F. W. DUNBAR.

CENTRAL ENERGY TELEPHONE SYSTEM

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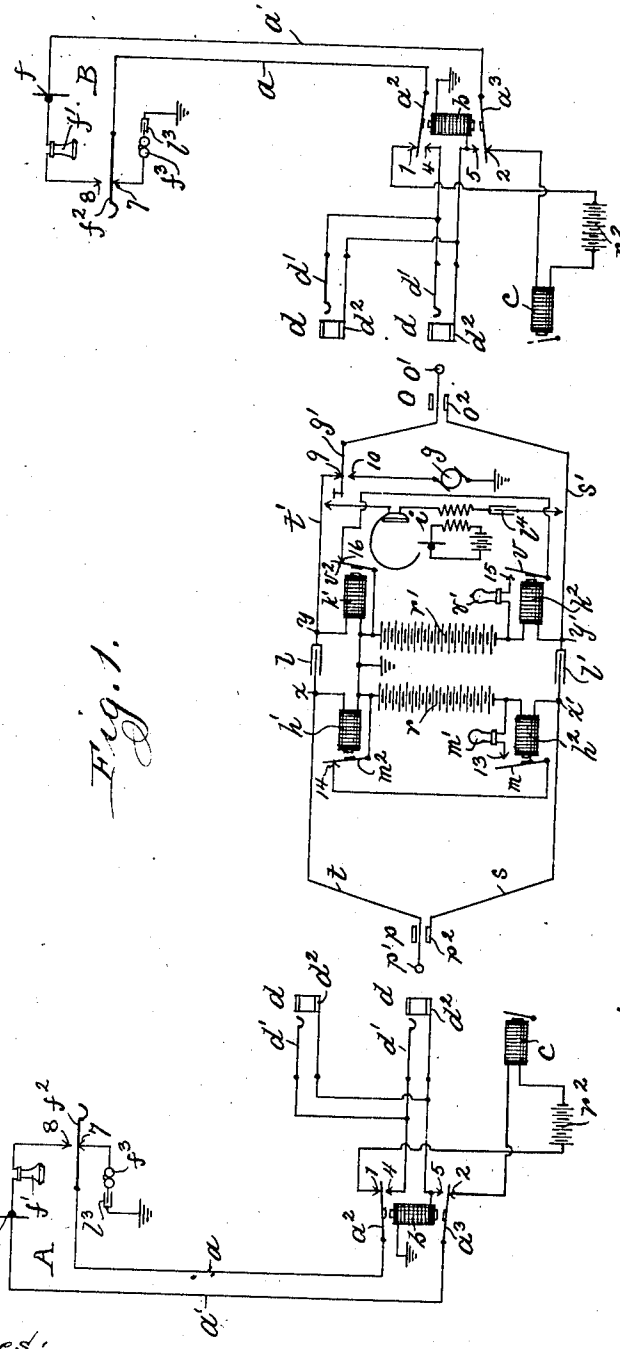

Fig. 1.

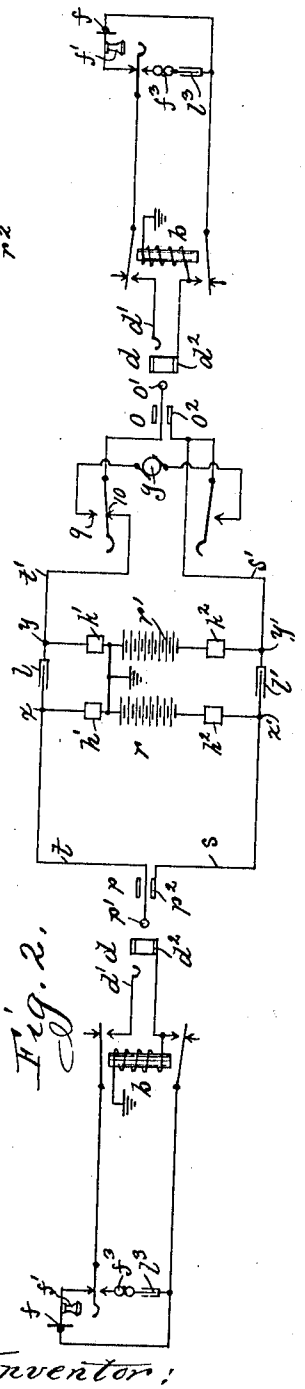

Fig. 2.

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CENTRAL-ENERGY TELEPHONE SYSTEM.

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To all whom it may concern:

Be it known that I, FRANCIS W. DUNBAR, citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Central-Energy Telephone Systems, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to a central energy telephone system, my object being to provide an improvement upon the telephone system disclosed in my Patent No. 686,272, dated Nov. 12th, 1901. In said patent I have shown the connection terminal normally disconnected from the telephone line and adapted to be connected therewith, when connection is made with the line, through the agency of a relay. I have shown also a relay employed for the additional function of disconnecting the individual annunciator from the line when connection is made therewith. In my Reissue Patent No. 12,031 dated September 12th, 1902, I have shown means for energizing said relay by sending current over a portion of the talking circuit through the main contacts of the connection terminal and the connecting plug. In said patent last above mentioned, I have illustrated a specific form of my invention wherein the winding of the relay is bridged between the limbs of the talking circuit, the relay being energized by a current from the charging source adapted to traverse a metallic circuit including portions of the two talking limbs.

