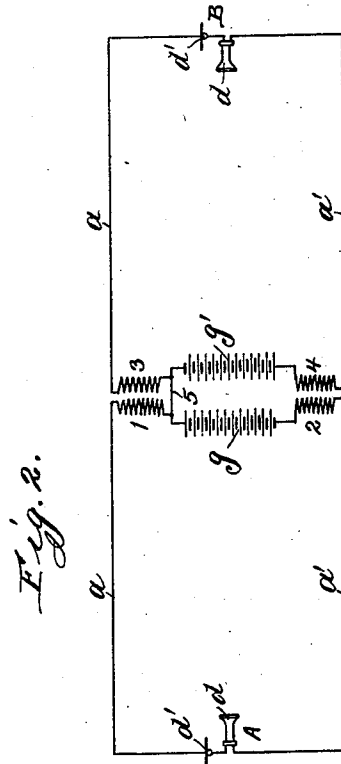
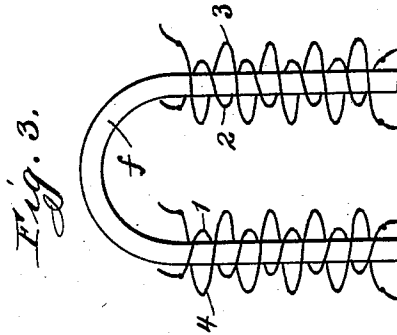
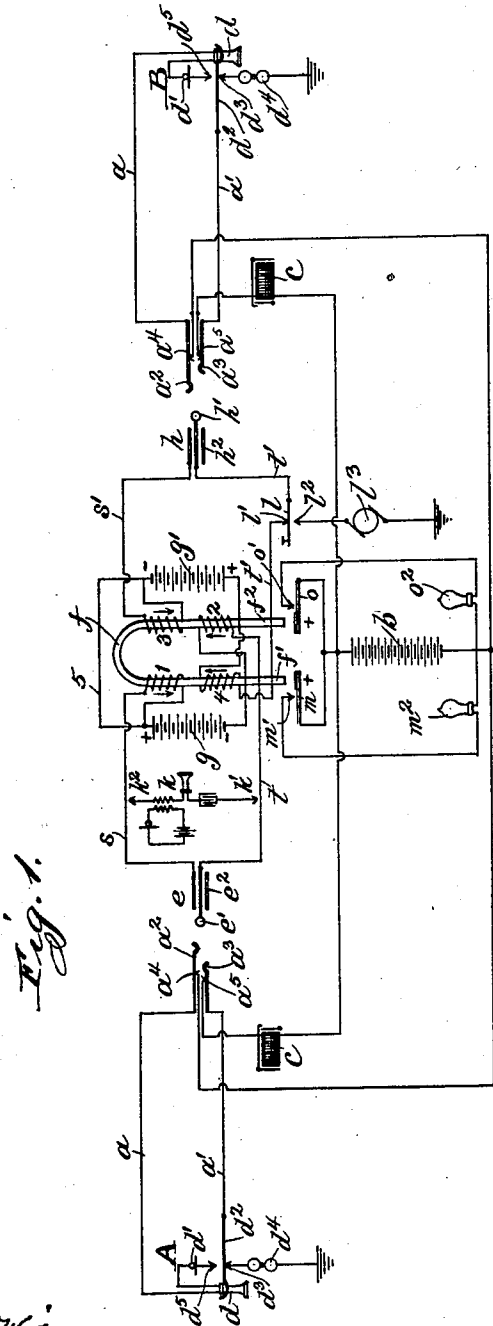


K. B. MILLER.
CENTRAL ENERGY TELEPHONE SYSTEM.

APPLICATION FILED NOV. 26, 1900.

NO MODEL.

2 SHEETS—SHEET 1.



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NO MODEL.

2 SHEETS—SHEET 2.

Fig. 5.

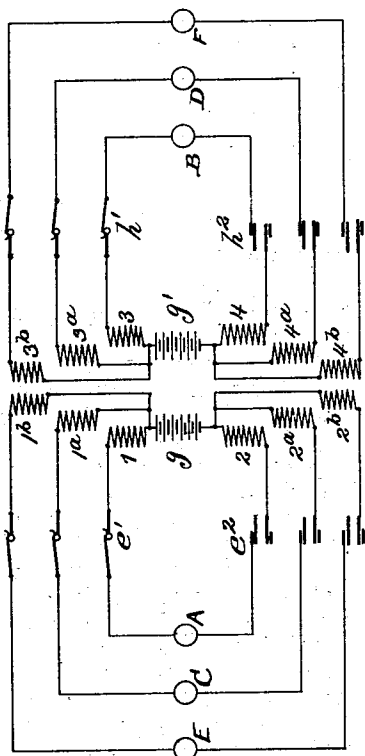


Fig. 6.

