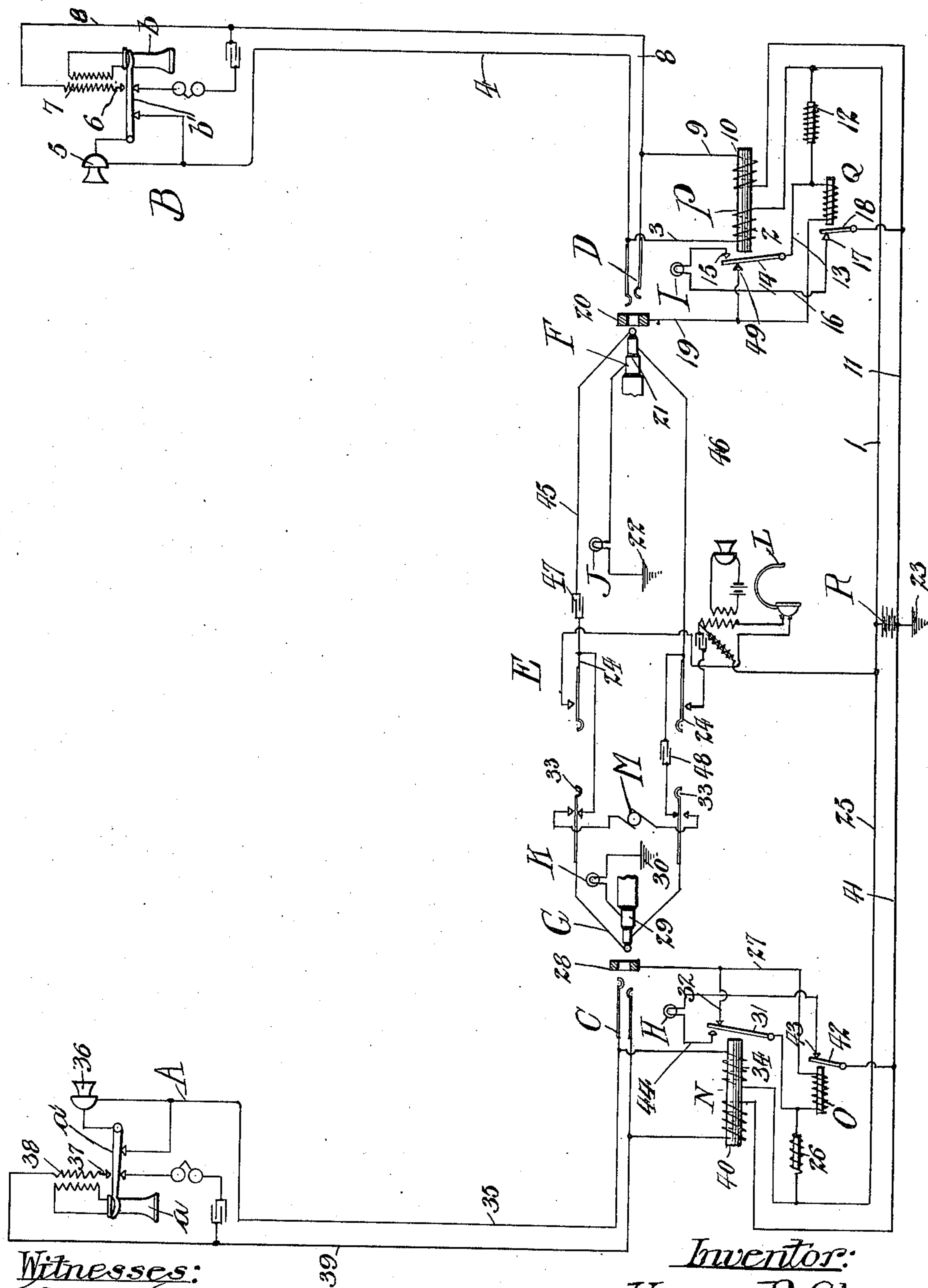


H. P. CLAUSEN.
 TELEPHONE SYSTEM.
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1,002,222.

Patented Sept. 5, 1911.



Witnesses:

J. B. Weiss
 Edward H. Eisfeldt

Inventor:

Henry P. Clausen
 By Buckley Durand
 Attys.

UNITED STATES PATENT OFFICE.

HENRY P. CLAUSEN, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, OF ROCHESTER, NEW YORK, A CORPORATION OF NEW YORK.

TELEPHONE SYSTEM.

1,002,222.

Specification of Letters Patent.

