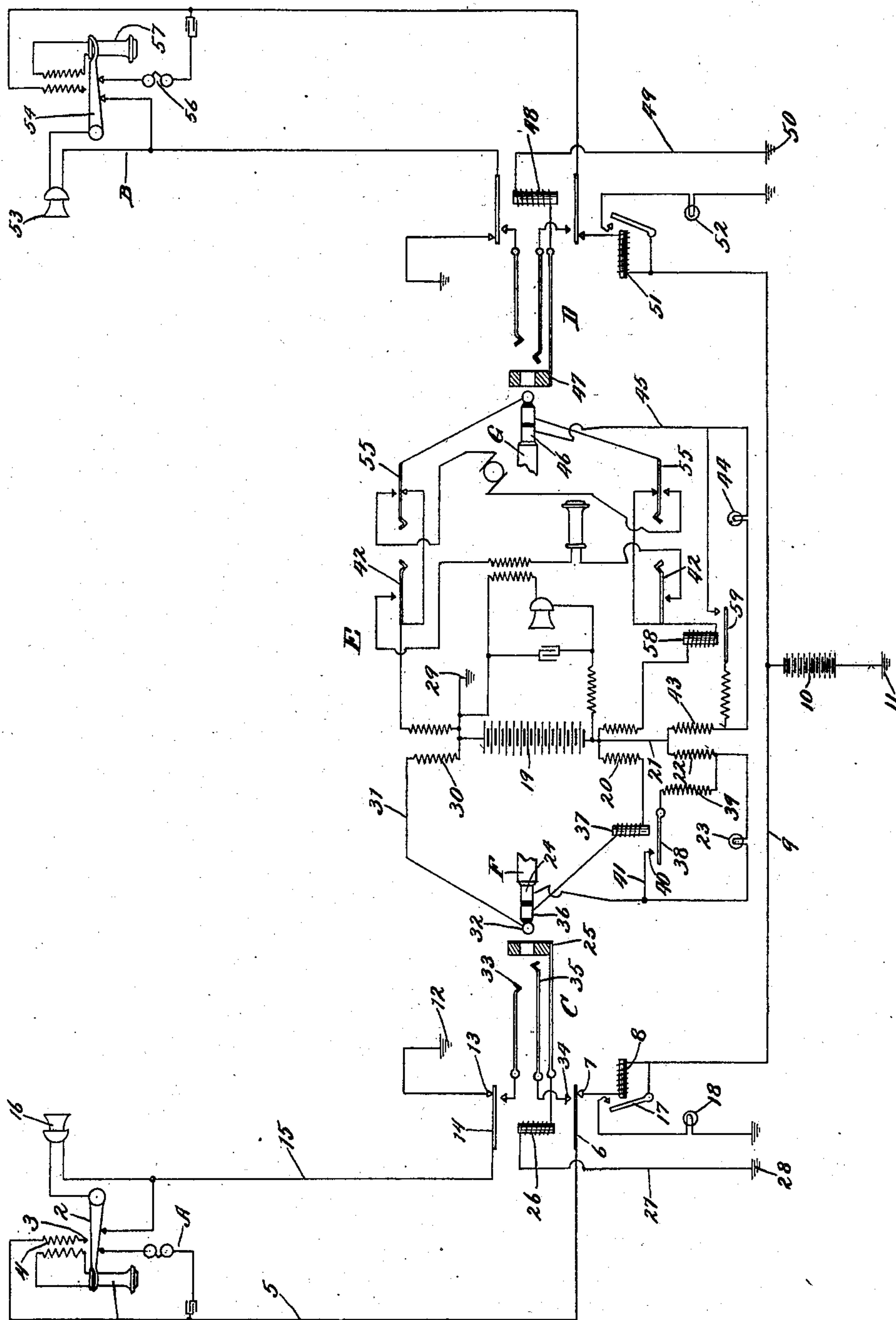


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H. P. CLAUSEN.
TELEPHONE SYSTEM.
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Witnesses:
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UNITED STATES PATENT OFFICE.

HENRY P. CLAUSEN, OF CHICAGO, ILLINOIS, ASSIGNOR TO AMERICAN ELECTRIC TELEPHONE COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION.

TELEPHONE SYSTEM.

No. 889,582.