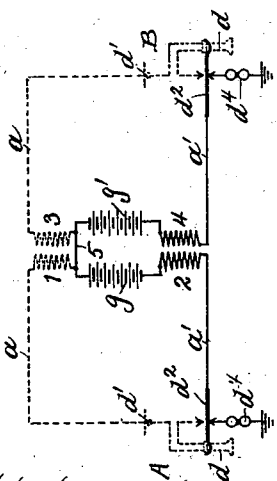
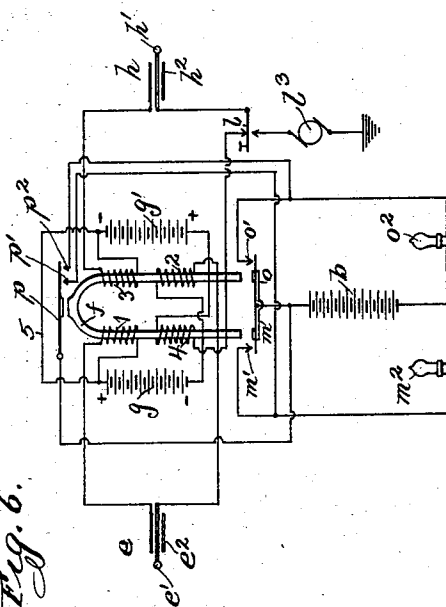


Fig. 6.



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UNITED STATES PATENT OFFICE.

KEMPSTER B. MILLER, OF CHICAGO, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

CENTRAL-ENERGY TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 726,964, dated May 5, 1903.

Application filed November 26, 1900. Serial No. 37,754. (No model.)

To all whom it may concern:

Be it known that I, KEMPSTER B. MILLER, 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 improved means whereby the talking-circuits and the signaling-circuits at the central station may be effectively supplied with energizing-current from a centralized supply. It has been customary heretofore in telephone systems of the general class to which the present invention relates to provide at the central station a common battery which supplies current for the talking-circuits of the connected subscribers and also for the relays which control the supervisory signals at the central station.

In accordance with the present invention, in the preferred form thereof I employ two batteries or sources of electricity, one adapted to be connected in circuit with one of two connected subscribers' lines—say the calling-subscriber's line—while the other is adapted to be connected in circuit with the other connected subscriber's line—to wit, the called-subscriber's line—the two batteries, so far as the talking-currents are concerned, being thus electrically separate and distinct. The batteries, however, cooperate in actuating the relay which controls the supervisory signals. The relay which controls the supervisory signals is so arranged that when the subscribers are in conversation the windings of the relay will be traversed by currents from their respective batteries in such a direction as to neutralize the relay-core, whereby the signals remain quiescent. Should one of the subscribers alone hang up his telephone, the circuit through one of the batteries will be opened, thereby permitting the other battery to polarize the relay-core to actuate one of the supervisory signals, depending upon which subscriber thus hangs up his telephone.

Should both subscribers hang up their telephones, a circuit is closed through the windings in such a manner as to actuate both of the supervisory signals. I preferably employ the repeating-coil interposed between the two connected lines as the relay for operating the supervisory signals, as will be hereinafter described.

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

Figure 1 is a diagram showing two subscribers' telephone-lines and the central-station apparatus equipped in accordance with my invention. Fig. 2 is a diagram showing the circuits when the subscribers are connected for conversation. Fig. 3 is a view showing diagrammatically the manner in which the windings of the repeating-coil and relay are superimposed. Fig. 4 is a diagram showing the circuit for controlling the supervisory signals to convey the clearing-out signal. Fig. 5 is a diagram showing the manner of connecting the batteries with the plurality of telephone-lines. Fig. 6 is a diagram showing a modification of my invention.

Like characters refer to like parts in the several figures.