Patented Sept. 5, 1911.

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To all whom it may concern:

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

My invention relates to telephone systems in which the current for signaling purposes is supplied from a battery or other source at the central station, and preferably to systems in which the current for talking purposes is also supplied from a common battery or centralized source of supply. In systems of this character, the subscribers' lines usually terminate in what are called "spring-jacks," these spring-jacks being located on the switchboards at the central station; and the connections are established by the operators through the medium of what are called plugs and cord-circuits. Said plugs are usually arranged in pairs, one at each end of a flexible conductor composed of two or more strands, and when inserted in spring-jacks a pair of these plugs and the connecting cords are adapted to establish a talking circuit between the subscribers' lines to which said jacks are allotted. It is also customary to provide the switchboard apparatus with what are called line and supervisory signals, the line signals enabling the subscribers to call-in and attract the attention of the operator, when a connection is desired, and the supervisory signals enabling the subscribers to indicate when they are through talking. In systems of this character, it is also preferable to employ complete metallic line connection between the sub-stations and the exchange or central station.

Generally stated, the object of my invention is to provide an improved, simplified, and highly efficient telephone system of the foregoing character.

A special object is to provide an improved arrangement whereby the line and supervisory signals may be controlled and operated in accordance with approved methods of practice, and without the necessity of employing relays or other similar devices in the cord-circuits.

It is also an object to provide certain details and features of improvement tending to increase the general efficiency of a telephone system of this particular character.

To the foregoing and other useful ends, my invention consists in matters hereinafter set forth and claimed.

The accompanying drawing is a diagram illustrating the construction and circuit arrangement of a telephone system embodying the principles of my invention, only two substations and a single cord-circuit being shown, and it being understood, however, that the system may comprise as many substations as is desirable or necessary, and that it may also comprise as many operators' cord-circuits as may be found convenient or expedient.

As thus illustrated, my improved central energy or common battery telephone system comprises a couple of substations A, B, having complete metallic line connection with the switchboard apparatus at the central station. The line of substation A terminates in a spring-jack C, while the line of substation D terminates in a spring-jack D, both jacks being located on either the same or different sections or divisions of the switchboard at the exchange or central station. An operator's cord-circuit E, provided with answering and calling plugs F and G, is provided and employed as a medium for establishing electrical connection between the said jacks, and for thereby establishing a through talking circuit between the substations. A line signal H is associated with the jack C, so as to enable the subscriber at substation A to call-in and attract the attention of the operator; and a similar line signal I, associated with the jack D, enables the subscriber at substation B to receive attention from the operator. The supervisory signals J and K are associated, respectively, with the said answering and calling plugs, and the arrangement, as will hereinafter more fully appear, is such that the signal J is displayed when the subscriber at substation B hangs up his receiver. In a similar manner, the signal K is displayed when the subscriber at substation A hangs up his receiver. In order that she may converse with

subscribers, the operator is provided with a talking set L, adapted to be bridged across the cord-circuit. The generator M, which is also adapted to be bridged across the cord-circuit, enables the operator to ring the bells at the subscribers' stations. The functions of the relays N, O, and P, Q, will be more readily understood from an explanation of the manner in which connection is established between the two substations.

Suppose, for example, that the subscriber at substation B desires to communicate with the subscriber at substation A. In such case the subscriber B takes down his receiver *b*, and by so doing releases the switch-hook *b'*, and thereby closes a line circuit from the common battery or centralized source of current R, through the battery lead 1, through a coil 2 of the line relay P, through the conductor 3, thence through the limb or line conductor 4, through the transmitter 5, through the contact point 6, through one coil 7 of the inductive connection between the receiver and the line circuit, through the other limb or line conductor 8, through the conductor 9, thence through the other coil 10 of said line relay, and through the other battery lead 11 to said battery. The windings of said line relay P are such that the current flowing through this completed line circuit energizes the said relay and causes it to attract its armature. When attracted, the said armature closes a circuit from the said battery, through the battery lead 1, through the impedance coil 12, or other suitable resistance, through the conductor 13, through the said armature 14, through contact 15, thence through the line lamp signal I, through the conductor 16, through the contact 17, and the armature 18, and thence through the battery lead 11 to said battery. The resistance of this circuit is such that sufficient current flows therein to cause the lamp I to glow. This attracts the attention of the operator, who thereupon inserts the answering-plug F in the spring-jack D. This act on the part of the operator establishes a derived circuit from the battery R through the battery lead 1, through the resistance 12 and the coil of the relay Q, through the conductor 19, through the testing ring 20 of said jack, through the sleeve contact 21 of said plug, thence through the supervisory lamp signal J, and through the ground or common connections 22 and 23 to said battery. Sufficient current flows through this derived circuit to energize the relay Q, which is in the nature of a cut-off relay, and to cause it to attract its armature 18. When thus attracted, the armature 18 opens the above described local circuit of the line lamp signal I, thereby cutting off the battery from this lamp and causing it to cease glowing. But the current flowing through this derived circuit, owing to the re-

