by said ringing-key for temporarily sending a continuous current through said magnet during the time the calling-generator is connected with the line, and a retardation-coil included in the path of said latter temporary current, substantially as described.

18. The combination with a telephone-line, of a line-signal therefor, a cut-off relay for the line to render the line-signal inoperative, a cord connector for uniting said line with another telephone-line, a charging source of continuous current adapted to be connected with said cord connector to send current over a portion of the talking-circuit through said relay and to furnish current to the line for conversation, a calling-generator adapted to produce a non-continuous current, a ringing-key adapted to connect said calling-generator with the line and to open the circuit of said charging source through said relay, means for temporarily sending a continuous current through said relay to energize the same during the time the calling-generator is in circuit, and a retardation-coil in the path of said temporary current to prevent the passage of the ringing-current, substantially as described.

19. The combination with a telephone-line, of a connection-terminal normally disconnected therefrom, a line-signal, a relay for connecting said connection-terminal with the line and for simultaneously rendering said signal inoperative, a charging source of continuous current adapted to energize said relay and to furnish current for talking during a connection, a calling-generator adapted to produce a non-continuous current, a ringing-key to connect said calling-generator with the line and to

open the circuit of said charging source through said relay, means for temporarily sending a continuous current through said relay during the time the calling-generator is connected in circuit, a retardation-coil included in the path of the latter temporary current for the purpose of preventing the passage over said path of the ringing-current, substantially as described.

20. In a telephone system, the combination with a telephone-line, of a line-signaling device therefor, a cut-off relay for the line adapted when actuated to render said line-signaling device inoperative, a cord-circuit to establish connection with the line, a steady current source associated with said cord-circuit and adapted during a connection to furnish current over a portion of the talking-circuit for the operation of said relay and over the line for talking, a ringing-generator adapted to be connected with the line to call a subscriber located thereon, means to open the cord-circuit during calling to prevent the ringing-current from flowing back over the same, means for temporarily sending a continuous current through said cut-off relay during calling, and means connected in the path of said temporary current to permit the passage of the continuous current and to prevent the passage of the ringing-current, substantially as described.

21. In a telephone system, the combination with a telephone-line, of a line-signaling device therefor, a cut-off relay for the line adapted when actuated to render said line-signaling device inoperative, a cord-circuit to establish connections with the line, a steady current source associated with said cord-circuit and adapted during a connection to furnish current over a portion of the talking-circuit for the operation of said cut-off relay and over the line for talking, a ringing-generator adapted to be connected with the line to call the subscriber located thereon, means to open the cord-circuit during calling to prevent the ringing-current from flowing back over the same, means for temporarily sending a continuous current through said relay during calling, and a retardation-coil in the path of said latter current to prevent the passage of ringing-current and to permit the passage of steady current, substantially as described.

22. In a telephone system, the combination with a telephone-line, of a line-signal therefor, a cut-off relay bridged between the line conductors and adapted when actuated to render the line-signal inoperative, a cord-circuit to establish connections with the line, a source of steady current bridged across the cord-circuit and adapted during the connection to furnish current for the operation of the cut-off relay, a ringing-generator adapted to be connected with the cord-circuit to call the wanted subscriber, the cord-circuit being opened between said source and the cut-off relay at the time of calling the subscriber, means for

temporarily sending a continuous current through said cut-off relay during calling to maintain the same operated, and a retardation-coil in the path of said temporary current to prevent the passage thereover of the ringing-current, substantially as described.

23. In a telephone system, the combination with a telephone-line, of a connection-terminal normally disconnected therefrom, a relay for connecting said terminal with the line, a central source of current adapted to be connected in the metallic circuit for talking purposes, means for operating said relay from said source when connection is made with the line by current flowing over a path including a portion of the talking-circuit, a calling-generator for sending ringing-current over the line of the called subscriber only, means for simultaneously sending continuous current through said relay to maintain the same actuated during calling, and a retardation-coil in the path of the latter current to prevent the passage thereover of the ringing-current, substantially as described.