In accordance with the present invention, I provide means whereby the circuit for energizing the relay comprehends a portion of the talking circuit with return through a third conductor, as, for instance, the ground, common return, or other suitable path, the present invention in this respect being a species under the generic invention disclosed in my patent last above mentioned.

Another feature of the present invention consists in the clearing out apparatus at the central station. I employ two relays one under the control of the subscriber's switch and the other under the control of a switch at the central station, as, for instance, the operator's plug, the two relays conjointly acting to control the lamp or other clearing out signal. In the present invention I provide two separate relays adapted to conjointly control the circuit through the supervisory signal, one of the relays serving when energized to open the circuit through the supervisory signal and the other serving when energized to close the said circuit. Accordingly, when the charging current traverses both relays the circuit of the signaling device will be open so that during conversation the supervisory signal remains unactuated. When it is desired to actuate the supervisory signal, current is sent through the relay which is adapted, when energized, to close the local circuit and the circuit of the other relay coil, is opened; in this manner the local circuit through the supervisory signal is closed and the supervisory signal is thereby actuated.

I have illustrated my invention in the accompanying drawing in which:—

Figure 1 is a diagram illustrating two subscribers' lines and the central station apparatus for uniting the same for conversation. Fig. 2 is a similar diagram showing a modification in which the ringing currents are sent over metallic circuit.

Like letters refer to like parts in the several figures.

The telephone line A extends in two limbs, a, a', to the central station, where the same terminate, respectively, in the springs, a^2, a^3, the spring, a^2, normally resting against contact, 1, and the spring, a^3, normally resting against contact 2. Between the contacts, 1 and 2, are connected the individual annunciator or signal controlling relay, c, and a battery, r^2, the springs, a^2, and a^3, carrying armatures adapted to be attracted by the relay magnet, b, one end of the winding of said relay magnet being grounded, while the opposite end is connected with contact, 5, and with the sleeves, d^2, d^2 of the connection terminals, d, d. The spring, a^3, when attracted, by the relay, is adapted to engage contact, 5, and likewise, the spring, a^2, is adapted to engage contact, 4, which latter contact is connected with the line springs, d', d'.

At the substation are provided the usual microphone, f, receiver, f', and switch hook, f^2, normally resting against contact, 7, and adapted, when the receiver is removed,

to engage contact, 8. Contact 7 is connected through bell, f^3, and condenser, l^3, to ground. The condenser, l^3, may be omitted if no extraneous currents, such as earth currents, are encountered of sufficient magnitude to interfere with the correct operation of relays h' and k', as hereinafter described.

The telephone line B shown upon the right of the drawing is provided with the same apparatus and circuits as line A, and like parts have been indicated by the same reference letters.

The answering plug, p, is provided with a tip, p', and a sleeve, p^2, the former being connected with strand, t, and the latter with strand, s. The calling plug, o, is provided with a tip, o', and a sleeve, o^2, the former being connected with strand, t', and the latter with strand, s'. The strands t, and t', are united through condenser, l, and the strands, s, and s', are united through a condenser, l'. Between the strands, t, and s, relays, h', and h^2, are provided, a battery, r, being interposed between said relays. Between the strands, t', and s', relays, k' and k^2, are connected, a battery r', being interposed between said relays. The relay, h', controls spring, m^2, normally resting against contact, 14, and adapted, when energized, to separate said contacts, m^2 and 14. The relay, h^2, controls spring, m, and is adapted, when energized, to move the same against contact 13. The relay contacts are connected in circuit with lamp, m' and battery, r. Relay k', controls contacts, v^2, and 16, and relay, k^2 controls contacts, v, and 15, and said contacts are included with the lamp v', in circuit with battery, r'.

The ringing key, g', normally engages contact, 9, and is adapted to engage contact 10, connected through generator, g, to ground. The operator's telephone set, i, is adapted to be connected between the strands, t', and s', and a condenser, l^4, is connected in circuit therewith.

If subscriber A desires to converse with subscriber B, he removes his telephone receiver from the hook, thereby closing circuit of battery, r^2, through indicator, c, over the limbs, a, a', of the telephone line. The relay is thus actuated to convey to the operator the signal for connection. The operator lifts answering plug, p, and inserts the same in the connection terminal belonging to line A, the circuit of battery, r, is thus closed from ground, over strand, s, sleeve, p^2, sleeve, d^2, and through relay, b, to ground. The relay is thereby actuated and attracts springs, a^2, and a^3, disconnecting the same from contacts, 1, and 2, respectively, and moving the same into contact, respectively, with contacts, 4, and 5. The individual annunciator, c, is in this manner disconnected from the circuit, and the connection terminals are connected with the limbs of line A. Circuit of battery, r, is also closed over strands, s, t and limbs, a a' of substation A. The operater then connects her telephone set, i, in circuit, and learning that connection is desired with subscriber B, she lifts calling plug, o, and touches the tip thereof to the sleeve d^2, belonging to line B. If she hears a click in her telephone, she will know that line B is busy and that a connection is made therewith at another board. If she hears no click she will know that the line is idle. If the line B is connected for conversation at another board, the sleeve d^2 will be connected with a source of electricity and will thus be charged to a difference of potential relatively to the earth or central office common return. Accordingly, when the tip of the calling plug is touched to the sleeve, d^2, currents will flow over the strand, t', and through the relay, k', to ground. The making and breaking of the circuit through the tip of the plug will cause a current of self induction in the windings of relay, k', which will traverse the operator's telephone set to produce the click in her telephone.