sistance of the relay Q, is not sufficient to cause the lamp J to glow. Thus the operator answers the call, and in so doing automatically restores the line or calling signal, to its normal condition. Upon receiving the order for connection from subscriber B, which she does by pressing her listening key 24, so as to bridge her talking set across the cord-circuit, the operator then inserts the calling plug G in the jack C. The insertion of the calling plug in this manner completes a derived circuit from the battery R, through the battery lead 25, through the impedance coil or other suitable resistances 26, through the coil of the cut-off relay O, thence through the conductor 27, through the testing ring 28 of the jack C, through the sleeve contact 29 of said calling plug, thence through the lamp K, and through the ground or common connections 30 and 23 to said battery. It will also be observed that this derived circuit includes the armature 31 and the contact 32, which are so arranged as to constitute a normally closed shunt around the coil of the cut-off relay O. As this shunt is of low resistance, the relay O consequently remains deenergized, while at the same time sufficient current flows through the derived circuit to cause the lamp K to glow. This lamp, as will hereinafter more fully appear, continues to glow until the called subscriber answers the call. The operator now presses her ringing key 33, so as to bridge the generator across the cord-circuit, and so as to thereby project ringing current on to the line leading to substation A. This rings the bell at substation A, and subscriber A, in answering the call, takes down his receiver *a*, thereby releasing the switch-hook *a'*. In rising, the switch-hook closes a line circuit from the battery R, through the battery lead 25, through the coil 34 of the line relay N, thence through the limb or line conductor 35, through the subscriber's transmitter 36, through the switch-hook *a'* and the contact 37, through the coil 38 of the inductive connection between the receiver A and the line circuit, thence through the other limb or line conductor 39, through the other coil 40 of the said line relay N, and through the battery-lead 41 to said battery. The windings of the relay N are such that the closing of this line circuit causes said relay to attract its armature 31, thereby opening the shunt around the cut-off relay O. The path of low resistance around the relay O being thus removed or opened, the said relay becomes energized, and its armature 42, when attracted, moves away from the contact 43, thereby preventing the lamp H from glowing. At the same time, the armature 31, in moving away from the contact 32, opens the circuit of the lamp K, and causes the latter to cease glowing. The armature 31 when thus attracted also moves into engagement

with the contact 44, but this does not cause the lamp H to glow, as previously stated, inasmuch as the relay O has already opened the circuit of the lamp. The through talking circuit thus established between the two subscribers, comprises, it will be seen, the limbs of the two lines, the jack and plug contacts, and the talking strands 45 and 46 of the cord-circuit. Preferably, these talking strands are provided, respectively, with condensers 47 and 48 to stop the flow of battery current. When the subscriber B hangs up his receiver, and thereby opens the line circuit, the relay P becomes deenergized, thereby allowing its armature 14 to engage the contact 49, and in so doing to close a low resistance shunt around the cut-off relay Q. The resistance of the circuit of the lamp J being thus reduced, said lamp is thereby caused to glow, and to, in this way, indicate to the operator that subscriber B is through talking. In a similar manner, subscriber A, in hanging up his receiver, opens the line circuit, deenergizes the relay N, and closes a shunt around the cut-off relay O, which results, of course, in a sufficient reduction of the resistance in the circuit of lamp K to cause the latter to glow. The operator then withdraws the plugs and in so doing restores the system to its normal condition, at least so far as these two particular substations and this particular cord-circuit are concerned.

It will be seen that the relays N and P, by having their coils located in opposite sides of the line circuit, balance the circuit, and act as impedance or retardation to prevent the passage of voice currents. It will also be seen that the relays N and O are employed to conjointly control the circuit of the lamp H, and that the relay N is adapted to control the circuit of the supervisory lamp K. The relay N and the jack C and the plug G are adapted to conjointly control the circuit of the lamp K. In a similar manner, it will be seen that the relays P and Q have a conjoint control over the circuit of lamp J, and that the relay P is adapted, independently of any other relay, to control the circuit of the lamp J. Also, the relay P and the jack D and the plug F are adapted to conjointly control the circuit of the relay J. Again, my improved system, as will be observed, comprises line relays adapted to control normally closed shunts around cut-off relays.

