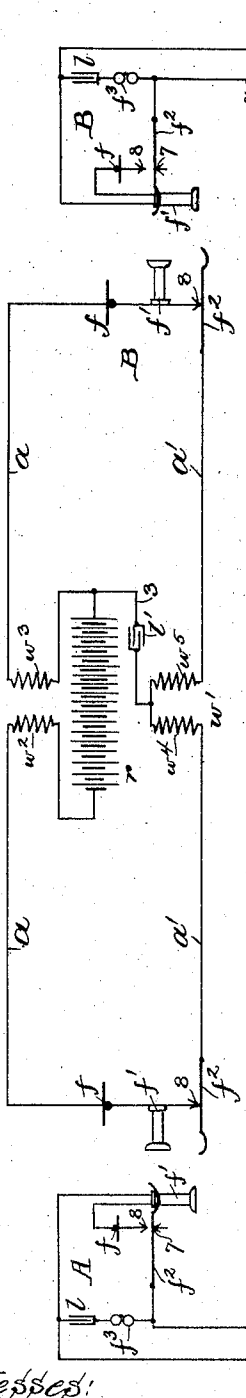
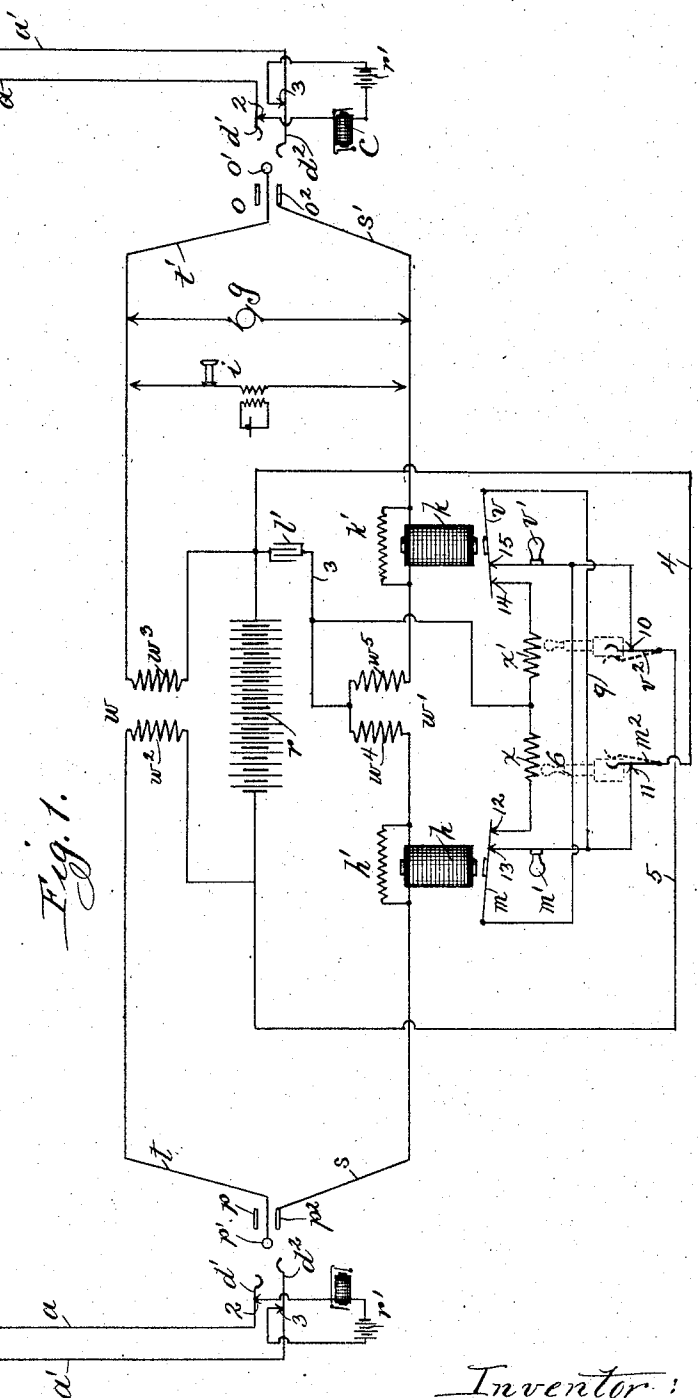


W. W. DEAN.  
CENTRAL SUPPLY TELEPHONE SYSTEM.  
APPLICATION FILED MAR. 22, 1901.

*Fig. 2.*



*Fig. 1.*



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# UNITED STATES PATENT OFFICE.

WILLIAM W. DEAN, OF CHICAGO, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

## CENTRAL-SUPPLY TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 780,601, dated January 24, 1905.

Application filed March 22, 1901. Serial No. 52,275.