As shown in Fig. 1, the line of subscriber A extends in two limbs a a' to the central station, where the limbs terminate in the line-springs a^2 a^3 , respectively, of the spring-jack. The spring a^2 normally rests against contact a^4 and the spring a^3 against contact a^5 , between which contacts the battery b and individual annunciator c are connected. The subscriber is provided at the substation with the usual receiver d and with a microphone d' , connected directly in the circuit. The switch-hook d^2 normally rests upon back contact d^3 , which is connected through bell d^4 to ground. When the receiver is removed from the hook, the same engages contact d^5 to close together the two limbs of the telephone-line. The subscriber B is provided with similar mechanism and is similarly connected with the central station, and I have employed the same reference characters to indicate the apparatus associated with the line of subscriber B. The answering-plug e is provided with a tip e^1 and a sleeve e^2 , the sleeve being con-

nected by strand s through winding 1, carried upon the core f , the opposite end of said winding being connected with battery g and thence through winding 2 to the tip-strand t , which is connected with the tip e' of the plug. Likewise, the calling-plug h is provided with a tip h' and a sleeve h^2 , the former being connected by strand t' through the ringing-key l and thence through winding 4, battery g' , and winding 3 to sleeve-strand s' , which is connected with the sleeve h^2 . The windings 1 and 2, which are connected with battery g , are wound upon the core in such a direction that the current from the battery g traverses the two windings in a direction to add the magnetic effects thereof—that is, in such a direction as to set up lines of force in the same direction in the bent bar f on which they are wound, as is indicated by the arrows adjacent said coils. Likewise, the windings 3 and 4, connected with battery g' , are adapted, when traversed by the current from battery g' , to add their magnetic effects in polarizing the core f , as shown by the adjacent arrows. Opposite the poles of the core f springs m and o are provided, the spring m carrying an armature adapted to rest opposite the pole f' , while the spring o carries an armature adapted to rest opposite the pole f^2 . The armatures are polarized with like polarity—for instance, with positive polarity. The springs m and o are connected with one side of the battery b , while the back contacts m' and o' thereof are connected with the opposite side of the battery, the supervisory signal or lamp m^2 being connected with the contact m' and the lamp o^2 with contact o' . Each of the batteries g and g' preferably consists of about ten cells of low internal resistance. The spring l of the ringing-key is adapted to vibrate between the contacts l' and l^2 , the latter being connected to ground through the calling-generator l^3 .

The operator's telephone set k is connected in the usual manner between the contacts k' and k^2 , adapted to be connected with the opposite strands of the cord connectors, to thereby bridge the operator's telephone in circuit.

Supposing subscriber A desirous of conversing with the subscriber B, he removes his telephone-receiver from the hook, thus closing circuit of battery b through annunciator c to contact a^5 , spring a^3 , limb a' , hook d^2 , contact d^5 , limb a , spring a^2 , contact a^4 , back to the battery b . The individual annunciator c is thus actuated, thereby attracting the attention of the operator at the central station. The operator thereupon lifts answering-plug e and inserts the same in the spring-jack belonging to subscriber A. The springs a^2 and a^3 are lifted from their contacts a^4 and a^5 , respectively, and the individual annunciator c is thus disconnected from the telephone-circuit. As soon as the plug e is inserted the circuit of battery g is closed through windings 1 and 2 and through the two limbs

of the telephone-line, since the subscriber's receiver is removed from the hook, and current is thus caused to traverse windings 1 and 2 in such a direction as to impart to pole f^2 a negative polarity, while imparting a positive polarity to pole f' . The armature of spring o is thus attracted, thereby closing the circuit of battery b through spring o , contact o' , and lamp o^2 , thereby lighting the lamp. The operator now connects her telephone set in circuit in the usual manner and receives the number of the called subscriber. Learning that subscriber B is desired, she lifts the calling-plug h , which is the companion to the answering-plug e , and inserts the same in the spring-jack belonging to subscriber B. Then she depresses the ringing-key, thereby sending calling-current from the generator l^3 over strand t' and limb a' and to ground through the bell of subscriber B. When subscriber B responds and removes his telephone from the hook, the circuit of battery g' is closed through windings 3 and 4, which tend to polarize the core f and in a direction opposite to that in which the windings 1 and 2 tend to polarize the same, and the core is thus rendered neutral and inert. The armature of spring o is therefore released to open the circuit through lamp o^2 , and the lamp o^2 is extinguished to signify to the operator that the called subscriber has answered and that the parties are in conversation.

The circuit during conversation is shown in Fig. 2. When subscriber A is talking, his microphone serves to vary the resistance of the circuit of battery g , while when subscriber B is talking the resistance of the circuit of battery g' is varied.

