

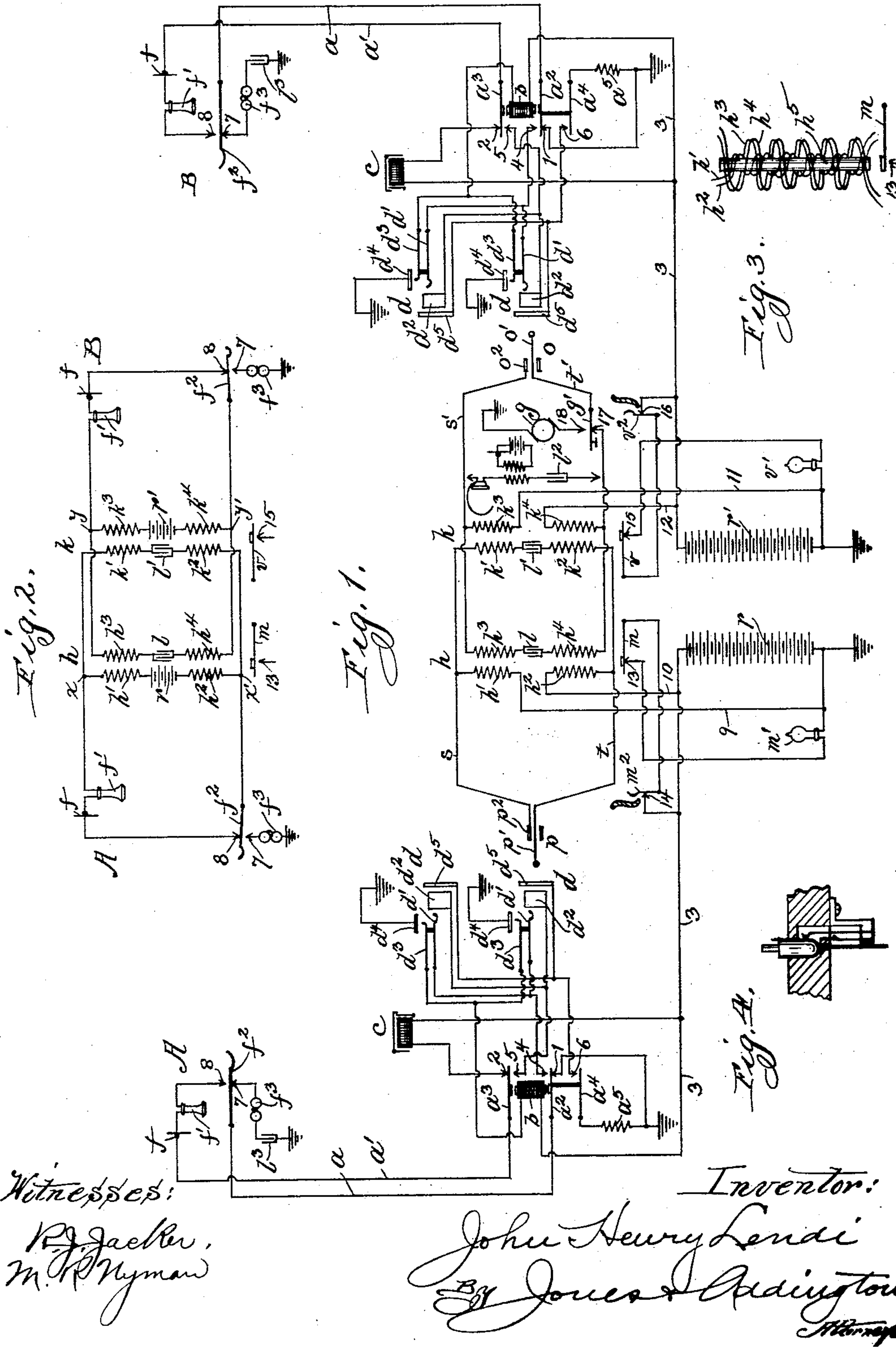
No. 751,797.

PATENTED FEB. 9, 1904.

