

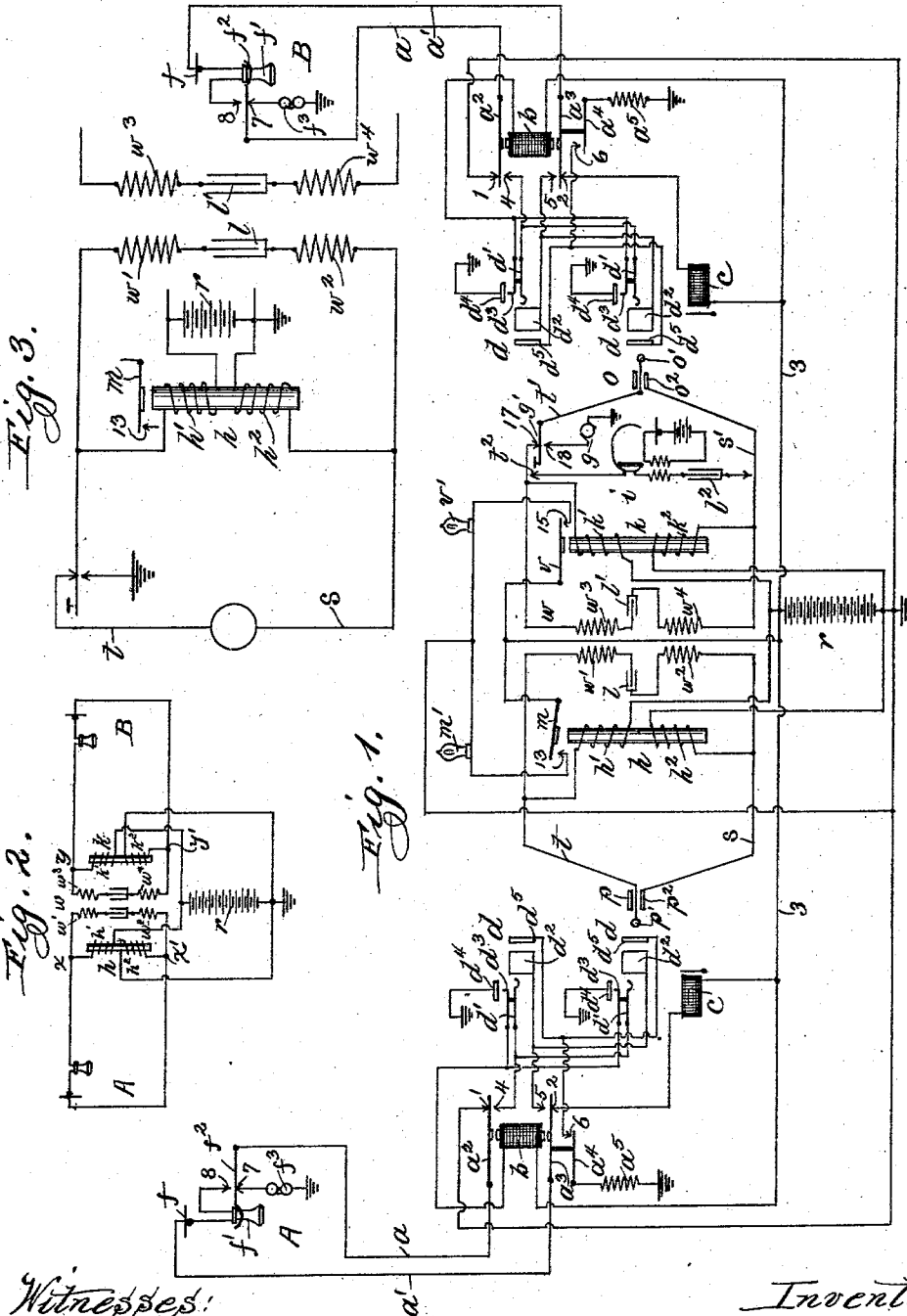
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W. A. TAYLOR.
CENTRAL ENERGY TELEPHONE SYSTEM.

APPLICATION FILED FEB. 4, 1901.

NO MODEL.



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UNITED STATES PATENT OFFICE.

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CENTRAL-ENERGY TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 743,953, dated November 10, 1903.

Application filed February 4, 1901. Serial No. 45,897. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM A. TAYLOR, 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 to provide an improved form of signal apparatus at the central station.