In Fig. 2 the various parts are marked to correspond with similar parts shown in Fig. 1. As shown in Fig. 3, the windings 1 and 4 are superimposed on the same leg of the bent bar f , while windings 2 and 3 are superimposed on the other leg. Therefore any fluctuation of an electric current in either of the circuits containing 1 and 2 or 3 and 4 will be reproduced on the other circuit by the well-known laws of electromagnetic induction. When, however, the resistance of the circuit of subscriber A is being varied by the microphone at that station, the windings 1 and 2 in series act together as a primary coil of an induction-coil of which the secondary is formed by windings 3 and 4. When the microphone at station B is in action, windings 3 and 4 serve as the primary coil and 1 and 2 as the secondary.

When the parties have completed their conversation, they hang up their telephone-receivers, thereby actuating the supervisory signals to convey the clearing-out signal to the operator. If one of the subscribers alone hangs up his telephone, one of the lamps alone will be lighted, while if both subscribers hang up their telephones both lamps will be lighted. Thus, if subscriber A hangs up his telephone, while subscriber B does not, the circuit of

battery g' will alone be closed, and the core f will be polarized with a negative polarity at f' and positive polarity at f^2 , thereby lighting the lamp m^2 to signify to the operator
 5 that the subscriber A has completed conversation. Likewise, if subscriber B hangs up his telephone, while subscriber A does not, the battery g' will alone be included in circuit, and the windings 1 and 2 will produce
 10 a negative polarity at f^2 and a positive polarity at f' , thereby lighting lamp o^2 . If both subscribers hang up their telephones, then circuit will be closed from the ground at substation A, through the bell d^1 , over
 15 limb a' and strand t , through winding 2, battery g , conductor 5, battery g' , winding 4, strand t' , and limb a' of subscriber B, through his bell to ground. The windings 2 and 4 are thus energized, and as the windings are upon
 20 opposite legs of the core f and tend to polarize the core oppositely the result will be that poles f' and f^2 will be of negative polarity, while a consequent pole will be formed at the bend of the core. The armatures of levers
 25 m and o will therefore be attracted to close circuit through the supervisory lamps m^2 and o^2 . The circuit for the clearing-out signal when both subscribers hang up their telephones is shown in Fig. 4.
 30 As shown in Fig. 3, I superimpose the windings mounted on each leg of the relay-core and wind each coil over the entire length of the leg. This construction renders the action as a repeating-coil more efficient and at the same time makes it possible for steady
 35 currents in one winding to be completely neutralized by steady currents in the other winding on the same leg of the core. This neutralization of the core of the repeating-coil is of material advantage in its effect upon the efficiency of the apparatus when acting
 40 as a repeating-coil, for iron in a neutral state is more susceptible to slight changes in magnetism caused by varying currents than when the iron is strongly polarized in one direction
 45 or the other.

In Fig. 5 I have illustrated the manner in which a plurality of pairs of connected telephone-lines are associated with the pair of
 50 batteries. The telephone-lines A and B are connected through the windings 1 2 3 4 of the repeating-coil, the battery g being in circuit with the windings 1 and 2, while battery g' is in circuit with windings 3 and 4. Likewise lines C and D are connected through
 55 windings 1^a 2^a 3^a 4^a of a second repeating-coil and lines E and F through windings 1^b 2^b 3^b 4^b of a third repeating-coil. One line of each connected pair is thus connected with
 60 battery g , while the other line of each pair is connected with battery g' . In practice I preferably connect all of the answering-plugs with one of the batteries—say battery g —and all of the calling-plugs with the other bat-
 65 tery, g' .

In Fig. 6 I have shown a modification of the relay in which an armature is provided on

the spring p and mounted opposite the bend of the core f . This spring p is connected
 with one pole of the battery b and is adapted
 70 when attracted by the consequent pole developed at the bend of the core to engage contacts p' p^2 , the former being connected through lamp m^2 to the opposite pole of the battery, while the latter is connected through lamp o^2 .
 75 The springs m and o are formed integral and pivoted, so that but one can engage its contact m' or o' at a time. When circuit is closed through but one of the batteries g or g' , one or the other of the lamps m^2 o^2 will be lighted,
 80 as above described. When both subscribers hang up their telephones to send the clearing-out signal, a consequent pole is developed at the bend of the core, and spring p is attracted, thereby closing circuit through lamps m^2
 85 and o^2 .

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

1. The combination with a plurality of telephone-lines, each having a microphone connected directly in circuit at the substation, of means for connecting any two of the lines together in pairs for conversation, a repeating-coil interposed between the lines of each
 90 connected pair, and a pair of common sources of electricity at the central station, one source placed in circuit with each line of each pair and a winding of said repeating-coil by the act of establishing the connection for conversation,
 95 substantially as described.