Assuming that the operator finds the line of subscriber B to be idle, she inserts the calling plug, o, into the connection terminals belonging to line B. The circuit of battery, r', is thereby closed from ground over strand, s', sleeve, o^2, sleeve, d^2, through relay, b, to ground. The relay is thus energized and connects the connection terminals of line B with the limbs of the telephone line. The operator then depresses ringing key, g', thereby sending current from generator, g, through tip, o', line spring, d', contacts, 4 and a^2, and limb, a, through the bell of line, B, to ground. Since the ringing key, g', is inserted in the tip strand, and the tip strand alone is opened in ringing, the circuit of battery r', over the sleeve strand and through the relay is not affected. Consequently, the sending of a ringing current does not interfere with the passage of the current from battery, r', through the relay of the called subscriber.

During conversation variations of resistance caused by the microphone of subscriber A produce a corresponding variation of the difference of potential between the points, x, and x', and correspondingly varying currents are thereby caused to pass to substation B. Likewise, the microphone at the substation B varies the difference of potential between the points, y, and y', thereby propagating correspondingly varying currents which pass to substation A.

When the answering plug is inserted in the connection terminal belonging to the calling subscriber, the circuit of battery, r, is closed through relays h', and h^2, over strands, t, and s, and limbs, a, and a'. Current is also closed from ground through bat-

tery, r, relay, h^2, strand, s and relay, b, to ground. Both of the relays are thereby energized and contacts, m, and 13, are closed together, while the contacts, m^2 and 14 are separated. The circuit of battery, r, through lamp, m', is thereby opened during conversation. Likewise, the insertion of the calling plug in the connection terminal of the called subscriber closes circuit of battery, r', through relays, k', and k^2, and over strands, t', and s', and the limbs, a, and a', of the called subscriber. Current from battery, r', also passes through relay, k^2, and relay, b, to ground. The circuit through lamp, v', is thus opened. When the subscribers have completed their conversation and desire disconnection they hang up their respective telephone receivers. Thus, when subscriber A hangs up his telephone receiver, the circuit of battery, r, through relay, h', is opened, and the relay, h', is thus deënergized permitting contacts, m^2 and 14 to close together. The circuit of battery, r, remains closed through relay, h^2, its circuit being traced from ground through battery, r, relay, h^2, strand, s, relay, b, to ground. Relay, h^2, being thus energized, contacts, m, and 13, are held together, and the circuit of battery, r, is thus completed through lamp, m', thereby lighting the same, to convey to the operator the signal for disconnection. In a similar manner, the lamp, v', is lighted when subscriber B hangs up his telephone receiver. Should either of the subscribers desire a reconnection with another party, he may, by vibrating his switch hook cause the intermittent lighting of the lamp belonging to his line to convey to the operator the signal for a new connection.

It will be noted that relays, h', and k', are under the control of the respective subscribers, while relays, h^2 and k^2, are under the control of the operator. Circuit is closed through relay, h^2, by the insertion of answering plug, p, and is opened by the withdrawal thereof; likewise, relay, k^2, is under the control of calling plug, o. Relay, h', is actuated by subscriber A through his switch hook and relay k', by subscriber B through his switch hook. Each subscriber thus has two relays, one under the control of the operator and the other under the control of the subscriber and the lamp circuit is controlled by the conjoint action of the two relays.

In Fig. 2 I have illustrated a modification of my invention in which the calling currents are adapted to be sent over the metallic talking circuit; the circuit arrangements are similar to those shown in Fig. 1, except that the bell, f^3, at the substation is adapted to be bridged with a condenser b^3, between the limbs, a, a', while the generator, g, at the central station is adapted to be bridged between the strands, t', and s'. The contacts of the ringing key, associated with strands, s', are adapted to maintain the continuity of the circuit of battery, r', over the sleeve strand and through the relay, b. When, therefore, the ringing key is depressed to bridge the generator, g, between the terminals of the calling plug, the circuit of battery, r', from ground, through strand, s', and through relay, b, to ground is not interrupted.

It will be understood of course, that the indicators or annunciators may be replaced by any other form of signal controlling electromagnets without departing from the spirit of my invention. The telephone lines are free from constant grounds at the substations thus doing away with an objectionable feature of some systems.

Having described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a telephone system, the combination with a telephone line, of a line signal therefor, a cord circuit, a magnet to render said signal inoperative during a connection, and a central source of current adapted to furnish current over the telephone line for talking purposes, said magnet being operated from said source during the connection by current over a path including a portion of the cord and talking circuit and a third conductor, substantially as described.

2. In a telephone system, the combination with a telephone line, of a line signal therefor, a cord circuit, an electro-magnetic device actuated when a connection is established with the line to render said signal inoperative, and a central source of current included in the metallic telephone line to furnish current for talking and for the operation of said magnet, the actuating winding of said magnet being connected during conversation between one side of the talking circuit and a third conductor and energized by current over a strand of the cord circuit, substantially as described.