J. H. LENDI.
CENTRAL ENERGY TELEPHONE SYSTEM.

APPLICATION FILED DEC. 19, 1900.

NO MODEL.



UNITED STATES PATENT OFFICE.

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CENTRAL-ENERGY TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 751,797, dated February 9, 1904.

Application filed December 19, 1900. Serial No. 40,403. (No model.)

To all whom it may concern:

Be it known that I, JOHN HENRY LENDI, a 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 drawings, forming a part of this specification.

My invention relates to a central-energy telephone system, my object being more particularly to provide an improved form of signaling apparatus at the central station.

My object, moreover, is to provide an improved form of combined relay and repeating-coil.

I have hereinafter illustrated and described one specific embodiment of my invention for the purpose of illustrating the general principle underlying the same, and in accordance therewith I employ a pair of repeating-coils, the windings of the two coils being in parallel with each other. One pair of windings of each repeating-coil is adapted to be connected in circuit with one of two connected subscribers, while the remaining windings of the two repeating-coils are adapted to be connected with the other of the two connected subscribers. In order to make the repeating-coils perform the function of relays for operating the supervisory signals, I associate with the windings means whereby the magnetism of the core of one of the repeating-coils is under the control of one of the two connected subscribers, while the magnetism of the core of the other repeating-coil is under the control of the other of the connected subscribers. To accomplish this result, a condenser may be interposed in the circuit of one of the windings of each repeating-coil, whereby the core will be magnetized by the remaining winding alone. By placing one of these magnetized windings under the control of each of the connected subscribers the repeating-coils are individualized and may serve as relays for actuating the supervisory signals.

While I have illustrated my invention in con-

nection with one specific embodiment of the invention, it will be understood that the features of my invention are capable of other embodiments within the spirit of my invention, as more particularly set forth in the claims appended hereto.

I have illustrated my invention in the accompanying drawings, in which—

Figure 1 is a diagram showing the two telephone-lines and the cord-circuit for connecting the same for conversation. Fig. 2 is a diagram showing the talking-circuit. Fig. 3 is a diagram showing the manner of mounting the windings of the relays and repeating-coils upon a common core. Fig. 4 is a detail view of the plug-seat switch.

Like characters refer to like parts in the several figures.

The telephone-line A extends in two limbs a a' to the central station, where said limbs terminate, respectively, in the springs a^2 a^3 , the spring a^2 normally resting against back contact 1, which is connected to ground, the spring a^3 normally resting against back contact 2, which is connected through individual annunciator c to conductor 3. The springs a^2 and a^3 carry armatures resting opposite the poles of a relay-magnet b , and the spring a^2 when attracted is adapted to engage front contact 4, which is connected with the line-springs d' d' of the spring-jacks or switch-sockets d d . The spring a^3 is adapted when attracted to engage contact 5, which is connected with the sleeves d^2 d^2 of the spring-jacks. Moving with the spring a^2 , but insulated therefrom, is a spring a^4 , connected to ground through a resistance a^5 and adapted when the relay is energized to engage contact 6, which is connected with the test-rings d^5 d^5 . One end of the winding of relay b is connected with conductor 3 and the other end is connected with the contact-springs d^3 d^3 , which springs are mounted to move with, but insulated from, the line-springs d' d' , respectively. When the plug is inserted in the spring-jack, the line-spring d' is moved by the tip thereof to carry the spring d^3 into engagement with the grounded contact d^4 .

The subscriber is provided at the substation with the usual microphone f , receiver f' , and switch-hook f^2 , adapted when the line is not in use to engage contact 7, which is connected through bell f^3 and condenser l^3 to ground. When the telephone is removed from the hook, the hook engages contact 8, which is connected with the telephone transmitter and receiver. The telephone-line B (shown at the right of the drawings) is like the telephone-line A and is provided with the same parts and mechanism, and like parts have been indicated by the same reference-letters employed in connection with the line A.