2. The combination with a plurality of telephone-lines, terminating at a central office, of means for connecting the same together in pairs for conversation, and a pair of sources of
 100 electricity common to the plurality of lines, one adapted to be included in circuit with each line of a connected pair by the act of establishing the connection, substantially as described.

3. The combination with a plurality of telephone-lines, of means for connecting the same in pairs for conversation, a pair of sources of electricity common to the plurality of lines and connected therewith in the act of establishing
 105 connections, one adapted to be included in circuit with the lines of the calling subscribers, and the other in circuit with the line of the called subscribers, substantially as described.

4. The combination with a plurality of telephone-lines, of a plurality of cord connectors for connecting the same in pairs, and a pair of sources of electricity, one member of each
 110 cord connector being connected with each of said sources of electricity, whereby said sources are common to the plurality of lines and are connected therewith by the act of establishing the connections, substantially as described.

5. The combination with a plurality of telephone-lines, of a plurality of pairs of connecting-plugs, a repeating-coil interposed between the plugs of each pair, and a pair of sources
 115

of electricity, one plug of each pair being connected in circuit with one of said sources and the other plug of each pair in circuit with the other source, substantially as described.

5 6. The combination with a plurality of telephone-lines, of a plurality of pairs of connecting-plugs, a repeating-coil interposed between the plugs of each pair, each winding of each repeating-coil being divided into two parts,
10 and a pair of sources of electricity, one interposed between the two parts of each winding connected with the answering-plugs, and the other source interposed between the two parts of each winding connected with the calling-plugs, substantially as described.

7. In a telephone-exchange system, the combination with a plurality of telephone-lines, each having a transmitter at the substation connected in circuit with its main line, of a
20 cord-circuit at the central office to inductively unite said lines in pairs for conversation, two sources of current-supply arranged to be connected in circuit with the said main lines by the act of uniting the lines for conversation
25 by means of the said cord-circuit, one source with one line of the connected pair and one source with the other line of the pair, whereby each of the two connected main lines is independently supplied with current from a separate
30 source for conversational purposes, substantially as described.

8. In a telephone-exchange system, the combination with a plurality of telephone-lines, each having a transmitter at the substation
35 connected directly in its main-line circuit, of a suitable calling-signal for each said line at the central office and rendered inoperative when a connection for conversation is made with the said line, a cord-circuit at the central
40 office to inductively unite said lines for conversation, two sources of current-supply arranged to be connected in circuit with the said main lines by the act of uniting the lines for conversation through the medium of the
45 cord-circuit, one source of current with one line of the connected pair and the other source with the other line of the pair, whereby each of the two connected main lines is independently supplied with current from a separate
50 source for conversational purposes, substantially as described.

9. In a telephone-exchange system, the combination with a plurality of metallic-circuit telephone-lines, each having a transmitter at
55 the substation connected in the main circuit of the metallic line, of a cord-circuit at the central office to inductively unite said lines in pairs for conversation, two sources of current arranged to be connected in circuit with
60 the said metallic lines by the act of uniting the lines for conversation through the medium of said cord-circuit, one source of current being connected with one line of the united pair and the other source with the
65 other line of the pair, whereby each of the two connected metallic lines is independently supplied with current for conversational purposes

from a separate source of supply, substantially as described.

10. In a telephone-exchange system, the combination with a plurality of metallic telephone-lines, each having a transmitter connected directly in the metallic line at the substation, of a suitable calling-signal for each
70 line at the central office, means to render the said signal inoperative when a connection for conversation is made with the said line, a
75 cord-circuit at the central office to inductively unite said lines in pairs for conversation, two sources of current-supply at the central office arranged to be connected in circuit with the said metallic lines by the act of uniting them
80 together for conversation through the medium of the cord-circuit, one of said sources of current being connected with one line of the united pair and the other source with the
85 other line of the pair, whereby each of the two connected main lines is independently supplied with current for conversational purposes from a separate source, substantially
90 as described.

11. In a telephone-exchange system, the combination with a plurality of metallic telephone-lines, each having a transmitter at the substation connected directly in circuit with
95 its main line, of a suitable calling-signal for each said line at the central office, said signal being rendered inoperative when a connection for conversation is made with the said line, a plurality of cord-circuits at the central
100 office to inductively unite said lines in pairs for conversation, two sources of current-supply at the central office arranged to be connected in circuit with said pairs of main lines by the act of uniting the lines together for conversation
105 through the medium of the cord-circuits, one of said sources being thereby connected with one of the lines of each pair and the other source with the other line of the pair, whereby each of the two connected main
110 lines is independently supplied with current from a separate source for conversational purposes, said two sources of current being common to the plurality of cord-circuits, substantially as described.