It has been proposed to provide a telephone system wherein the telephone-lines are adapted to be united for conversation through a repeating-coil, the signal-controlling electromagnet of each line and the charging source of electricity being bridged between the two limbs of the talking-circuit of the lines; also, to provide means, such as a condenser, for preventing the current from the charging source from passing through the windings of the repeating-coil and controlling the signal-controlling electromagnet by the conjoint action of a switch at the substation and a plug-seat switch.

It is the object of the present invention to provide an improved circuit arrangement whereby such plug-seat switches and the back contacts employed in connection with the supervisory relays may be dispensed with.

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

Figure 1 is a diagram illustrating two telephone-lines and the central-station apparatus for uniting the same for conversation. Fig. 2 is a diagram showing the talking-circuits of two connected subscribers. Fig. 3 is a diagram illustrating the relay-windings and the circuit therethrough.

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 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 spring a^3 , but insulated therefrom, is a spring a^4 , connected to ground through resistance a^5 and adapted when the relay is energized to engage contact 6, which is connected with the test-rings d^3 d^3 . 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 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 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 characters employed in connection with the line A.

The answering-plug p is provided with a tip p' and a sleeve p^2 , the former being connected with the strand t and the latter with a strand s . The calling-plug o is provided with a tip o' and a sleeve o^2 , the former being connected with a strand t' and the latter with a strand s' . The strands t s and t' s' are united through a repeating-coil w , having windings w' and w^2 connected between the strands t and s and windings w^3 and w^4 con-

nected between the windings t' and s' . In
 circuit with windings $w' w^2$ is a condenser l ,
 and in circuit with windings $w^3 w^4$ is a con-
 denser l' . Between the strands t and s the
 windings h' and h^2 of a relay h are provided,
 a battery r being interposed between said
 windings. Likewise between the strands t'
 and s' the windings k' and k^2 of relay k are
 connected, the battery r being interposed
 between said windings. The windings of the
 relays are placed in opposition, so that as
 the battery-current traverses the same while
 the lines are connected for conversation the
 windings will neutralize each other, thereby
 rendering the relay inert. The conductors
 3, extending to the telephone-lines, are con-
 nected with the battery r , and the opposite
 pole of said battery is grounded. Opposite
 the pole of relay h a spring m is provided
 carrying an armature and adapted when the
 relay is energized to engage contact 13. Con-
 tact 13 is connected, through the lamp
 m' , with one pole of the battery r , and the
 spring m is connected with the opposite pole
 of said battery. Likewise the spring v of
 relay k is connected with one pole of battery
 r , and the contact 15 is connected through
 lamp v' to the opposite pole of said battery.
 The windings h' and h^2 of the relay h are
 wound upon the core in such a manner that
 when the battery-current flows through one
 of said windings h' out over the telephone-
 line and back through the winding h^2 the
 current will be in such a direction as to neu-
 tralize the core. Therefore while the bat-
 tery-current flows through both windings the
 relay h remains unenergized. When, how-
 ever, current is passed through one of the
 windings alone, the core will be polarized to
 attract its armature. Since the windings h'
 and h^2 are wound upon opposite ends of the
 core and are not superimposed, the talking-
 currents will meet impedance, which will pre-
 vent the same passing through the windings
 $h' h^2$. The relay thus opposes the passage
 of the talking-current, is neutralized during
 the passage of the battery-current through
 both windings, and is energized by the pas-
 sage of the battery-current through one of the
 windings. The relay k is wound and con-
 structed in the same manner as relay h .

In the strand t' a ringing-key g' is provided
 normally resting against contact 17 and adapt-
 ed when depressed to engage contact 18, which
 is connected to ground through generator g .
 The operator's telephone set i is adapted to
 be connected between the strands t' and s' ,
 and a condenser l^2 is interposed in the circuit
 of the telephone set.