Specification of Letters Patent.

Patented June 2, 1908.

Application filed November 15, 1902. Serial No. 131,472.

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 of that class in which the current, both for signaling and talking purposes, is furnished from a battery or generator located at the central station. And it relates more particularly to telephone exchange systems in which there is a complete metallic connection between the central station and each substation.

Generally stated, the object of my invention is to provide a simple, serviceable and highly efficient telephone system of the foregoing character.

A special object is to provide an improved arrangement whereby the spring jacks on the switchboards may be normally disconnected from the subscriber's lines, and whereby the battery, which is bridged across the cord circuit, and which furnishes the current to the lines for talking purposes, may also be advantageously and effectively employed for energizing the cut-off relays, as well as for simultaneously establishing connection between the lines and the said jacks, and cutting off or opening the circuits of the line relays.

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

In certain respects, it will be seen that my present invention is a modification of the system shown in my prior patent No. 866,714, dated September 24, 1907; but as herein disclosed, the line is not short circuited when the subscriber calls, and as another difference between this and my said prior patent, the calling subscriber can hang up and thereby retire the line signal at any time before the operator answers the call.

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

The accompanying diagram illustrates the circuit connections of a telephone system embodying the principles of my invention.

In the said diagram A indicates a substa-

tion equipped with the ordinary or usual subscriber's apparatus, B indicates a similar substation.

C indicates the spring jack or terminal on the switchboard at the central station, which is allotted to the line of substation A.

D indicates a similar spring jack terminal allotted to the line of substation B.

E indicates generally the operator's cords and plugs by which she establishes connection between the lines of any two subscribers.

The telephone system thus shown is of the common battery type—that is to say, the current, both for talking and signaling purposes, is furnished from a battery located at the central station. It will be readily understood that the subscriber's substation apparatus can be of any suitable known or approved character. It will also be understood that the specific construction of the various relays, switches, plugs, etc., shown in the diagram, can be of any suitable or desired character. The character of the system as a whole, and also the character of the different circuit connections, will be best understood by considering the various operations.

With the construction thus shown, the operation of connecting up one subscriber with another is as follows: When the subscriber at substation A removes the receiver 1 from the hook switch 2, a complete metallic circuit is closed from this hook switch through the contact point 3, through the primary 4 of the induction coil, through the line conductor 5, through the armature 6 of the cut-off relay, through the contact point 7, through the coil of the line relay 8, through the lead or battery connection 9 to the battery 10, thence through the ground or common connections 11 and 12, to contact point 13, through the other armature 14 of the said cutting-off relay, through the other line conductor 15, and thence through the subscriber's transmitter 16 to the said hook switch. The flow of current through this closed line circuit causes the line relay 8 to attract its armature 17, thereby closing the local circuit of the line lamp 18. The central or switchboard operator observing this signal then inserts the answering plug F in the spring jack C. This closes a local circuit from the talking battery 19 through the conductor 21, through the resistance coil 22, through the supervisory lamp 23, through the sleeve con-

tact 24 of the plug, through the testing ring 25 of the jack, thence through the coil of the cut-off relay 26, through the conductor 27, and thence through the ground or common connections 28 and 29 to said battery. The current flowing through this local circuit energizes the cut off relay, causing it to retract its armatures 6 and 14. This action of the cut-off relay not only severs the connection between the battery 10 and the line, so as to deenergize the line relay 8 and extinguish the lamp 18, but also completes a line circuit from the battery 19 through the winding 30 of the other repeating coil, through the talking strand 31 to the cord circuit, through the plug tip 32, through the jack spring 33, through the armature 14 and the line conductor 15, through the subscriber's transmitter 16 and hook switch 2, thence through the contact point 3 and the coil 4, through the other line conductor 5, through the cut-off relay armature 6, through the contact point 34, thence through the other jack spring 35 and the ring contact 36 of the plug, and through the supervisory relay 37 and the winding 20 to said battery. The energizing of the relay 37 in this manner causes its armature 38 to close a shunt around the lamp 23, so as to extinguish this lamp which was lighted by the initial insertion of the plug in the jack. This shunt, as will be observed, consists of the resistance coil 39, the armature 38, the contact point 40, and the conductor 41. The central operator can now press her listening key 42, so as to connect her head telephone with the calling subscriber's line. After receiving the order for connection and assuming that the calling subscriber desires to communicate with the subscriber at substation B, the operator then inserts the calling plug G in the jack D. This completes a local circuit from the battery 19 through the resistance coil 43, through the other supervisory lamp 44, thence through a third cord strand 45 to the sleeve contact of the plug, through the testing ring 47 of the jack, thence through the cut-off relay 48, through the conductor 49, and through the ground or common connections 50 and 29 to said battery. In this way the insertion of the calling plug causes the supervisory lamp 44 to glow and at the same time establishes connection between the jack D and the line, and also severs the connection between this line and the line relay 51, so as to prevent the glowing of the line lamp 52. With connection thus established between the jack D and the calling subscriber's line, the operator can now project or impress ringing current onto the said line by pressing the ringing key 55, so as to ring the bell 56 at substation B. Responding to this signal the subscriber at substation B takes down the receiver 57, thereby closing the line circuit in the manner described in connection with