The connecting mechanism at the central station comprises an answering-plug p and a calling-plug o , the tip p' of the plug p being connected with the tip-strand t , while the sleeve p^2 of the plug is connected with the sleeve-strand s . The tip o' of the plug o is connected with the tip-strand t' , while the sleeve o^2 is connected with the sleeve-strand s' . The plugs are joined together through two repeating-coils, the windings of which are in parallel with each other. Connected between the strands s and t are the windings h' and h^2 of the repeating-coil h and the windings k' and k^2 of the repeating-coil k . Between the strands s' and t' are included the windings h^3 and h^4 of the repeating-coil h and the windings k^3 and k^4 of the repeating-coil k . The battery r is connected between the windings h' and h^2 by means of conductors 9 and 10, while the battery r' is connected between the coils k^3 and k^4 by means of conductors 11 and 12. A condenser l is interposed between the windings h^3 and h^4 , and a condenser l' is interposed between the windings k' and k^2 . One pole of battery r is connected with the conductor 3, with which line A is in connection, and one pole of the battery r' is in communication with conductor 3, connected to line B. The opposite poles of the batteries r and r' are grounded.

The repeating-coils h and k in addition to their function as repeating-coils serve also as relays for actuating the supervisory signals. The relay h controls the supervisory signal, which is adapted to be actuated by the calling subscriber, while the relay k is adapted to control the supervisory signal actuated by the called subscriber. A spring m carries an armature situated opposite the pole of relay h , and this spring normally engages contact 13, which is connected through the supervisory lamp or signal m' with one pole of the battery r . The spring m is connected through the spring m^2 and contact 14 of a plug-seat switch to the opposite pole of the battery r . When the answering-plug is in the seat, the spring m^2 is moved out of engagement with contact 14 to open the circuit through the lamp m' , and when the plug is removed from the seat the spring m^2 and contact 14 rest in contact. Likewise a spring v carries an ar-

mature resting opposite the pole of relay k and normally engaging a contact 15, connected through lamp v' with one pole of battery r' . The spring v is connected with the opposite pole of the battery r' through spring v^2 and contact 16 of a plug-seat switch adapted to be actuated by the calling-plug o . As shown in Fig. 3, the windings h' h^2 and h^3 h^4 of the relay are wound upon a single core h^5 .

In the tip-strand t' a ringing-key g' is provided, normally resting against contact 17 and adapted when depressed to engage contact 18 to connect the grounded generator g in circuit with the tip o' of the calling-plug. The operator's telephone set is adapted to be bridged between the strands s' t' . A condenser l^2 is included in circuit therewith.

I will now describe the operation of making and disconnecting the connection between two subscribers: Supposing subscriber A desirous of conversing with subscriber B, he removes his telephone-receiver from the hook, thereby closing the circuit of battery r through the individual annunciator c belonging to line A. This circuit may be traced from battery r over conductor 3, annunciator c , contact 2, spring a^3 , limb a' , contact 8, hook f^2 , limb a , spring a^2 , contact l to ground, and thence to the grounded pole of battery r . Annunciator c is thus actuated to attract the attention of the operator, who thereupon removes the answering-plug p from its seat in the plug-seat switch and inserts the same in the spring-jack belonging to the subscriber A. The insertion of the plug p moves the spring d^3 into contact with contact d^4 , thus closing circuit of battery r from ground over conductor 3, through relay b , spring d^3 , contact d^4 to ground. The relay b is thus energized, attracting the armatures carried on springs a^2 and a^3 and moving said springs into engagement, respectively, with contacts 4 and 5. The annunciator c is thus disconnected from circuit, and the spring a^2 is connected with the line-spring d' of the spring-jack, while the spring a^3 is connected with the terminal sleeve d^2 of the spring-jack. The spring-jack terminals are thus connected with the limbs of the telephone-line. The circuit of battery r is closed through the limbs a a' of the telephone-line A, thus energizing the relay h and separating the contacts m and 13 to thus open the circuit through lamp m' to extinguish the same. The operator now lifts the calling-plug o from its seat, thereby closing together contacts v^2 and 16 and lighting the lamp v' . She then touches the tip o' of the plug o to the test-ring d^5 of the called subscriber. If the subscriber's line is in use, the relay b belonging thereto will be energized, thus closing spring a^4 into contact with contact 6, and a testing-circuit will thus be closed from battery r' through coil k^4 , tip-strand t' , tip o' , test-ring d^5 , contacts 6 and a^4 to ground and thence back to the battery. Since the telephone-receiver of the operator's