Assuming now that subscriber A is desirous
 of conversing with subscriber B, he lifts his
 receiver from the telephone-hook, thereby
 closing together limbs $a' a'$ at the substation.
 The circuit of battery r is thus closed over
 conductor 3, annunciator c , contact 2, spring
 a^3 , limbs $a' a$, spring a^2 , contact 1 to the op-
 posite pole of battery r . The individual an-

nunciator c is thus actuated to convey to the
 operator the signal for connection, and the
 operator thereupon lifts the answering-plug
 p and inserts the same in the spring-jack be-
 longing to subscriber A. The insertion of the
 plug moves spring d^3 against contact d^4 , there-
 by energizing the relay b , the circuit through
 said relay being traced from battery r , through
 conductor 3, relay b , spring d^3 , contact d^4 to
 ground, and back to the battery. The relay
 being thus energized attracts the armatures
 and moves springs $a^2 a^3$ out of engagement,
 respectively, with contacts 1 and 2, thus dis-
 connecting the annunciator from circuit, and
 moves said springs into engagement, respec-
 tively, with contacts 4 and 5, thus connect-
 ing the terminals of the spring-jacks with the
 limbs of the telephone-line. The insertion of
 the answering-plug also connects battery r in
 circuit through the windings $h' h^2$ of relay h
 and through the strands t and s of the cord-
 circuit and the limbs $a' a'$ of the line. Since
 the battery-current traverses both of the
 windings h' and h^2 , the core of the relay re-
 mains neutral and the relay remains unactu-
 ated. The operator then connects her tele-
 phone set i in circuit in the usual manner
 and receives the number of the called sub-
 scriber. Learning that connection is desired
 with subscriber B she lifts the answering-
 plug o and touches the tip o' thereof to the
 test-ring d^5 belonging to the spring-jack of
 subscriber B. If subscriber B is busy, his
 relay will be energized and test-ring d^5 will be
 connected to ground through contact 6 and
 spring a^4 . If the line be thus busy, the op-
 erator upon touching the tip of plug o to the
 test-ring will hear a click in her telephone-
 receiver; but, on the other hand, if the line be
 idle she will hear no click and will know that
 the line is not busy. The click in the tele-
 phone is due to the fact that by touching the
 tip of the plug to the test-contact the poten-
 tial at the point t^2 of strand t' is lowered,
 thereby permitting a current to flow through
 the operator's receiver. When the tip o is not
 in contact with the test-ring, the battery r is
 on open circuit, and the point t^2 is therefore of
 the same potential as the pole of the battery.
 When, however, the tip of the plug is touched
 to the test-ring, the circuit of battery r is
 closed from ground through the winding k' ,
 strand t' , tip o' , test-ring d^5 , contacts 6 and a^4 to
 ground. The resistance thus interposed be-
 tween the pole of the battery and the point
 t^2 by the winding k' lowers the potential of
 the point t^2 on closed circuit, and this change
 of potential of the point t^2 , with which the
 operator's telephone set is connected, causes
 a momentary current to flow through the re-
 ceiver, thereby causing a click therein. As-
 suming that the operator finds the line of the
 called subscriber idle, she inserts the plug o
 therein and then depresses key g' , thereby
 sending current from generator g over strand
 t' , tip o' , spring d' , contacts 4 and a^2 , limb a ,
 through bell f^3 to ground. When the sub-

scriber responds, he lifts the receiver from the hook, thus closing together the limbs $a a'$ at the substation. The circuit of battery r is thus closed through windings $k' k^2$, strands $t' s'$, and limbs $a a'$. Since the current flows through both of the windings of the relay, the relay remains unactuated. The circuits during conversation are shown in Fig. 2. When subscriber A is talking and the microphone is actuated, variation of the resistance therein causes a corresponding variation of the difference of potential between the points x and x' , and this variation of difference of potential causes a correspondingly-varying current to traverse the windings w' and w^2 , thereby inducing corresponding currents in windings w^3 and w^4 , which pass through the receiver of subscriber B. Likewise when subscriber B is talking the difference of potential between the points y and y' is varied, and correspondingly-varying currents will be caused to pass through the receiver of subscriber A. When the subscribers have completed their conversation and desire disconnection, they hang up their telephone-receivers, thereby separating limbs $a a'$ at the substation and closing circuit from ground over limbs $a a'$, relay-windings h' and h^2 , battery r to ground. Lamps m' and v' are thus lighted to convey to the operator the signal for disconnection. Thus when subscriber A hangs up his telephone-receiver the circuit of battery r is closed from ground through winding h' , strand t , limb a to ground at the substation. But one of the windings of the relay h being thus energized, the core thereof is polarized to attract its armature and close together contacts m and 13 , thereby lighting lamp m' . Similarly the lamp v' is lighted by subscriber B in hanging up his telephone. The operator thereupon removes the plugs p and o from the respective sockets, and the circuit of the battery is opened at the plug-terminals and the relays are deenergized to extinguish the lamps. If one of the subscribers should desire an immediate reconnection with another subscriber, he may by vibrating his switch-hook in the usual manner cause the lamp to be alternately lighted and extinguished to thus convey the signal to the operator for reconnection.