substation A. The closing of this line circuit which, as explained, includes the battery 19 energizes the other supervisory relay 58, causing its armature 59 to close a shunt or short-circuit around the lamp 44. This is substantially the same as the shunting out or short-circuiting of the lamp 23 previously described. In this way the central operator understands that the called subscriber has responded to the call. The subscribers are now connected for talking purposes through a talking circuit including the limbs of the two lines or contacts of the jacks and plugs, and the two talking strands of the cord circuit and also the said repeating coils. When the subscriber at substation A hangs up the receiver the line circuit will be broken, the supervisory relay 37 deenergized, and the shunt around the lamp 23 thereby opened. This of course causes the lamp 23 to glow, thus advising the operator that the subscriber at substation A is through talking. In a similar manner, the hanging up of the receiver 57 at substation B opens the line circuit and deenergizes the supervisory relay 58, thereby opening the shunt or short-circuit around the lamp 44 and allowing the latter to glow. The central operator now withdraws the plugs from the jacks and the system is then in its normal condition, as shown in the diagram. Thus it will be seen that each supervisory lamp is arranged to be connected in series with the cut-off relay of the line. Furthermore, it will be observed that the battery 19 energizes the cut-off relays through circuits including cord strands and plug and jack contacts. Again, it will be seen that the operator can send calling current over the line of the called subscriber only, and at the same time maintain the cut-off relay in its operated condition. Other advantages will be readily apparent to those skilled in the art.

What I claim as my invention is:

1. The combination with a telephone line and a connection terminal therefor normally not in operative relation with the line, of a connecting plug and cord circuit to cooperate with said line, a supervisory signal controlling magnet and a battery associated with said cord-circuit, a telephone transmitter and a switch at the subscriber's station, and means controlled over a strand of said cord circuit by the insertion of the plug into the jack for placing the jack in operative relation with the line, whereby talking current is furnished to said transmitter and said magnet is placed under the control of the subscriber, a ringing circuit including both sides of the subscriber's line in series, said supervisory signal means comprising an armature, an energizing circuit for causing the attraction of said armature, said energizing circuit including both sides of the telephone line, and a line signal adapted to be retired if

the calling subscriber hangs up his receiver before the operator answers the call.

2. The combination with a telephone line and a connection terminal therefor normally not in operative relation with said line, of a connecting plug and cord circuit adapted to cooperate with said line, a supervisory signal controlling magnet and a battery associated with said cord circuit, a switch at the subscriber's station, and means controlled by the insertion of the plug into the jack for placing said jack in operative relation with the line, whereby said signal controlling magnet is placed under the control of the subscriber the system being free from ground connections at the subscribers' stations, whereby both sides of the subscribers' lines are used for signaling and ringing and talking purposes, and any calling subscribers' station receiving battery current at all times before the operator answers, or until the line circuit at such station is again opened, substantially as described.

3. The combination with a telephone line, and a connection terminal in the form of a spring jack normally not in operative relation with the line, of a cord circuit and a connecting plug, a central source of current associated with said line and circuit to furnish talking current to the substations, and means including said source of current and actuated over a strand of said cord circuit by the insertion of said plug in the jack for placing said jack in operative relation with said line, a ringing circuit including both sides of the subscriber's line in series, said supervisory signal means comprising an armature, an energizing circuit for causing the attraction of said armature, said energizing circuit including both sides of the telephone line, and a line signal adapted to be retired if the calling subscriber hangs up his receiver before the operator answers the call.