set is in circuit with the winding k^4 , the breaking of the circuit as the tip o' is removed from contact with the test-ring d^5 will cause a kick of self-induction to pass back through the operator's receiver, thereby causing a click which may serve as a test-signal. If the line is not in use and the relay b deenergized, the circuit will be opened between the contacts 6 and a^4 and no click will be heard in the operator's telephone. The operator hearing no click in her telephone when the line B is tested, and thus learning that the line is not busy, will insert the calling-plug o in the spring-jack belonging to line B and will thereupon depress ringing-key g' , and the current from generator g will pass from ground over strand t' and limb a of subscriber B to ground through his bell f^3 , thereby ringing the same. When subscriber B responds and lifts his receiver from the hook, the limbs a and a' will be closed together in metallic circuit, and the circuit through the battery r' will thus be closed through the coils $k^3 k^4$ of the relay k and through the strands $s' t'$ and the limbs $a a'$ of the telephone-line. The relay k will thus be energized, and the armature carried upon spring V will be attracted to separate contacts v and 15, and thereby open the circuit through the lamp v' , thus extinguishing the same. Upon the extinguishment of the lamp the operator will know that the subscribers are in conversation. During the conversation the lamps m' and v' remain extinguished. The talking-circuit is illustrated in diagram in Fig. 2. When subscriber A is talking and his microphone f is actuated to vary the resistance, the potential between the points x and x' is correspondingly varied. The coils $h' h^2$ and $k' k^2$ are thus subjected to varying currents, which induce corresponding currents in the secondaries $h^3 h^4$ and $k^3 k^4$, respectively, of the relays or repeating-coils $h k$. Likewise when subscriber B is talking the difference of potential between the points $y y'$ is varied, and the coils $h^3 h^4$ and $k^3 k^4$ act as the primaries, while the coils $h' h^2$ and $k' k^2$ act as the secondaries, of the repeating-coils. For talking purposes the two repeating-coils are thus in parallel with each other. Since, however, the repeating-coils are also to serve as relays, it is necessary to provide means whereby the relay h may be controlled by a switch at the substation A, while the relay k may be controlled by a switch at the substation B. For this purpose the condensers $l l'$ are employed, whereby the current from battery r' is prevented from affecting the core of relay h , while the current from battery r is prevented from affecting the core of relay k . In this manner each relay may be controlled from but one of the substations—that is, relay h from substation A, while the relay k may be controlled only from substation B. At the completion of the conversation one or both of the subscribers hang up their receivers, thus

lighting the lamps belonging to their respective lines. Thus when subscriber A hangs up his receiver the limbs a and a' are disconnected and the circuit of battery r through the windings $h' h^2$ is thus opened. The spring m thus falls back into contact with contact 13 to close the circuit through lamp m' . Likewise the hanging up of the receiver by subscriber B opens the limbs $a a'$ at the switch-hook, thereby opening the circuit of battery r' through the coils $k^3 k^4$ of relay k , which deenergizes said relay and closes the circuit through lamp v' . Seeing the lamps lighted, the operator knows that the subscribers are through conversing and withdraws the plugs p and o and returns the same to their respective seats. The return of the plugs to their respective seats separates the contacts of the plug-seat switches, thereby opening the local circuits through the lamps $m' v'$ and extinguishing the same. The relay and the plug-seat switch thus cooperate in controlling the clearing-out signal. The lamp of the calling subscriber is lighted upon the removal of the plug from its seat and is extinguished upon the insertion of the plug and the consequent energization of the relay. The lamp of the called subscriber is lighted upon the removal of the calling-plug from its seat and is extinguished when the called subscriber removes his receiver from the hook. The lamp is lighted when the subscriber hangs up his telephone at the completion of the conversation and is extinguished upon the return of the plug to its seat.

I disclaim herein the matter claimed in the patent to Francis W. Dunbar for telephone-switchboard systems, dated November 12, 1901, No. 686,272.