12. In a telephone-exchange system, the combination with a plurality of telephone-lines, each having a transmitter at the substation connected directly in its main-line circuit, of a calling-signal for each said line at
120 the central office, a central source of current common to the lines and normally connected therewith to control the operation of said signals, said signals being rendered inoperative when a connection for conversation is established with the lines, a plurality of cord-circuits at the central office to inductively unite
125 said lines in pairs for conversation, two sources of current-supply arranged to be connected in circuit with the pairs of main lines by the act of connecting the cord-circuits with the lines, one of said sources being connected with one line of each united pair and the
130 other source with the other line of the said

pair, whereby each of the two lines of the united pairs is independently supplied with current from a separate source for conversational purposes, said two sources of current being common to the said plurality of cord-circuits in the order named, substantially as described.

13. The combination with a pair of telephone-lines, of a separate source of electricity in circuit with each line, a relay having a core and an armature opposite each pole thereof, said armatures being polarized alike, a signaling device controlled by each armature, and windings on said core one in circuit with each source and arranged to neutralize the core when both sources are in circuit, substantially as described.

14. The combination with a pair of telephone-lines, of a separate source of electricity in circuit with each line, a combined relay and repeating-coil having a core and an armature opposite each pole thereof, said armatures being polarized alike, a signaling device controlled by each armature, and windings on said core one in circuit with each source and arranged to neutralize the core when both sources are in circuit, substantially as described.

15. The combination with a pair of telephone-lines, of a separate source of electricity in circuit with each line, a relay having a core and an armature opposite each end thereof, said armatures being polarized alike, a signaling device controlled by each armature, a pair of windings on said core one in circuit with each source a part of each winding being mounted on opposite ends of said core, and said windings being so distributed and arranged on said core as to neutralize the core when both sources are in circuit, substantially as described.

16. The combination with a pair of telephone-lines, each having two limbs, of a separate source of electricity in circuit with each line, a relay having a core and an armature opposite each pole thereof, said armatures being polarized alike, a signaling device controlled by each armature, a pair of windings on said core, one in circuit with each source, part of each pair being mounted on opposite ends of said core, said several windings being arranged to neutralize the core when both sources are connected in their individual circuits, and means actuated by the hanging up of both subscribers' telephones for closing circuit through said sources in series and through one winding on each end of said core to attract both armatures, substantially as described.

17. The combination with a pair of telephone-lines and a signal, of a pair of sources of electricity adapted to be individually included in the circuits of the telephone-lines

for talking purposes and acting conjointly to control said signal, substantially as described.

18. The combination with a pair of telephone-lines joined by a repeating-coil, of a pair of sources of electricity at the central station one in circuit with each line, and a signal controlled by the conjoint action of said sources of electricity, substantially as described.

19. The combination with a pair of telephone-lines, of a pair of sources of electricity, means for including said sources of electricity, one in circuit with each of said lines, and for including both of said sources of electricity in series in a common circuit, and a signal controlled by said sources of electricity, substantially as described.

20. The combination with a pair of telephone-lines, of a pair of sources of electricity, means for including said sources of electricity, one in circuit with each of said lines, at one time and under certain conditions of use and for including both of said sources of electricity in series in a common circuit at another time and under other circumstances of use, and a signal controlled by said sources of electricity, substantially as described.

21. The combination with a pair of telephone-lines, of a pair of sources of electricity, means for including one of said sources of electricity in each of said lines, and for including both of said sources in series in a circuit including both lines, and a signal controlled by said sources, substantially as described.

22. The combination with a pair of metallic-circuit telephone-lines, of a pair of sources of electricity, means for including one of said sources of electricity in circuit with each of said telephone-lines, and for including both of said sources of electricity in a circuit including in series one limb of each of said lines, and a third conductor, and a signal adapted to be controlled by said sources of electricity, substantially as described.

23. The combination with a pair of telephone-lines united through a repeating-coil, of a pair of sources of electricity, one in circuit with each of said lines, a signaling device comprising a magnet having a winding in circuit with each of said lines, said windings being arranged to neutralize each other when both sources of electricity are in closed circuit and to energize said magnet when one of said sources alone is in circuit, substantially as described.

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

KEMPSTER B. MILLER.

Witnesses:

WILLIAM W. DEAN,
T. W. DUNBAR.