4. The combination with a telephone line and a connection terminal in the form of a spring jack normally not in operative relation with said line, of a cord circuit and connecting plug, supervisory signaling apparatus associated with said circuit, a central source of current associated with said line and circuit to operate said supervisory apparatus, and a relay adapted to be energized from said source to place said jack in operative relation with the line when said plug is inserted into said jack the system being free from ground connections at the subscribers' stations, whereby both sides of the subscribers' lines are used for signaling and ringing and talking purposes, and any calling subscriber's station receiving battery current at all times before the operator answers, or until the line circuit at such station is again opened, substantially as described.

5. The combination with a telephone line and a connection terminal in the form of a

spring jack, of a connecting plug and a cord circuit, a central source of current associated with said line and circuit to furnish current for talking purposes, supervisory signal apparatus associated with the cord circuit and operated from said source of current, and a relay actuated from said source over a strand of said cord circuit by the insertion of said plug into and its withdrawal from said jack for controlling the operative relation of said jack with said line, a ringing circuit including both sides of the subscriber's line in series, said supervisory signal means comprising an armature, an energizing circuit for causing the attraction of said armature, said energizing circuit including both sides of the telephone line, and a line signal adapted to be retired if the calling subscriber hangs up his receiver before the operator answers the call.

6. In a telephone system, a metallic circuit line, a connection terminal in the form of a spring jack normally not in operative relation with said line, a connecting plug and a cord circuit, a signaling device normally in operative relation with said line, a central source of current and supervisory signaling apparatus associated with said line and cord circuit, said source being adapted to furnish current for the operation of said apparatus and for talking purposes, and a relay actuated from said source over a strand of said cord circuit when said plug is inserted in said jack to place said signaling device in inoperative relation with said line and said jack in operative relation with said line, a ringing circuit including both sides of the subscriber's line in series, said supervisory signal means comprising an armature, an energizing circuit for causing the attraction of said armature, said energizing circuit including both sides of the telephone line, and a line signal adapted to be retired if the calling subscriber hangs up his receiver before the operator answers the call.

7. The combination with a telephone line having a limb extending to the central station, of a line contact for said limb normally disconnected therefrom, a cord circuit and connecting plug, supervisory signaling apparatus connected with said circuit, a central source of current associated with said line and circuit to furnish current for talking purposes and for the operation of said supervisory apparatus, and means energized over a strand of said cord circuit for automatically connecting said line contact with said limb when the line is in use and for disconnecting the same therefrom when the line is not in use, a ringing circuit including both sides of the subscriber's line in series, said supervisory signal means comprising an armature, an energizing circuit for causing the attraction of said armature, said energizing circuit including both sides of the telephone line, and a line signal adapted to be retired

if the calling subscriber hangs up his receiver before the operator answers the call.

8. The combination with a telephone line having a limb extending to the central station, of a signaling device normally connected with said limb, a line contact for said line normally disconnected therefrom, a cord circuit and connecting plug, supervisory signaling apparatus associated with said cord-circuit, a central battery to furnish current for talking purposes and for the operation of said apparatus, and a relay energized from said battery over a strand of said cord circuit and adapted to disconnect said limb from said signaling device and to connect the same with the line contact when a connection is established with the line, a ringing circuit including both sides of the subscriber's line in series, said supervisory signal means comprising an armature, an energizing circuit for causing the attraction of said armature, said energizing circuit including both sides of the telephone line, and a line signal adapted to be retired if the calling subscriber hangs up his receiver before the operator answers the call.

9. The combination with a telephone line having a limb extending to the central station, of a spring or moving part with which said limb connects at the central office, a signaling device connected with said spring or part in its normal position, a line contact for said limb, a cord circuit and connecting plug, a central battery associated with the said line circuit, supervisory signals also associated with the circuit, said battery being adapted to furnish current to the substations for talking purposes and for operating said supervisory signals, and a relay also energized from said battery over a strand of said cord circuit and adapted to disconnect said spring or part from the signaling device and to connect it with the line contact when a connection is established with the line, a ringing circuit including both sides of the subscriber's line in series, said supervisory signal means comprising an armature, an energizing circuit for causing the attraction of said armature, said energizing circuit including both sides of the telephone line, and a line signal adapted to be retired if the calling subscriber hangs up his receiver before the operator answers the call.