It will be readily understood that the resistances for the various relays and coils and the capacities of the condensers can be adjusted to suit varying conditions, and can be of any suitable or desired character. It will also be understood that the various instruments, devices, etc., employed in the system can be of any suitable, known, or improved construction. With my improved

circuit arrangement, however, it will be seen that a very small amount of current is required for clearing the line signals.

I claim as my invention:—

1. A telephone system comprising a subscriber's line, a line signal and a supervisory signal, a centralized source of current supply, a line relay and a cut-off relay, said relays being adapted to conjointly control said line signal, the said supervisory signal being included in the energizing circuit of the cut-off relay and said line relay being adapted to control the said supervisory signal, by shunting the resistance of the cut-off relay.

2. A telephone system comprising a subscriber's line, line and supervisory signals, a central source of current supply, a line relay and a cut-off relay, said relays being adapted to conjointly control the said line signal, the line relay being adapted to control the said supervisory signal, by shunting the resistance of the cut-off relay, and a coil of the cut-off relay being adapted to act as resistance to prevent the display of said supervisory signal until the line relay is deenergized.

3. A telephone system comprising a subscriber's line, line and supervisory signals, line and cut-off relays, a central source of current supply, a normally closed shunt around the coil of said cut-off relay, said shunt being included in the circuit of said supervisory signal, said relays being adapted to conjointly control the said line signal, and said line relay being adapted to control said shunt.

4. A telephone system comprising a subscriber's line, line and supervisory signals, a central source of current supply, a jack connected with said line, an operator's cord-circuit plug connected with said supervisory signal, and line and cut-off relays, said relays being adapted to conjointly control said line signal, and said line relay and said plug and jack being adapted to conjointly control said supervisory signal, and an artificial resistance adapted to be included in and excluded from the circuit of said supervisory signal in the control of said signal.

5. A telephone system comprising a pair of subscribers' lines, a subscriber's switch-hook for each line, a central source of current supply connected with said lines, line and supervisory signals, a jack connected with each line, an operator's cord-circuit provided with plugs adapted for insertion in said jacks, line and cut-off relays for each line, a normally closed shunt around the coil of each cut-off relay, the line and cut-off relays of each line being adapted to conjointly control the line signal allotted to said line, each line relay being adapted to control the shunt about the associated cut-off relay, and said line relay thereby being adapted to co-

operate with said jacks and plugs in conjointly controlling the said supervisory signals.

6. A telephone system comprising a subscriber's line, a central source of supply, a jack connected with the line, an operator's cord-circuit plug, a line signal, a local circuit for said line signal including said battery, and including also a normally closed and a normally open switch-point, a supervisory signal connected with the plug, a local circuit for said supervisory signal including said battery and including also said plug and jack and normally closed switch-point, a line relay adapted to control the normally closed switch-point of said supervisory signal, and also the normally open switch-point of said line signal, and a normally short circuited cut-off relay adapted to control the normally closed switch-point of said line signal.

7. A telephone system comprising a subscriber's line, line and supervisory signals, a line relay and a normally short circuited cut-off relay adapted to conjointly control the circuit of said line signal, each relay being adapted to control a switch-point in the circuit of said line-signal, and a central source of current supply, said supervisory signal being adapted to constitute part of the energizing circuit of said cut-off relay.

8. A telephone system comprising a subscriber's line, a line signal, a central source of current supply, a normally short circuited cut-off relay, and a supervisory signal, the coil of said cut-off relay being adapted to serve as resistance to prevent the display of said supervisory signal until the proper time.

9. A telephone system comprising a cut-off relay, a shunt normally included about said relay, together with means for opening and closing said shunt, means to be cut off by the energizing of said relay and a battery having one pole normally connected with one terminal of said relay, a lamp signal and a local circuit for energizing the cut-off relay in series with said lamp signal.

10. A telephone system comprising a cut-off relay, a shunt for said relay, together with means for opening and closing said shunt, said relay and shunt being in a normally open circuit, means to be cut off by the energizing of said relay, a supervisory lamp signal and a local circuit for energizing said cut-off relay in series with said lamp signal.

11. A telephone system comprising a cut-off relay, a lamp signal, a normally closed shunt around such cut-off relay, a battery, and a normally open circuit including said lamp signal and the coil of said relay in series together with means for opening and closing said shunt.