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

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, of a repeating-coil through which the same are adapted to be united for conversation, a signal-controlling electromagnet bridged between the two limbs of the talking-circuit of one of said lines, said electromagnet having two windings and possessing impedance to the passage of talking-currents, a charging source of electricity, a switch at

the substation for closing a complete circuit of said source through one of said windings at one time to actuate said magnet or both of said windings at another time, and means for preventing the passage of the current from said source through the winding of the repeating-coil associated with said electromagnet, substantially as described.

2. The combination with a pair of telephone-lines, of a repeating-coil through which the same are adapted to be united for conversation, a signal-controlling electromagnet and a charging source of electricity bridged between the two limbs of the talking-circuit of each of said lines, each of said electromagnets having two windings and possessing impedance to the passage of talking-currents, and a switch at each substation for controlling the passage of current through one only or both of the windings of the electromagnet corresponding thereto, and a condenser in circuit with each of the windings of said repeating-coil to prevent the passage of said charging-current therethrough, substantially as described.

3. The combination with a telephone-line, of a repeating-coil through which the same is adapted to be united with another line, a signal-controlling electromagnet bridged between the two limbs of the talking-circuit of said line, said electromagnet having two windings and possessing impedance to the passage of talking-currents, a source of electricity interposed between the two windings of said electromagnet, a switch at the substation for closing the circuit of said source through one of said windings to permit an excess current to flow therethrough or both of the windings of said electromagnet, and a condenser in circuit with the winding of said repeating-coil to prevent the closing of the circuit of said source therethrough, substantially as described.

4. The combination with a telephone-line, of a repeating-coil through which the same is adapted to be united with another telephone-line, a signal-controlling electromagnet bridged between the two limbs of the talking-circuit of one of said lines, and having two windings and possessing impedance to the passage of talking-currents, a source of electricity interposed between said windings and having one pole connected with a third conductor, a switch at the substation for closing a complete circuit of said source through both of said windings, or a complete circuit through one of said windings with return through said third conductor to operate said magnet, and a condenser in circuit with the winding of said repeating-coil to prevent the closing of the circuit of said source therethrough, substantially as described.

5. The combination with a pair of telephone-lines, of a repeating-coil through which the same are adapted to be united for conversation, a signal-controlling electromagnet bridged between the limbs of the talking-cir-

cuit of one of said lines, said electromagnet having two differential windings and possessing impedance to the passage of talking-currents, a charging source of electricity, a switch at the substation for closing the circuit of said source over the metallic line and through both of said windings whereby the same is rendered neutral, or for causing an excess flow of current from said source through one winding of said electromagnet to operate the same, and means for preventing the passage of current from said source through the winding of the repeating-coil associated with said electromagnet, substantially as described.

6. The combination with a pair of telephone-lines, of a repeating-coil through which the same are adapted to be united for conversation, a signal-controlling electromagnet bridged between the limbs of the talking-circuit of one of said lines, said electromagnet having two differential windings and possessing impedance to the passage of talking-currents, a charging source of electricity, a switch at the substation for closing the circuit of said source over the metallic line and through both of said windings whereby the same is rendered neutral, or for causing an excess flow of current from said source through one winding of said electromagnet to operate the same, and a condenser in circuit with the winding of the repeating-coil associated with said electromagnet and serving to prevent the passage of current from said source through said winding, substantially as described.

7. The combination with a pair of telephone-lines, of a repeating-coil through which the same are adapted to be united for conversation, a signal-controlling electromagnet and a charging source of electricity bridged between the two limbs of the talking-circuit of each of said lines, each of said electromagnets having two differential windings and possessing impedance to the passage of the talking-currents, means for permitting current to flow from said source through said windings and over the metallic line in a direction to cause said windings to neutralize each other, or to permit an excess flow of current through one of said windings from said source to actuate said magnets, and means in the circuit of each winding of said repeating-coil to prevent the passage of current from said source but to permit the passage of the voice-currents, substantially as described.