10. 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 cord circuit, and 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, a ringing circuit including both sides of the

subscriber's line in series, said supervisory signal means comprising an armature, an energizing circuit for causing the attraction of said armature, said energizing circuit including both sides of the telephone line, and a line signal adapted to be retired if the calling subscriber hangs up his receiver before the operator answers the call.

11. The combination with a telephone-line and a connection-terminal therefor normally not in operative relation with the line, of a connecting plug and cord-circuit to cooperate with said line, a supervisory signal controlling magnet and a battery associated with said cord-circuit, a telephone transmitter and a switch at the subscriber's station, and means controlled by the insertion of the plug into the jack for placing the jack in operative relation with the line by current flowing over a path including a portion of the cord-circuit, whereby talking current is furnished to said transmitter and said magnet is placed under the control of the subscriber, a ringing circuit including both sides of the subscriber's line in series, said supervisory signal means comprising an armature, an energizing circuit for causing the attraction of said armature, said energizing circuit including both sides of the telephone line, and a line signal adapted to be retired if the calling subscriber hangs up his receiver before the operator answers the call.

12. The combination with a telephone line, and a connection terminal therefor normally not in operative relation with said line, of a connecting plug and cord circuit adapted to cooperate with said line, a supervisory signal controlling magnet and a battery associated with said cord circuit, a switch at the subscriber's station, and means including a contact connected with the cord circuit controlled by the insertion of the plug into the jack for placing said jack in operative relation with the line, whereby said signal controlling magnet is placed under the control of the subscriber, a ringing circuit including both sides of the subscriber's line in series, said supervisory signal means comprising an armature, an energizing circuit for causing the attraction of said armature, said energizing circuit including both sides of the telephone line, and a line signal adapted to be retired if the calling subscriber hangs up his receiver before the operator answers the call.

13. The combination with a telephone line and a connection terminal in the form of a spring jack normally not in operative relation with the line, of a cord circuit and a connecting plug, a central source of current associated with said line and circuit to furnish talking current to the substations, and means including said source of current actuated by the insertion of said plug in the jack and by current flowing over a part of the

cord circuit for placing said jack in operative relation with said line, a ringing circuit including both sides of the subscriber's line in series, said supervisory signal means comprising an armature, an energizing circuit for causing the attraction of said armature, said energizing circuit including both sides of the telephone line, and a line signal adapted to be retired if the calling subscriber hangs up his receiver before the operator answers the call.

14. The combination with a telephone line and a connection terminal in the form of a spring jack normally not in operative relation with said line, of a cord circuit and connecting plug, supervisory signaling apparatus associated with said circuit, a central source of current associated with said line and circuit to operate said supervisory apparatus, and a relay adapted to be energized from said source over a path including a portion of the cord circuit to place said jack in operative relation with the line when said plug is inserted in said jack, a ringing circuit including both sides of the subscriber's line in series, said supervisory signal means comprising an armature, an energizing circuit for causing the attraction of said armature, said energizing circuit including both sides of the telephone line, and a line signal adapted to be retired if the calling subscriber hangs up his receiver before the operator answers the call.

15. The combination with a telephone line, and a connection terminal in the form of a spring jack, of a connecting plug and a cord circuit, a central source of current associated with said line and circuit to furnish current for talking purposes, supervisory signal apparatus associated with the cord circuit and operated from said source of current, and a relay actuated from said source by the insertion of said plug into and its withdrawal from said jack for controlling the operative relation of said jack with said line, said relay being actuated by current flowing over a portion of a strand of the cord circuit, a contact of the plug and jack, a ringing circuit including both sides of the subscriber's line in series, said supervisory signal means comprising an armature, an energizing circuit for causing the attraction of said armature, said energizing circuit including both sides of the telephone line, and a line signal adapted to be retired if the calling subscriber hangs up his receiver before the operator answers the call.