12. A telephone system comprising a relay and a lamp signal, the relay controlling the

said lamp signal, and a normally open circuit including said lamp signal for energizing the said relay, and a normally open circuit excluding the said relay for lighting the said lamp.

13. In a telephone system, a line, a line relay, a cut-off relay, and a shunt around the cut-off relay controlled by the line relay.

14. In a telephone system, a line, a line relay therefor, a cut-off relay, and a normally closed shunt around the cut-off relay controlled by the line relay.

15. In a telephone system, a line, a line relay, and means for energizing it during use of the line for conversational purposes, a cut-off relay, and a low resistance shunt closed around the cut-off relay by the de-energizing of the line relay.

16. In a telephone system, a line, a line relay, a cut-off relay, a shunt around the cut-off relay controlled by the line relay, and a supervisory lamp signal provided with a circuit which includes said shunt.

17. In a telephone system, a line, a relay having one terminal thereof permanently connected with the line, a normally closed shunt around said relay, means for opening said shunt, and a supervisory lamp signal provided with a circuit which includes said shunt when the same is closed.

18. In a telephone system, a double wound line relay, a normally closed shunt controlled thereby and a cut-off relay associated therewith and included in said shunt, as stated.

19. In a telephone exchange system, the combination with a telephone line extending from a substation to an exchange, of a line relay at the exchange, a source of current adapted to be closed through said line relay through the agency of substation apparatus, cord connecting apparatus for connecting said line with another for conversation, a cut-off relay included in a high resistance circuit controlled by the cord connecting apparatus, a line signal jointly controlled by said line and cut-off relays, a supervisory signal included in said high resistance circuit, and means whereby the deenergization of said line relay causes a short-circuiting of the resistance of the circuit through said supervisory signal.

20. In a telephone exchange system, the combination with a telephone line extending from a substation to an exchange, of a line relay at the exchange, a source of current adapted to be closed through said line relay through the agency of substation apparatus, cord connecting apparatus for connecting said line with another for conversation, a cut-off relay included in a high resistance circuit controlled by the cord connecting apparatus, a line signal in a local circuit including the armatures of said relays, the circuit through said line signal being closed

when the line relay is energized and the cut-off relay is deenergized, a supervisory signal included in said high resistance circuit, and means whereby the deenergization of said line relay causes a short-circuiting of the resistance of the circuit through said supervisory signal.

21. A telephone exchange system including a telephone line extending from a subscriber's station to an exchange, a connecting switch in association with the telephone line, a cord circuit for uniting telephone lines in conversation, a disconnect signal device, a circuit therefor including a portion of the connecting switch and the cooperating portion of a cord circuit in connection therewith when lines are united for conversation, a line relay in association with the telephone line controlled by the switch-hook at the substation serving, when the telephone is upon its hook, to close an opening in said circuit, and, when the telephone is removed from its hook, to establish an opening in said circuit, and a cut-off relay brought into the disconnect signal circuit by the energized line relay.

22. A telephone exchange system including a telephone line extending from a substation to an exchange, a connecting switch in association with the telephone line, a cord circuit for uniting telephone lines in conversation, a disconnect signal device, a circuit therefor including a portion of the connecting switch and the cooperating portion of a cord circuit in connection therewith when lines are united for conversation, a line relay in association with the telephone line controlled at the substation serving, when the telephone line is open at the substation, to close an opening in said circuit, and, when the telephone line is closed at the substation, to establish an opening in said circuit, and a cut-off relay brought into the disconnect signal circuit by the energized line relay.

23. A telephone exchange system including a telephone line extending from a subscriber's station to an exchange, a jack for the telephone line, a cord circuit for uniting telephone lines in conversation, a disconnect signal device, a circuit therefor including a portion of the jack and the cooperating plug of a cord circuit in connection therewith when lines are united for conversation, a line relay in association with the telephone line controlled by the switch-hook at the substation serving, when the telephone is upon its hook, to close an opening in said circuit, and, when the telephone is removed from its hook, to establish an opening in said circuit, and a cut-off relay brought into the disconnect signal circuit by the energized line relay.

24. A telephone exchange system including a telephone line extending from a substation to an exchange, a jack for the tele-

phone line, a cord circuit for uniting telephone lines in conversation, a disconnect signal device, a circuit therefor including a portion of the jack and the cooperating portion of a cord circuit in connection therewith when lines are united for conversation, a line relay in association with the telephone line controlled at the substation serving, when the telephone line is open at the substation, to close an opening in said circuit, and, when the telephone line is closed at the substation, to establish an opening in said circuit, and a cut-off relay brought into the disconnect signal circuit by the energized line relay.