8. The combination with a pair of telephone-lines, of a repeating-coil through which the same are adapted to be united for conversation, a signal-controlling electromagnet and a charging source of electricity bridged between the two limbs of the talking-circuit of each of said lines, each of said electromagnets having two differential windings and possessing impedance to the passage of the talking-currents, means for permitting current to

flow from said source through said windings and over the metallic line in a direction to cause said windings to neutralize each other, or to permit an excess flow of current through one of said windings from said source to actuate said magnets, and a condenser in circuit with each of the windings of said repeating-coil to prevent the passage of current from said source and to permit the passage of voice-currents, substantially as described.

9. The combination with a telephone-line, of a repeating-coil through which the same is adapted to be united with another line, a signal-controlling electromagnet bridged between the two limbs of the talking-circuit of said line, said electromagnet having two differential windings and possessing impedance to the passage of talking-currents, a source of electricity interposed between the two windings of said electromagnet and adapted to furnish current over the metallic line for conversational purposes, and a hook-switch at the substation for closing the circuit of said source through both of said windings and over the metallic line during conversation and to close the circuit from said source through one of said windings and suitable return when the conversation is terminated and the switch-hook depressed, and a condenser in circuit with the winding of said repeating-coil to prevent the closing of the circuit of said source therethrough, substantially as described.

10. The combination with a telephone-line, of a repeating-coil through which the same is adapted to be united with another telephone-line, a signal-controlling electromagnet bridged between the two limbs of the talking-circuit of one of said lines, said magnet having two differential windings and possessing impedance to the passage of talking-currents, a source of electricity connected between said windings and having one pole connected with a third conductor, means at the substation for controlling the flow of current from said source over the metallic line and through both of said windings to cause the same to neutralize each other, or through one of said windings with return through said third conductor to actuate said magnet, and means to prevent the passage of current from said source through the winding of said repeating-coil, substantially as described.

11. The combination with a telephone-line, of a repeating-coil through which the same is adapted to be united with another telephone-line, a signal-controlling electromagnet bridged between the two limbs of the talking-circuit of one of said lines, said magnet having two differential windings and possessing impedance to the passage of talking-currents, a source of electricity connected between said windings and having one pole connected with a third conductor, means at the substation for controlling the flow of current from said source over the metallic line and through both of said windings to cause the same to neutralize each other, or through one of said wind-

ings with return through said third conductor to actuate said magnet, and a condenser in circuit with the winding of said repeating-coil to prevent the closing of the circuit of said source therethrough, substantially as described.

12. The combination with a telephone-line, of a repeating-coil through which the same is adapted to be united with another telephone-line, a signal-controlling electromagnet bridged between the two limbs of the talking-circuit of one of said lines, said magnet having two differential windings and possessing impedance to the passage of talking-currents, a source of electricity connected between said windings and having one pole connected with a third conductor, a switch at the substation for closing the circuit of said source over the metallic line and through both of said windings whereby said electromagnet is rendered inoperative, or through one of said windings with return over said third conductor to actuate said electromagnet, and a condenser in circuit with the winding of said repeating-coil to prevent the closing of the circuit of said source therethrough, substantially as described.

13. In a telephone system, the combination with telephone-lines, of a cord-circuit to connect said lines together for conversation, a repeating-coil dividing said circuit conductively into two parts but inductively uniting them, a condenser in circuit with one winding of the repeating-coil to prevent the passage of steady current and permit the passage of voice-currents, a signal-controlling electromagnet bridged across the cord-circuit in parallel with said winding of the repeating-coil, said electromagnet having differential windings, a source of steady current interposed between said windings and adapted to send current therethrough and over the metallic line for conversational purposes, said windings being neutral to current over the metallic line and possessing sufficient impedance to prevent the passage of voice-currents to an objectionable degree, one pole of said source being connected to a third conductor, and means controlled from the substation for connecting the side of the talking-circuit connected with the opposite pole of said source with the said third conductor to unbalance said electromagnet and actuate the same, and a supervisory signal controlled by said electromagnet, substantially as described.

14. In a telephone system, the combination with telephone-lines, of a cord-circuit to unite said lines for conversation, a repeating-coil interposed in said cord-circuit to conductively separate but inductively unite its two ends, means to prevent the passage of steady current through said windings but to permit the passage of voice-currents, a differential relay connected with each end of the cord-circuit in parallel with said windings, a source of current interposed between said windings and serving to send current over the metallic line

to each substation for conversation when a connection is established by said cord-circuit with the lines, said source having one pole grounded, a supervisory signal associated with each end of the cord-circuit and controlled by the corresponding relay, and means controlled from the substation after a connection is established to permit current from said source to flow over the metallic line or over one line only with ground-return whereby in the first instance said relay is inoperative and in the second instance said relay is actuated, substantially as described.