16. In a telephone system, a metallic circuit line, a connection terminal in the form of a spring jack normally not in operative relation with said line, a connecting plug and a cord circuit, a signaling device normally in operative relation with said line, a central source of current and supervisory signaling apparatus associated with said line and cord

circuit, said source being adapted to furnish current for the operation of said apparatus and for talking purposes, and a relay actuated from said source over a portion of the cord circuit when said plug is inserted in said jack to place said signaling device in inoperative relation with said line and said jack in operative relation with said line, a ringing circuit including both sides of the subscriber's line in series, said supervisory signal means comprising an armature, an energizing circuit for causing the attraction of said armature, said energizing circuit including both sides of the telephone line, and a line signal adapted to be retired if the calling subscriber hangs up his receiver before the operator answers the call.

17. The combination with a telephone line having a limb extending to the central station, of a line contact for said limb normally disconnected therefrom, a cord circuit and connecting plug, supervisory signaling apparatus connected with said circuit, a central source of current associated with said line and circuit to furnish current for talking purposes and for the operation of said supervisory apparatus, and means actuated over a portion of the cord circuit for automatically connecting said line contact with said limb when the line is in use and for disconnecting the same therefrom when the line is not in use, a ringing circuit including both sides of the subscriber's line in series, said supervisory signal means comprising an armature, an energizing circuit for causing the attraction of said armature, said energizing circuit including both sides of the telephone line, and a line signal adapted to be retired if the calling subscriber hangs up his receiver before the operator answers the call.

18. The combination with a telephone line having a limb extending to the central station, of a signaling device normally connected with said limb, a line contact for said limb normally disconnected therefrom, a cord circuit and connecting plug, supervisory signaling apparatus associated with said cord circuit, a central battery to furnish current for talking purposes and for the operation of said apparatus, and a relay energized from said battery and connected directly to the cord circuit and adapted to disconnect said limb from said signaling device and to connect the same with the line contact when a connection is established with the line, a ringing circuit including both sides of the subscriber's line in series, said supervisory signal means comprising an armature, an energizing circuit for causing the attraction of said armature, said energizing circuit including both sides of the telephone line, and a line signal adapted to be retired if the calling subscriber hangs up his receiver before the operator answers the call.

19. The combination with a telephone line

having a limb extending to the central station, of a spring or moving part with which said limb connects at the central office, a signaling device connected with said spring or part in its normal position, a line contact for said limb, a cord circuit and connecting plug, a central battery associated with the said line circuit, supervisory signals also associated with the circuit, said battery being adapted to furnish current to the substations for talking purposes and for operating said supervisory signals, and a relay also energized from said battery over a circuit including a portion of the cord circuit and adapted to disconnect said spring or part from the signaling device and to connect it with the line contact when a connection is established with the line, a ringing circuit including both sides of the subscriber's line in series, said supervisory signal means comprising an armature, an energizing circuit for causing the attraction of said armature, said energizing circuit including both sides of the telephone line, and a line signal adapted to be retired if the calling subscriber hangs up his receiver before the operator answers the call.

20. The combination of a subscriber's line, a jack normally disconnected from the line, a relay for establishing connection between the line and said jack, a cord circuit and plug, a supervisory relay and a supervisory lamp associated with said cord circuit, and a battery for energizing both of said relays and lighting said lamp, the said first mentioned relay being energized over a path including said lamp the system being free

from ground connections at the subscriber's stations, whereby both sides of the subscribers' lines are used for signaling and ringing and talking purposes, and any calling subscriber's station receiving battery current at all times before the operator answers, or until the line circuit at such station is again opened, substantially as described.

21. In a central energy telephone system, the combination of a subscriber's line, a line contact normally disconnected from its allotted limb of said line, an operator's cord circuit, a battery connected with the cord circuit and adapted for supplying current to the line for talking purposes, a relay for establishing connection between said contact and its allotted limb of the line, and electrical connections for supplying energizing current to said relay over a path including a strand of the operator's cord circuit, a ringing circuit including both sides of the subscriber's line in series, said supervisory signal means comprising an armature, an energizing circuit for causing the attraction of said armature, said energizing circuit including both sides of the telephone line, and a line signal adapted to be retired if the calling subscriber hangs up his receiver before the operator answers the call.

Signed by me at Chicago, Cook county, Illinois, this 11th day of November, 1902.

HENRY P. CLAUSEN.

Witnesses:

WM. A. HARDERS,
HARRY P. BAUMGARTNER.