3. In a telephone system, the combination with a telephone line, of a line signal therefor at the central office, a magnet to render said signal inoperative when a connection is established with the line, a cord circuit to establish conversational circuits with the line, and a source of current associated with the cord circuit and adapted to be included in the metallic telephone line to furnish current for conversational purposes, said magnet being actuated by current from said source over one side of the cord circuit with return including a third conductor, said side of the cord circuit being included in the established conversational circuit, substantially as described.

4. In a telephone system, the combination with a telephone line, of a line signal therefor at the central office, a magnet to render

said signal inoperative during connections, a cord circuit, and a source of current associated with the line and cord circuit and adapted to be included in the metallic line during conversation, said magnet being actuated by current from said source flowing over one side only of the cord circuit with suitable return, said side of the cord circuit being included in the talking circuit, substantially as described.

5. The combination with a telephone line extending in two limbs to the central office, of a relay actuating winding adapted to be connected during a connection between one of said limbs and a third conductor, a source of talking current at the central station, adapted to be connected during conversation between said third conductor and the limb with which said relay winding is connected and to send current through said relay winding over a circuit including a portion of the talking circuit of the telephone line and cord circuit, substantially as described.

6. The combination with a telephone line extending in two limbs to line contacts at the central station, of a relay actuating winding connected between one of said limbs and a third conductor, a cord connector terminating in connecting plugs, a charging source of electricity at the central station connected between said third conductor and one strand of the cord connector and adapted to be included in the metallic circuit of the line, and to send current through said relay winding over a circuit including one of the main terminals of the connecting plug, a portion of the cord circuit, and a line contact of the telephone line, substantially as described.

7. The combination with a telephone line extending in two limbs to the central station, of a line signal controlling electro-magnet therefor, a relay for rendering the line signal inoperative and having its winding connected during conversation between one of said limbs and a third conductor, a source of current at the central office adapted to be included in the metallic circuit of said line, and means for closing circuit from said source through said relay winding over a portion of the talking circuit of the telephone line and cord circuit when connection is made with the line, substantially as described.

8. The combination with a telephone line extending in two limbs to the central station, of a connection terminal normally operatively disconnected from said line, a relay for connecting said connection terminal with the line and having its winding connected between one of said limbs and a third conductor, a source of current at the central office adapted to be included in the metallic circuit of said line to furnish current to the substations for talking, and means for closing circuit through said relay winding over a portion of the talking circuit when connection is made with the line, substantially as described.

9. The combination with a telephone line extending in two limbs to the central station, and having line contacts thereat, of a relay actuating winding adapted to be connected between one of said limbs and a third conductor, a cord connector at the central station terminating in connecting plugs, a charging source of electricity adapted to be bridged between the strands of said cord connector and having one pole connected with said third conductor and adapted to send current through said relay winding over a circuit including said third conductor and a portion of the talking circuit, substantially as described.

10. The combination with a telephone line and a connection terminal therefor having two contacts each normally operatively disconnected from the line, of a third conductor, a signal controlling electro-magnet normally connected with said line, a relay for disconnecting said electro-magnet from the line, a cord circuit terminating in a connecting plug, a source of electricity connected with a main terminal of the plug, and means for closing the circuit of said source through the winding of said relay when connection is made with the line, said relay winding circuit including said main terminal of the connecting plug, and a line contact of the telephone line, with return through said third conductor, substantially as described.

11. The combination with a telephone line and a connection terminal therefor, of a third conductor, a signal controlling electro-magnet normally connected with the said line, a relay for disconnecting said electro-magnet from the line, a cord circuit terminating in a connecting plug, a source of electricity adapted to be bridged across the metallic circuit of the line for talking purposes, and means for closing the circuit of said source through the winding of said relay when connection is made with the line, said relay winding circuit including a talking strand of the cord circuit, a main terminal of the connecting plug, a line contact and a portion of a talking limb of the telephone line, with return through said third conductor, substantially as described.

12. In a telephone system, the combination with a multiple switchboard telephone line, of a line signal therefor, a cord circuit, an electro-magnet actuated when a connection is established with the line for conversational purposes to render said signal inoperative, a central source of current included in the metallic line to furnish current for talking and for the operation of said magnet, the actuating winding of said magnet being connected during conversa-

tion between one side of the talking circuit and by means of an extra conductor with one pole of said source, the circuit of said actuating winding including a part of the cord circuit, substantially as described.

13. In a telephone system, the combination with a multiple switchboard telephone line, of a line signal therefor, a cord circuit, an electro-magnet actuated when a connection is established with the line for conversational purposes to render said signal inoperative, a central source of current included in the metallic line to furnish current for talking and for the operation of said magnet, the actuating winding of said magnet being connected on one side to the telephone line and on the other side to an auxiliary conductor leading to one pole of said source, the circuit of said actuating winding including a part of the cord circuit, substantially as described.

14. In a telephone system, the combination with a multiple switchboard telephone line, of a line signal therefor, a cord circuit, an electro-magnet actuated when a connection is established with the line for conversational purposes to render said signal inoperative, a central source of current included in the metallic line to furnish current for talking and for the operation of said magnet, the actuating winding of said magnet when a connection is established and the subscriber's telephone is not in use being included in a local circuit with said source, said local circuit including a portion of one side of the talking and cord circuit and an auxiliary conductor, substantially as described.