15. In a telephone system, the combination with telephone-lines, of a cord-circuit to unite said lines for conversation, a repeating-coil interposed in said cord-circuit to conductively separate but inductively unite its two ends, means to prevent the passage of steady current through said windings but to permit the passage of voice-currents, a differential relay connected with each end of the cord-circuit in parallel with said windings, a source of current interposed between said winding and serving to send current over the metallic line to the substation for conversation when a connection is established by said cord-circuit with the lines, said source having one pole grounded, a supervisory signal associated with each end of the cord-circuit and controlled by the corresponding relay, and a switch-hook at each substation for closing circuit over the metallic line during conversation whereby the relay associated with that line is rendered inoperative or for connecting the proper line-wire to ground at the termination of the conversation to permit current from said source to flow through one winding of the corresponding relay to actuate the same and operate the supervisory signal, substantially as described.

16. In a telephone system, the combination with telephone-lines, of a cord-circuit to unite said lines for conversation, a repeating-coil interposed in said cord-circuit to conductively separate but inductively unite its two ends, means to prevent the passage of steady current through said windings but to permit the passage of voice-currents, a differential relay connected with each end of the cord-circuit in parallel with said windings, a source of current interposed between said windings and serving to send current over the metallic line to the substation for conversation when a connection is established by said cord-circuit with the lines, said source having one pole grounded, a supervisory signal associated with each end of the cord-circuit and controlled by the corresponding relay, a switch-hook at each substation, and a signaling-bell normally grounded from one line-wire by said switch-hook, said line-wire being connected with the live pole of said central source of current when a connection is established, whereby during conversation current flows from said source over the metallic line and renders said relay and supervisory signal in-

operative, and at the termination of the conversation when the switch-hook is depressed current from said source flows over said line with ground-return to operate said relay and supervisory signal, substantially as described.

17. The combination with a pair of telephone-lines, of a repeating-coil through which the same are adapted to be united for conversation, a signal-controlling electromagnet and a separate charging source of electricity bridged between the limbs of the talking-circuit of each of said lines, each of said electromagnets having two differential windings and possessing impedance to the passage of talking-currents, means for permitting current to flow from said source through said windings and over the corresponding telephone-lines in a direction to cause said windings to neutralize each other, or to permit an excess flow of current through one of the windings of each of said electromagnets from the corresponding source to actuate the said magnets, and means in the circuit of each winding of said repeating-coil to prevent the passage of current from said source but to permit the passage of voice-currents, substantially as described.

18. The combination with a pair of telephone-lines, of a repeating-coil through which the same are adapted to be united for conversation, a signal-controlling electromagnet and a separate charging source of electricity bridged between the two limbs of the talking-circuit of each of said lines, each of said electromagnets having two differential windings and possessing impedance to the passage of the talking-currents, means for permitting the current to flow from said sources through said windings and over the corresponding telephone-lines in a direction to cause said windings to neutralize each other, or to permit an excess flow of current through one of

said windings of each electromagnet from the said sources to actuate said magnets, and a condenser in circuit with each of the windings of said repeating-coil to prevent the passage of current from said source and to permit the passage of voice-current, substantially as described.

19. The combination with a pair of telephone-lines, of a repeating-coil through which the same are adapted to be united for conversation, signal-controlling electromagnets bridged between the limbs of the talking-circuit of each line, said magnets having two differential windings and possessing impedance to the passage of talking-currents, a separate source of electricity interposed between the two windings of the electromagnets and adapted to furnish current over the corresponding metallic telephone-line for conversational purposes, a hook-switch at the substation of each line for closing the circuit of the source through both of said windings and over the metallic line during conversation, at which time said electromagnet is rendered inoperative by said current, or to close the circuit from the said source through one of the windings of the electromagnet with suitable return over a third conductor when the conversation is terminated and the switch-hook depressed, whereby said electromagnet is operated, and a condenser in circuit with each winding of said repeating-coil to prevent the closing of the circuit of the said source but to permit the passage of voice-currents, substantially as described.

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

WILLIAM A. TAYLOR.

Witnesses:

WILLIAM W. DEAN,
JOHN HENRY LEUDI.