24. In a telephone system, the combination with a telephone-line, of a magnet connected with the talking-circuit thereof, a cord-circuit, a calling-generator, a ringing-key to connect said generator with the cord-circuit to call the subscriber upon the line, said key serving to open the cord-circuit during ringing, and a source of steady current and a retardation-coil in series therewith temporarily connected with the cord-circuit by said key in calling to maintain said magnet operated, the said retardation-coil serving to oppose the passage of the ringing-current, substantially as described.

25. In a telephone system, the combination with a telephone-line, of a line-signal, a relay to render said signal inoperative when a connection exists, a cord-circuit, a source of current associated therewith and connected with the line during a connection to furnish current for talking and for the operation of said relay, the relay-circuit including one talking-strand of the cord-circuit and a portion of one side of the line with suitable return, a ringing-generator, a key to open the said relay-circuit when operated and to connect the said generator in the circuit of the line, means also actuated by said key for temporarily sending a continuous current through said relay during ringing, and a retardation-coil in the said temporary path so formed by the ringing-key, substantially as described.

26. In a telephone system, the combination with a telephone-line, of a line-signaling device therefor, a cut-off magnet for the line adapted when actuated to render said line-signaling device inoperative, a cord-circuit to establish connections with the line, a steady-current source associated with said cord-circuit and adapted during a connection to furnish current over a portion of the talking-circuit for the opera-

tion of said cut-off magnet, a ringing-generator, a ringing-key switch adapted to connect said generator with the cord-circuit and line to call the wanted subscriber, said switch serving to open the cord-circuit during calling to prevent the ringing-current from flowing back over the same and disturbing the calling subscriber, an auxiliary path for current completed by said key-switch from said source through said cut-off magnet during calling, and a retardation-coil in said auxiliary path to prevent the passage of the ringing-current, substantially as described.

27. In a telephone system, the combination with a multiple-switchboard common-battery telephone-line having its switchboard-section normally disconnected from the external line-circuit, of a line-signaling device normally connected with said external line-circuit, a cut-off relay bridged between the conductors of the switchboard-section and adapted to be actuated during a connection to disconnect said signaling device from the external line-circuit and connect the switchboard-section with said external line-circuit, a cord-circuit to establish connections with the line, a battery having one pole grounded bridged between the strands of the cord-circuit and adapted to send current through said relay to actuate the same during a connection and to furnish current over the telephone-line for talking, supervisory apparatus associated with the cord-circuit and adapted also to be actuated from said source, a grounded ringing-generator, a ringing-key in the cord-circuit between the connection of the said battery therewith and the connecting-plug, said key serving when actuated to open the cord-circuit strands and thus disconnect said battery, said key serving at the same time to connect said generator between ground and one side of the telephone-line, to actuate the subscriber's bell, an auxiliary path for current completed from the live pole of said battery to the other side of the line by said key during ringing whereby current from said battery flows over said auxiliary path through said bridged cut-off relay and the grounded ringing-generator to maintain the same actuated during ringing, and a retardation-coil included in said auxiliary path to prevent the passage of the ringing-current thereover and confine it to the subscriber's line, substantially as described.

28. In a telephone system, the combination with a telephone-line, of a line-signal therefor, a magnet to render said signal inoperative during a connection, a ringing-generator and a source of steady current connected with the line when calling the wanted subscriber, the current from said steady-current source serving to maintain said magnet operated during ringing and having its path completed through said ringing-generator, substantially as described.

29. In a telephone-system, the combination

with a telephone-line, of a line-signal therefor, a magnet to render said signal inoperative during a connection, a ringing-generator, and a source of steady current connected with the line when calling the wanted subscriber, the current from said steady-current source serving to maintain said magnet operated during ringing and having its path completed through said ringing-generator, and means to prevent the ringing-generator current from being confined to the path of the steady-current source, substantially as described.

30. In a telephone system, the combination with a telephone-line, of a line-signal therefor, a magnet to render said signal inoperative during a connection, a ringing-generator, and a source of steady current connected with the line when calling the wanted subscriber, the current from said steady-current source serving to maintain said magnet operated during ringing and having its path completed through said ringing-generator, and a retardation-coil in said steady-current path out of the desired path of the ringing-current to prevent the latter from flowing thereover, substantially as described.