15. In a telephone system, the combination with a multiple switchboard telephone line, of a line signal therefor, a cord circuit, an electro-magnet actuated when a connection is established with the line for conversational purposes to render said signal inoperative, a central source of current included in the metallic line to furnish current for talking and for the operation of said magnet, the actuating winding of said magnet being connected during conversation directly between one side of the talking circuit and one pole of said source outside the talking circuit, the other pole of said source being connected with one side of the talking and cord circuit, substantially as described.

16. In a telephone system, the combination with a multiple switchboard telephone line, of a line signal therefor, a cord circuit, an electro-magnet actuated when a connection is established with the line for conversational purposes to render said signal inoperative, a central source of current included in the metallic line to furnish current for talking and for the operation of said magnet, the actuating winding of said magnet under certain conditions of use being included in a local circuit with said source of current and including a portion of one side only of the talking circuit and a part of the cord circuit, substantially as described.

17. In a telephone system, the combination with a multiple switchboard telephone line, of a line signal therefor, a cord circuit, an electro-magnet actuated when a connection is established with the line for conversational purposes to render said signal inoperative, a metallic line circuit including said line established upon said connection, a central source of current included in the metallic line to furnish current for talking and for the operation of said magnet, the actuating winding of said magnet being connected during conversation on one side with one side of the metallic line and on the other side by means of an auxiliary conductor with one pole of said source, the other pole of said source being connected with one side of the cord circuit to send current through said actuating winding over a part of the cord circuit, substantially as described.

18. The combination with a telephone line extending in two limbs to the central station, of a relay actuating winding adapted to be connected between one of said limbs and a third conductor, a cord circuit, a charging source of electricity at the central station adapted to be connected between the third conductor and said limb through the medium of the cord circuit to send current through said relay winding, said source also being connected in the metallic circuit to furnish current for talking purposes, a calling generator at the central station, and means for sending calling current therefrom over the line of the called subscriber only, and at the same time maintaining said relay in operated condition, substantially as described.

19. The combination with a telephone line extending in two limbs to the central station, of a relay actuating winding adapted to be connected between one of said limbs and a third conductor, a cord circuit, a charging source of electricity at the central station adapted to be connected by means of the cord circuit between the third conductor and said limb to send current through said relay winding, said source also being connected in the metallic circuit to furnish current for talking purposes, a calling generator at the central station, and means for sending calling current therefrom over the line of the called subscriber only and at the same time maintaining said relay operated from said charging source, substantially as described.

20. The combination with a telephone line extending in two limbs to the central station, of a relay actuating winding adapted to be connected between one of said limbs and a third conductor, a cord circuit, a charging

source of electricity at the central station adapted to be connected by the cord circuit between the third conductor and said limb to send current through said relay winding, said source also being connected in the metallic circuit to furnish current for talking purposes, a calling generator at the central station, a ringing key for connecting said calling generator with the line of the called subscriber and for opening one of the limbs of the line, whereby the calling current reaches the called subscriber only and the said relay is maintained operated during calling, substantially as described.

21. The combination with a telephone line extending in two limbs to the central station, of a relay actuating winding adapted to be connected between one of said limbs and a third conductor, a cord circuit, a charging source of electricity at the central station adapted to be connected by means of the cord circuit between the third conductor and said limb to send current through said relay winding, said source also being connected in the metallic circuit to furnish current for talking purposes, a calling generator at the central station, a ringing key for connecting said calling generator with the line of the called subscriber and for opening the second limb of the line, whereby the calling current reaches the called subscriber alone and the said relay is maintained operated during calling, substantially as described.

22. The combination with a telephone line extending in two limbs to the central station, of a relay actuating winding adapted to be connected between one of said limbs and a third conductor, a cord circuit, a charging source of electricity at the central station adapted to be connected between the third conductor and said limb through the medium of the cord circuit to send current through said relay winding, said source also being connected in the metallic circuit to furnish current for talking purposes, a calling generator at the central station, a ringing key for connecting said calling generator with the line of the called subscriber and for opening the second limb of said line, the first limb remaining closed during said operation of the ringing key, whereby a calling current is prevented from reaching the calling subscriber and the relay is maintained operated during calling, substantially as described.

23. The combination with a telephone line extending in two limbs to the central station, of a relay actuating winding adapted to be connected between one of said limbs and a third conductor, a cord circuit, a charging source of electricity at the central station adapted to be connected between the third conductor and said limb by means of the cord circuit to send current through said relay winding, said source also being connected in the metallic circuit to furnish current for talking purposes, a calling generator at the central station, and means for sending calling current therefrom over the other limb of the telephone line with suitable return, substantially as described.

24. The combination with a telephone line extending in two limbs to the central station, of a relay actuating winding adapted to be connected between one of said limbs and a third conductor, a charging source of electricity adapted to be bridged between the two limbs at the central station and having one pole connected with said third conductor and adapted to send current through said relay winding, a bell or signaling device at the substation connected between the opposite limb of the telephone line and the third conductor, a calling generator at the central station, and a ringing key for connecting said calling generator with said opposite limb and for disconnecting said charging source from said opposite limb, substantially as described.