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

1. The combination with a pair of telephone-lines adapted to be connected together for conversation through the windings of a repeating-coil, of a source of electricity adapted to be connected in circuit with one of said windings, a switch at the substation for controlling the circuit of said source through said winding, a signaling device controlled by said winding, means for rendering the other winding opaque to the passage of an operative continuous current, and a signal-controlling electromagnet and separate source of current in circuit with the telephone-line connected with said latter-mentioned winding, substantially as described.

2. The combination with a pair of telephone-lines adapted to be united for conversation through a pair of repeating-coils having the corresponding windings thereof connected in parallel, of means for sending continuous current through one winding of each repeating-coil, means for rendering the other winding of each repeating-coil opaque to the passage of continuous currents, one of the windings

adapted to be traversed by continuous currents being in circuit with each telephone-line and switches at the substations for controlling the circuits through the respective windings
5 connected therewith, substantially as described.

3. The combination with a connecting-plug and a plug-seat switch, of a combined relay and repeating-coil, one winding of said re-
10 peating-coil being opaque to the passage of continuous currents, the other winding constituting the relay-winding, and a signaling device controlled by said relay and plug-seat switch, substantially as described.

4. The combination with a connecting-plug and the strands of a cord-connector, of a plug-seat switch, a combined relay and repeating-coil having one winding connected between
15 said strands, a charging source of electricity in circuit with said windings, means for rendering the other winding of the repeating-coil opaque to the passage of continuous currents, and a signaling device controlled by the ac-
20 tion of said relay and plug-seat switch, substantially as described.

5. The combination with a telephone-line, of a connecting-plug and strands connected therewith, a combined relay and repeating-coil having one winding connected between
25 said strands, a charging source of electricity in circuit with said winding, means for rendering the other winding opaque to the passage of continuous currents, a switch at the sub-
30 station for controlling the circuit of said source through the winding connected therewith, a plug-seat switch and a signaling device controlled by said relay and plug-seat switch, substantially as described.

6. In a telephone system, two repeating-
35 coils having their corresponding windings connected in multiple, one winding of each being opaque to continuous currents and the other winding of each including a source of current, substantially as described.

7. In a telephone system, the combination
40 with a pair of telephone-lines, a pair of repeating-coils to unite said lines for conversation, one winding of each coil connected in the circuit of each line, means to prevent the passage
45 of an operative continuous current through one winding of each coil while permitting the passage of voice-currents, the other winding of each coil permitting the passage of both
50 voice and continuous currents, a source of current included in the circuit of each line and the said latter winding, a switch at the sub-
55 station controlling the circuit of the source through said winding, and apparatus at the central office controlled by the magnetism of
60 said coils, substantially as described.

8. In a telephone system, the combination
with a pair of telephone-lines, a pair of repeat-
ing-coils to unite said lines for conversation,
one winding of each coil connected in the cir-
65 cuit of each line, a condenser in the circuit of

one winding of each coil to prevent the flow of continuous current therethrough while per-
mitting the passage of voice-currents, the other winding of each coil permitting the pas-
sage of both voice and continuous currents, a
70 source of current included in the circuit of each line and the said latter winding at the central office, a switch at the substation controlling the circuit of the source through said
75 winding, and signaling apparatus at the central office controlled by the said coils, substantially as described.

9. In a telephone system, the combination
with a pair of telephone-lines, a pair of repeat-
ing-coils to unite said lines for conversation,
80 one winding of each coil connected in the circuit of each line, means to prevent the passage of an operative continuous current through one winding of each coil while per-
85 mitting the passage of voice-currents, the other winding of each coil permitting the passage of both voice and continuous currents, a source of current included in the circuit of each line and the said latter winding, a switch
90 at the substation controlling the circuit of the said source through said winding, and signaling apparatus at the central office controlled by each said coil, substantially as described.