31. The combination with a telephone-line, of a signal therefor, a magnet to render said signal inoperative during a connection, a battery and a ringing-generator connected with said line when calling the subscriber, the battery and ringing-generator having derived circuits, the said generator being in the common portion thereof and the said battery serving to maintain said magnet operated during ringing, substantially as described.

32. In a telephone signaling system, a main-line circuit, a non-continuous-current generator for ringing the substation, a continuous-current generator, means for connecting both to the main-line circuit simultaneously and by the same operation to call the wanted subscriber, a line-signal, an electromagnet connected with said circuit to render said signal inoperative during a connection, said magnet being energized by said continuous-current generator during ringing and over a path of low actual resistance but relatively high apparent resistance, substantially as described.

33. In an electric signaling system, a main circuit, a non-continuous-current generator for calling the substation, a continuous-current generator, means for connecting both to the said circuit simultaneously and by the same operation when it is desired to call the subscriber, a line-signal, an electromagnet in a branch of said circuit and adapted to be energized from said source during a connection to prevent the operation of said signal, the circuit of said electromagnet being of high impedance to prevent the passage of current from the non-continuous-current generator, substantially as described.

34. A telephone signaling system comprising a main circuit, a line-signal connected

therewith, an electromagnet connected with the line to render said signal inoperative, an alternating-current generator for sending outgoing signals, a continuous or uniform-direction current generator and a retardation-coil, and a signal-sending key or circuit controller interposed between the main circuit and both generators and adapted when operated to close the circuit of both over the said circuit simultaneously.

35. In a telephone signaling system, a main circuit, a ringing-current generator and a continuous-current generator associated together at the central station of the said circuit, a circuit-closer for connecting both to the said main circuit simultaneously and by the same operation, means for disconnecting both at the end of the call without taking down the connection, a polarized electromagnetic bell at the substation responsive to alternating current only and adapted to give a signal upon the operation of said circuit-closer, a line-signal, an electromagnet to render said signal inoperative during a connection and actuated by current from said continuous-current generator, and means to prevent the passage of ringing-current over said continuous-current path, substantially as described.

36. The combination with a main circuit, of a line-signal therefor, and an electromagnet to render said signal inoperative during connection and connected with the main circuit, a source of alternating current for sending outgoing ringing-currents over the circuit, a source of continuous current for actuating said electromagnet to render the said signal inoperative during ringing and having impedance in its path to prevent the passage of the ringing-current, and means for connecting both sources with the circuit simultaneously in the normal act of calling the wanted subscriber, substantially as described.

37. The combination with a main circuit, of a polarized electromagnetic call device in-

cluded therein responsive to alternating currents, an alternating-current generator, a continuous-current generator and retardation-coil associated therewith, a signal at the same station as the said generators, an electromagnet connected with the said circuit to render said signal inoperative during a connection, and a compound circuit-closing device controlling the terminals of both generators and their connections with the main circuit so that when operated in calling a subscriber to make such connections the said magnet will be operated by the continuous current to prevent the operation of said signal by the alternating current and the latter current will be confined to the desired path, substantially as described.

38. In an electric signaling system, the combination with a main circuit, a line-signal, a cut-off relay connected with talking-circuit and adapted to render said signal inoperative during a connection, an alternating-current generator, a relatively low resistance continuous-current generator to operate said relay during ringing, a circuit-closer controlling branch terminals of the said main circuit and also the terminals of both generators and adapted when operated to connect both with said main circuit, an electromagnetic resistance or retardation coil of low actual but high inductive resistance included in the circuit of the continuous generator to prevent the currents of the alternating generator from being short-circuited or shunted through the said continuous-current generator while offering little opposition to the continuous currents developed thereby.

Signed by me at Chicago, county of Cook, State of Illinois, this 28th day of November, 1902.

ALBION D. T. LIBBY.

Witnesses:

C. S. WINSTON,
ROBERT LEWIS AMES.