25. In a telephone system, the combination with a telephone line, a source of current to furnish current for talking, a cord circuit, a line signal for the line, an electromagnetic device to render the signal inoperative during a connection and operated by current from said source over a portion of the cord and talking circuit, and means for sending a non-continuous ringing current out over the called line only and without interrupting the flow of continuous current from said source through said device, substantially as described.

26. In a telephone system, the combination with a telephone line, a source of current to furnish current for talking, a cord circuit, a line signal for the line, an electromagnet to render the signal inoperative during a connection and actuated by current from said source over a portion of the cord and talking circuit, and means for sending a non-continuous ringing current out over the called line only and without interrupting the path of current from said source through said electro-magnet, substantially as described.

27. The combination with a telephone line, of a line signal therefor, an electromagnet adapted to render said signal inoperative during a connection, a cord circuit, a source of current connected with the line to furnish current to the substation for talking purposes and for the operation of said electro-magnet, the circuit through said electro-magnet having a portion coincident with the cord and talking circuit, and means for maintaining said electro-magnet actuated from said talking source during the time the wanted subscriber is being called, substantially as described.

28. The combination with a telephone

line, of a line signal therefor, a magnet adapted to render said signal inoperative during a connection, a cord circuit, a source of current connected with the line to furnish current to the substation for talking purposes and for the operation of said magnet, the circuit through said magnet being completed over a portion of the cord and talking circuit, and means for maintaining said magnet actuated by current from said source and for simultaneously sending a non-continuous ringing current out over the called line to call the subscriber, substantially as described.

29. The combination with a telephone line, of a line signal therefor, a magnet adapted to render said signal inoperative during a connection, a cord circuit, a source of current connected with the line to furnish current to the substation for talking purposes and for the operation of said magnet, the circuit of said magnet being completed over a portion of the cord and talking circuit, and means for maintaining said magnet actuated by current from said source and for simultaneously sending a non-continuous ringing current out over the called line only to call the subscriber, substantially as described.

30. The combination with a telephone line, of a line signal therefor, a magnet to render said signal inoperative during connections, a cord connector for uniting said line with another telephone line, a source of continuous current adapted to be connected with said cord connector to send current through said magnet and over the telephone line 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 without disconnecting said source while the calling generator is in circuit, whereby said magnet is energized from said source while the subscriber is being called, substantially as described.

31. The combination with a telephone line, of a connection terminal normally disconnected therefrom, a signal for the line, a magnet for connecting said connection terminal with the line and for rendering said signal inoperative, a source of continuous current connected in the line to furnish current for talking purposes and adapted to energize said magnet over a circuit having a portion coincident with the talking circuit, a calling generator, a ringing key adapted to connect said calling generator with the line, and means for maintaining said magnet energized from said source during the time the calling generator is connected in circuit, substantially as described.

32. The combination with a telephone line, of a connection terminal normally in inoperative relation with the line, a signal in operative relation therewith, a magnet for placing said connection terminal in operative relation with the line and for rendering said signal inoperative, a source of continuous current adapted to energize said magnet over a circuit including a portion of the talking circuit and to also furnish current over the line for talking purposes, a ringing key adapted to connect said calling generator with the line and to open the metallic circuit to the calling telephone line whereby a calling subscriber is not disturbed, and means for energizing said magnet from said source during the time the calling generator is in circuit, substantially as described.

33. 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 cord circuit, a steady current source to furnish current for talking and for operating said magnet over a portion of the cord and talking circuit, a ringing generator adapted to be connected with the line to call the wanted subscriber, the current from said source serving to maintain said magnet operated during ringing, substantially as described.

34. The combination with a telephone line, of a connection terminal normally disconnected therefrom, a magnet for connecting said connection terminal with the line during connections, a central source of current adapted to be connected in the metallic circuit for talking purposes, means for operating said magnet from said source when connection is made with the line by current flowing over a path including a portion of the talking circuit, and means for sending a calling current over the line of the called subscriber only and at the same time maintaining said magnet in operative condition by current from said source, substantially as described.

35. The combination with a telephone line, of a connection terminal normally disconnected therefrom, a magnet for connecting said connection terminal with the line, a source of continuous current adapted to be included in the metallic line for conversation, a calling generator, said talking source being adapted to energize said relay over the talking circuit when connection is made with the line, a ringing key for connecting said calling source with the line of a called subscriber without disconnecting said continuous current source, whereby said magnet is energized from said source during the time the calling generator is connected with the line, substantially as described.

36. In a telephone system, the combination with a telephone line, of a source of current and a relay bridged between the two limbs of the talking circuit thereof at the central office, a second relay in a local circuit at the

central station, said local circuit having a portion co-incident with the talking circuit, and a signal controlled by the conjoint action of said relays, substantially as described.

37. In a telephone system, the combination with a telephone line, of a charging source of electricity and a relay connected with the tip strand of the cord circuit whereby the same is adapted to be operated over the telephone line, a second relay at the central office connected with the sleeve and talking strand of the plug circuit and adapted to be closed in a local circuit during conversation, whereby the same is operated as long as the plug is in the jack, and a signal in a local circuit including the contacts of both said relays, substantially as described.