10. In a telephone system, the combination
95 with a pair of telephone-lines, of a pair of repeating-coils to unite said lines for conversation, one winding of each coil connected in the circuit of each line and in parallel therein,
100 one winding of each coil being opaque to the passage of continuous current but open to the passage of voice-currents, the other winding of each coil being open to both voice and continuous currents, a source of current at the central office included in the circuit of each
105 line, a switch at the substation of each line controlling the circuit of the said source through the said winding, and signaling apparatus at the central office controlled by the magnetism of each said coil, substantially as described.

11. In a telephone system, the combination
with a pair of telephone-lines, a pair of repeat-
ing-coils to unite said lines for conversation,
one winding of each coil connected in the
115 circuit of each line and in parallel therein, a condenser in the circuit of one winding of each said coil, the other winding of each coil being open to the passage of both voice and continuous currents, a source of current at the central office included in the circuit of
120 each line and the said latter winding, a switch at the substation in each line controlling the circuit of the said source through said winding, and signaling apparatus at the central office controlled by each said coil, substan-
125 tially as described.

12. In a telephone system, the combination
with a pair of telephone-lines, a pair of repeat-
ing-coils to unite said lines for conversation,
one winding of each coil connected in the cir-
130

cuit of each line and in parallel therein, a condenser connected in the middle of one winding in each coil, a source of current connected in the middle of the other winding of each coil, a switch at the substation of each line controlling the circuit of the said source through the said winding, and signaling apparatus at the central office controlled by each coil, substantially as described.

10 13. In a telephone system, the combination with a pair of telephone-lines, of a cord-circuit at the central office to unite said lines for conversation, a pair of repeating-coils in said circuit to inductively unite the two ends thereof, one winding of each coil connected in the circuit of each said end, a condenser in the path of current through one winding of each coil, a source of current connected with the other winding of each coil and adapted to be included in the metallic circuit of the telephone-line when a connection is established by the cord-circuit with the lines, a switch at each substation to control the flow of current over the metallic line, and supervisory-signaling apparatus controlled during connection by the said coils, substantially as described.

14. In a telephone system, the combination with telephone-lines, of a cord-circuit at the central office to unite said lines for conversation, a pair of repeating-coils to inductively unite the ends of said cord-circuit, one winding of each coil connected with each end of the cord-circuit and in parallel therein, a condenser connected with one winding of each coil to prevent the passage therethrough of continuous currents, a source of continuous current connected in the middle of each of the other windings of said coils and adapted to be included in the metallic talking-circuit when a connection is established and to furnish current over the connected lines for conversation, and a supervisory signal for each end of the cord-circuit controlled during a connection by the corresponding coil, substantially as described.

15. In a telephone system, the combination with telephone-lines, of a cord-circuit to loop said lines together for conversation, a pair of repeating-coils connected with said cord-circuit to inductively unite but conductively separate the two ends of the same, and a separate source of current connected with each end of the cord-circuit and adapted during a connection to furnish current over the corresponding telephone-line for conversation, said repeating-coils being organized to operate as electromagnets, substantially as described.

16. In a telephone system, the combination with telephone-lines, of a cord-circuit to loop said lines together for conversation, a pair of repeating-coils connected with said cord-circuit to inductively unite but conductively separate the two ends of the same, a separate source of current connected with each end of the cord-circuit and adapted during a connection

to furnish current over the corresponding telephone-line for conversation, said repeating-coils being organized to operate as electromagnets, and a supervisory signal for each end of the cord-circuit controlled by the said coils, substantially as described.

17. In a telephone system, the combination with telephone-lines, of a cord-circuit to loop said lines together for conversation, a pair of repeating-coils connected with said cord-circuit, a winding of each coil connected with each end of the cord-circuit, one winding of each relay being opaque to the passage of continuous current, a separate source of current connected with the other winding of each coil and adapted during a connection to be included in the corresponding telephone-line to furnish current thereover for conversation, said repeating-coils being organized to operate as electromagnets, and a supervisory signal for each end of the cord-circuit controlled during a connection by the corresponding coil, substantially as described.