25. In a telephone exchange system, the combination with a telephone line extending from a substation to an exchange, of a line relay at the exchange, a source of current adapted to be closed through said line relay through the agency of substation apparatus, cord connecting apparatus for connecting said line with another for conversation, a cut-off relay included in a high resistance circuit controlled by the cord connecting apparatus, a line signal jointly controlled by said line and cut-off relays, the line signal being connected between the front contact of the line relay and the back contact of the cut-off relay, whereby said line signal has no permanent connection with said source of current, a supervisory signal included in said high resistance circuit, and means whereby the deenergization of said line relay causes a short-circuiting of the resistance of the circuit through said supervisory signal.

26. In a telephone exchange system, the combination with a telephone line extending from a substation to an exchange, of a line relay at the exchange, a source of current adapted to be closed through said line relay through the agency of substation apparatus, cord connecting apparatus for connecting said line with another for conversation, a cut-off relay included in a high resistance circuit controlled by the cord connecting apparatus, a line signal in a local circuit including the armatures of said relays, the line signal being connected between the front contact of the line relay and the back contact of the cut-off relay, whereby said line signal has no permanent connection with said source of current, the circuit through said line signal being closed when the line relay is energized and the cut-off relay is deenergized, a supervisory signal included in said high resistance circuit, and means whereby the deenergization of said line relay causes a short-circuiting of the resistance of the circuit through said supervisory signal.

27. A telephone exchange system including a telephone line extending from a subscriber's station to an exchange, a connecting switch in association with the telephone line,

a cord circuit for uniting telephone lines in conversation, a disconnect signal device, a circuit therefor including a portion of the connecting switch and the cooperating portion of a cord circuit in connection therewith when lines are united for conversation, a line relay in association with the telephone line controlled by the switch-hook at the substation serving, when the telephone is upon its hook, to close an opening in said circuit, and, when the telephone is removed from its hook, to establish an opening in said circuit, and a cut-off relay brought into the disconnect signal circuit by the energized line relay, the line signal being connected between the front contact of the line relay and the back contact of the cut-off relay, whereby said line signal has no permanent connection with said source of current.

28. A telephone exchange system including a telephone line extending from a substation to an exchange, a connecting switch in association with the telephone line, a cord circuit for uniting telephone lines in conversation, a disconnect signal device, a circuit therefor including a portion of the connecting switch and the cooperating portion of a cord circuit in connection therewith when lines are united for conversation, a line relay in association with the telephone line controlled at the substation serving, when the telephone line is open at the substation, to close an opening in said circuit, and, when the telephone line is closed at the substation, to establish an opening in said circuit, and a cut-off relay brought into the disconnect signal circuit by the energized line relay, the line signal being connected between the front contact of the line relay and the back contact of the cut-off relay, whereby said line signal has no permanent connection with said source of current.

29. A telephone exchange system including a telephone line extending from a subscriber's station to an exchange, a jack for the telephone line, a cord circuit for uniting

telephone lines in conversation, a disconnect signal device, a circuit therefor including a portion of the jack and the cooperating plug of a cord circuit in connection therewith when lines are united for conversation, a line relay in association with the telephone line controlled by the switch-hook at the substation serving, when the telephone is upon its hook, to close an opening in said circuit, and, when the telephone is removed from its hook, to establish an opening in said circuit, and a cut-off relay brought into the disconnect signal circuit by the energized line relay, the line signal being connected between the front contact of the line relay and the back contact of the cut-off relay, whereby said line signal has no permanent connection with said source of current.

30. A telephone exchange system including a telephone line extending from a substation to an exchange, a jack for the telephone line, a cord circuit for uniting telephone lines in conversation, a disconnect signal device, a circuit therefor including a portion of the jack and the cooperating portion of a cord circuit in connection therewith when lines are united for conversation, a line relay in association with the telephone line controlled at the substation serving, when the telephone line is open at the substation, to close an opening in said circuit, and, when the telephone line is closed at the substation, to establish an opening in said circuit, and a cut-off relay brought into the disconnect signal circuit by the energized line relay, the line signal being connected between the front contact of the line relay and the back contact of the cut-off relay, whereby said line signal has no permanent connection with said source of current.

Signed by me at Chicago, Cook county, Illinois, this 13th day of July, 1903.

HENRY P. CLAUSEN.

Witnesses:

ARTHUR F. DURAND,
WM. A. HARDERS.