38. In a telephone system, the combination with a telephone line, of a source of current and an electro-magnet bridged between the two limbs of the talking circuit thereof, a second-electro-magnet and means for energizing it over a circuit having a part co-incident with the talking circuit, a switch at the substation and a switch at the central station for controlling the circuit through said electro-magnets, and a supervisory signal controlled by the joint action of said electro-magnets, substantially as described.

39. In a telephone system, the combination with a telephone line, a line signal, a cut-off relay to render the signal inoperative, a cord circuit and source of current associated with the line, of a supervisory signal associated with said cord circuit, and means for establishing a path for current over one side of the talking circuit of said cord circuit to operate said cut-off relay and said supervisory signal, and a relay adapted to render the said signal inoperative and having its winding in a path for current over the other side of said cord circuit and telephone line, said relay being controlled by the subscriber, substantially as described.

40. In a telephone system, the combination with a telephone line and cord circuit adapted to connect with said line, of a supervisory signal associated with said cord circuit and adapted to be operated by current in a local circuit including one side of said cord and talking circuit when connected with the line, and means controlled by the subscriber for rendering said signal inoperative by current passed over the line circuit, substantially as described.

41. In a telephone system, the combination with a telephone line and cord circuit adapted to connect with said line, of a supervisory signal associated with said cord circuit and adapted to be operated when a connection exists by current passed over one side of said cord and talking circuit and over a suitable office return and not under the control of the subscriber, and means under the control of the subscriber for rendering said signal inoperative by current passed over the line circuit, substantially as described.

42. In a telephone system, the combination with a telephone line, a cut-off relay and cord circuit adapted to connect with said line, of a supervisory signal associated with said cord circuit and adapted when a connection exists to be operated over a local circuit having a part co-incident with the talking circuit and not under the control of the subscriber, said local circuit including the actuating winding of said cut-off relay, and means under the control of the subscriber for rendering the said supervisory signal inoperative by current passed over the line circuit, substantially as described.

43. In a telephone system, the combination with a telephone line and a cut-off relay therefor, of a cord circuit adapted to be connected with said line, a supervisory signal associated with said cord circuit and adapted to be operated by current passing over one side of said cord and talking circuit when connected with the line, the actuating winding of the cut-off relay being included in the path of said current whereby it is operated, and means controlled by the subscriber for rendering said signal inoperative by current passing over the line circuit, substantially as described.

44. In a telephone system, the combination with a telephone line and cut-off relay therefor, of a cord circuit adapted to connect with said line, of a supervisory signal associated with said line circuit and adapted to be operated when a connection exists by current passing over one side of said cord and talking circuit and over a suitable office return and not under the control of the subscriber, the actuating winding of said cut-off relay being also included in the path of said current, and means under the control of the subscriber for rendering said signal inoperative by current passing over the line circuit, substantially as described.

45. In a telephone system, the combination with a subscriber's telephone and line circuit normally discontinuous or open to direct currents at the subscriber's station, of a main line terminal consisting of two normally open contact pieces at the central office, a cord circuit consisting of two strands and with contact terminals adapted to connect with the contact terminals of the line when the line is connected for conversation, a source of current associated with said cord circuit and adapted to send current over the telephone line to feed the subscriber's transmitter, a supervisory signal associated with said cord circuit and adapted to be placed in condition to operate over one side of said cord circuit when connected with the line, the circuit for operating said signal being completed over a local circuit at the central office, and means under the control of the

subscriber to render said signal inoperative by closing the line circuit at the subscriber's station to form a path for current over the line circuit, substantially as described.

46. In a telephone system, the combination with a main line normally open or discontinuous at the subscriber's station, of a telephone instrument at said subscriber's station, a calling signal normally associated with the line at the central office, a cut-off relay at the central office adapted to render the calling signal inoperative when connection is made with the line, a line terminal for the said line, a cord circuit consisting of two conductors each forming a part of the talking circuit and adapted to be placed in connection with the said line terminal, a source of current associated with said cord circuit and adapted to send current over the line circuit for energizing the subscriber's transmitter during conversation, a supervisory signal associated with said cord circuit and adapted to be placed in condition to operate when connection is made with said line over a local circuit including the cut-off relay or electro-magnet, said circuit not including the subscriber's instrument, and means controlled by the subscriber for rendering the said supervisory signal inoperative by current from the said source located in the cord circuit and sent over the line, substantially as described.

47. The combination with a telephone line, of a subscriber's station, a line terminal at the central office associated with said line, a cord circuit consisting of two conductors forming a part of each side of the talking circuit and adapted to be united to the said line circuit by means of registering contacts in the line terminal and cord terminal, a source of current and a supervisory signal associated with said cord circuit and adapted to be operated when connection is made with the line by means of an electro-magnet operated over a circuit established by the connection of the cord circuit with the line circuit, said circuit being local and not completed through the subscriber's instrument, and means under the control of the subscriber for rendering inoperative the said signal by current passed over the line circuit, substantially as described.

48. In a telephone system, the combination with a line circuit, of a subscriber's telephone, a line terminal at the central office consisting of two contacts registering with two contacts in a cord circuit when connection is made with the line, said cord circuit including a source of current for energizing the subscriber's transmitter, a supervisory signal associated with said cord circuit and adapted to be placed in condition to operate by current over one side of the cord and talking circuit when connection is made with the line, said circuit being local and not under the control of the subscriber, and means for rendering the said signal inoperative by current sent over the main line, said flow of current being under the control of the subscriber, substantially as described.