18. In a telephone system, the combination with telephone-lines, of a cord-circuit to loop said lines together for conversation, a pair of repeating-coils connected with said cord-circuit, a winding in each coil being connected in each end of the cord-circuit and in parallel therein, a condenser in series with one winding of each coil, a separate source of current in series with the other winding of each coil and adapted to be included in the metallic talking-circuit established by the connection of the corresponding end of the cord-circuit with a telephone-line, said repeating-coils being organized to operate as electromagnets, and a supervisory signal for each end of the cord-circuit controlled by the corresponding repeating-coil, substantially as described.

19. In a telephone system, the combination with telephone-lines, of a cord-circuit to connect said lines together for conversation and having a plug at each end, a signal-controlling electromagnet for each end of the cord-circuit having its actuating-windings connected between the strands thereof, said electromagnets serving also as repeating-coils to inductively unite the two ends of the cord-circuit, a separate charging source of electricity adapted to send current through the actuating-winding of each magnet, a plug-seat switch for each plug, a switch at the substation of each line for controlling the circuit of said source through the actuating-winding of the said electromagnet associated therewith, and a supervisory signal for each end of the circuit controlled by the corresponding electromagnet and plug-seat switch, substantially as described.

20. The combination with a cord-circuit having a plug connected at each end, and the strands thereof conductively divided but inductively united, of a signal-controlling electromagnet for each end of the cord-circuit

having its actuating-winding bridged between the strands thereof, said electromagnets serving also as repeating-coils to inductively unite the two ends of the cord-circuit, a separate
5 source of current for each end of the cord-circuit adapted to send current through the actuating-winding of the corresponding electromagnet, a plug-seat switch for each plug, and a signaling device for each end of the cord-
10 circuit controlled by the corresponding electromagnet and the plug-seat switch, substantially as described.

21. In a telephone system, the combination with telephone-lines, of a cord-circuit to loop
15 said lines together for conversation, a pair of repeating-coils connected with said cord-circuit, a winding of each coil connected with each end of the cord-circuit, one winding of each coil being opaque to the passage of continuous current, a separate source of current connected
20 with the other winding of each coil and adapted during a connection to be included in the corresponding telephone-line to furnish current thereover for conversation, said repeating-
25 coils being organized to operate as electromagnets, a supervisory signal for each end of the cord-circuit, local circuits for said supervisory signals each controlled at one point by said coils and at another point by auxiliary
30 means, substantially as described.

22. In a telephone system, the combination with telephone-lines, of a cord-circuit to loop
35 said lines together for conversation, a pair of repeating-coils connected with said cord-circuit, a winding of each coil connected with each end of the cord-circuit, one winding of each coil being opaque to the passage of continuous current, a separate source of current connected with the other winding of each coil and adapted
40 during a connection to be included in the corresponding telephone-line to furnish current thereover for conversation, said repeating-coils being organized to operate as electromagnets, a supervisory signal for each end of

the cord-circuit operated over local circuits, 45
said coils controlling the said local circuits so as to deprive said signals of operating-current during conversation to render them inert at that time, and other means for controlling said
50 circuits to likewise deprive said signals of operating-current when the cord-circuit is not connected with the lines whereby said signals are normally inert, substantially as described.

23. In a telephone system, two line-circuits, means for supplying electric energy thereto, 55
a primary induction-coil in each of said line-circuits, and a secondary coil connected in each line-circuit in shunt around the source of electrical supply therefor, and arranged in inductive relation to the primary coil of the opposite
60 line-circuit.

24. In a telephone system, the combination with two line-circuits, means for supplying electric energy thereto, a pair of repeating-coils, a primary winding of said coils included 65
in each of said line-circuits, and a secondary winding of said coils connected in each line-circuit in shunt around the source of electrical supply therefor and arranged in inductive relation to the primary coil of the opposite line-
70 circuit, substantially as described.

25. In a telephone system, the combination with two line-circuits, a pair of repeating-coils at the central office having inductively-associated windings to unite said circuits for 75
conversation, each said coil having a winding connected in each circuit, said windings in each circuit being connected in parallel with each other, and means for supplying current to said line-circuits for conversational purposes, substantially as described. 80

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

JOHN HENRY LENDI.

Witnesses:

KEMPSTER B. MILLER,
WM. W. DEAN.