49. In a telephone system, the combination with a subscriber's instrument, of a line circuit, a calling signal and a cut-off relay, said relay being adapted to render the line signal inoperative when a connection is made with the line, a connection terminal for said line at the central office consisting of two contacts adapted to register with the two contacts of a cord circuit, said cord circuit including a source of current adapted to supply current for energizing the subscriber's transmitter, a supervisory signal associated with said cord circuit, said signal being placed in condition to operate when connection is made with a line and the subscriber's instrument is not in use by current flowing over one side of the talking circuit and in a circuit local to the exchange, said local circuit including an operative winding of the cut-off relay, means controlled by the removal of the subscriber's instrument from its hook for rendering said supervisory signal inoperative by current sent over the main line from said source, and further means for maintaining the cut-off relay operated while connection is made with the line, substantially as described.

50. In a telephone exchange system, the combination with a subscriber's telephone line, of a cutoff relay therefor, a cord circuit, a pair of magnetic windings and a source of current in bridge of the talking strands of said cord circuit, one of said windings and said cutoff relay being energized by current from said source over a portion of a talking strand of said cord circuit upon connection between said line and cord circuit, a supervisory signal for said cord displayed responsive to said energization of said winding and means under control of the subscriber to include the other winding and the line limbs in circuit with said source and first said windings whereby said other winding is energized to efface said signal.

51. In a telephone exchange system, the combination with a subscriber's telephone line of a cutoff relay therefor, a cord circuit, a pair of magnetic windings and a source of current in bridge of the talking strands of said cord circuit, a supervisory signal for said cord circuit, said cutoff relay and one of said windings being energized over a portion of one of the talking strands of the cord circuit, responsive to a connection between said line and cord circuit, whereby said signal is displayed, and means under the control of the subscriber to include said

telephone line and the other winding in circuit with the first said winding whereby said signal is effaced.

52. In a telephone exchange system, the combination with a subscriber's telephone line, of a cutoff relay therefor, a cord circuit, a magnetic winding and a source of current connected to a talking strand of the said cord circuit, said cutoff relay and said winding being energized over a portion of said talking strand responsive to a connection between said line and cord, a second magnetic winding connected to another talking strand of said cord and means under control of the subscriber to include the latter winding in circuit with the first said winding to render the latter winding effective.

53. In a telephone exchange system the combination with a subscriber's telephone line of a cutoff relay therefor, a cord circuit, a pair of magnetic windings and a source of current in bridge of the talking conductors of said cord, one of said windings and said cutoff relay being rendered effective by current from said source over a portion of one of the talking conductors of the cord, and means controlled by the subscriber to include the other winding and the telephone line in series with the first said winding and said source, whereby the said second winding is rendered effective.

54. In a telephone exchange system, the combination with a telephone line, of a cutoff relay therefor, a cord circuit, a signal for said cord, a source of current and a pair of magnetic windings in bridge of the talking conductors of said cord, a circuit connection for said relay and one of said windings, established over a portion of a talking strand of the cord responsive to connection between said line and cord, whereby said winding is rendered effective to display said signal, and a switch at the sub-station of said line operated to alter the circuit of said windings, whereby said second winding is rendered effective to efface said signal.

55. In a telephone exchange system, the combination of a telephone line, a cutoff relay therefor, a cord circuit, a signal for said cord circuit, a magnetic winding for controlling said signal, a source of current and a circuit connection closed during the connection of said cord circuit to said line whereby said cutoff relay and said winding are energized by current from said source over a portion of one of the talking strands of said cord circuit.

56. In a telephone exchange system, the combination of a line extending in two limbs to a sub-station, a cutoff relay therefor, a cord circuit, a signal for said cord circuit, two magnetic windings for controlling said signal, a source of current, a circuit connection closed during the connection of said cord circuit to said line whereby said cutoff relay and one of said windings are energized by current from said source over a portion of one of the talking strands of said cord circuit, and a switch at the substation for closing a circuit of said source including the two limbs of said line and both of said windings.

57. In a telephone exchange system, the combination with a sub-station telephone line, of a cutoff relay therefor, a cord circuit, a signal for said cord, a magnetic winding for controlling said signal, a source of talking current, a circuit connection, closed during a connection of said cord to said line whereby said cutoff relay and said winding are energized by current from said source over a portion of a talking strand of said cord circuit, a transmitter at said sub-station, and a switch at said sub-station adapted to connect said transmitter in circuit with said winding and said source to supply talking current to said transmitter through said winding.

58. In a telephone exchange system, the combination of a telephone line extending in two limbs to a sub-station, a cutoff relay therefor, a cord circuit, a signal for said cord circuit, two magnetic windings for controlling said signal, a source of talking current, a circuit connection closed during the connection of said cord circuit to said line whereby said cutoff relay and one of said windings are energized by current from said source over a portion of one of the talking strands of said cord circuit, a switch at the sub-station for closing a circuit of said source including the two limbs of said line and both of said windings, and a transmitter at said substation adapted to be included in the latter circuit, the talking current for said transmitter being supplied from said source over said windings and said line limbs.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

FRANCIS W. DUNBAR.

Witnesses:
JOSEPH C. BELDEN,
MELANCTHON R. NYMAN.