*To all whom it may concern:*

Be it known that I, WILLIAM W. DEAN, 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-Supply 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-supply telephone system—that is, a telephone system of the class in which the microphones at the substations are energized from a source of electricity located at the central station.

In accordance with the present invention I provide a source of electricity at the central station adapted to send current over the limbs of the two connected telephone-lines in series, said source being associated with a repeating-coil interposed between the lines in such a manner that the talking-currents may traverse each line independently, corresponding currents being propagated in the connected line through the agency of the repeating-coil.

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

Figure 1 is a diagram showing two telephone-lines connected together with the apparatus embodying my invention. Fig. 2 is a diagram showing the energizing and talking circuits.

Like characters refer to like parts in both the figures.

The telephone-line from substation A extends in two limbs  $a$   $a'$  to the central station, where the limbs terminate, respectively, in the line-springs  $d'$  and  $d''$  of the switch-socket. Any preferred form of individual indicator may be employed, and I have illustrated an indicator  $c$  and a battery  $r'$ , connected between contacts 2 and 3, normally resting against line-springs  $d'$  and  $d''$ , respectively, and separated therefrom upon the insertion of the plug. At the substation the usual microphone  $f$ , receiver  $f'$ , and switch-hook  $f''$  are provided, the switch-hook normally resting against contact 7 and adapted when the receiver is re-

moved from the hook to engage contact 8. The bell  $f^3$  and condenser  $l$  are bridged between the two limbs of the telephone-line.

The apparatus of substation B is similar to that of substation A, and like parts are indicated by the same reference characters.

I have shown the central-station apparatus as consisting of the usual answering-plug  $p$ , having tip  $p'$  and sleeve  $p^2$ , the former connected with strand  $t$  and the latter with strand  $s$ . The calling-plug  $o$  is provided with the usual tip  $o'$  and sleeve  $o^2$ , the former being connected with strand  $t'$  and the latter with strand  $s'$ . Between the strands  $t$   $s$  and  $t'$   $s'$  are the repeating-coils  $w$  and  $w'$ , the coil  $w$  having two windings  $w^2$   $w^3$  and the coil  $w'$  having two windings  $w^4$  and  $w^5$ . The energizing-battery  $r$  is connected between the windings  $w^2$  and  $w^3$ , and a bridge 3, containing a condenser  $l'$ , connects the united ends of the windings  $w^4$  and  $w^5$  with the united ends of windings  $w^2$  and  $w^3$ . In the strand  $s$  is the magnet-coil of a signal-controlling electromagnet or relay  $h$ , around which is a path  $h'$ , permitting the passage of talking-currents, while limiting the passage of continuous currents. Likewise in the strand  $s'$  is the winding of an electromagnet  $h$ , having a similar path  $h'$  around the same. Non-inductive resistances, condensers; or similar devices may be employed in the paths  $h'$  and  $h'$ . The magnet  $h$  controls an arm  $m$ , normally resting against contacts 12 and 13, contact 12 being connected through resistance  $x$  with the conductor 3. The contact 13 is connected through signal-lamp  $m'$  and with contact 11, which is adapted to rest against spring  $m^2$  of a plug-seat switch controlled by the plug  $p$ , the spring  $m^2$  being connected by conductor 4 with one pole of the battery  $r$ . Likewise the magnet  $h$  controls arm  $v$ , which normally rests against contacts 14 and 15, the former being connected through resistance  $x'$  with conductor 3 and the latter being connected through lamp  $v'$  with contact 10, which is adapted to rest against spring  $v^2$  of a plug-seat switch controlled by the plug  $o$ . The spring  $v^2$  is connected by conductor 5 with the pole of the battery  $r$  opposite to that with

which conductor 4 is connected. The spring or other contact  $m$  is connected by conductor 6 with contact 10. The spring or other contact  $v$  is connected by conductor 9 with contact 11. The operator's telephone set  $i$  and the calling-generator  $g$  are adapted to be bridged between the strands  $t'$  and  $s'$  in the usual manner.

The essential features of the apparatus are illustrated in diagram in Fig. 2. When the subscribers are connected for conversation, the current from battery  $r$  passes through winding  $w^3$ , thence through the apparatus at the substation B, through windings  $w^5$  and  $w^4$ , and through the apparatus of substation A, and then passes through winding  $w^2$  back to the opposite side of the battery. The current from the battery  $r$  thus traverses the limbs of the two connected lines in series. The talking-currents, however, propagated from substation A traverse windings  $w^3$  and  $w^4$  through the bridge 3 and induce corresponding currents in windings  $w^5$  and  $w^6$ , which pass to substation B. In a similar manner talking-currents propagated at substation B pass to substation A. The condenser  $l'$  in the bridge 3 permits the passage of the talking-currents, while preventing the flow of the current from battery  $r$ . The voice-currents are thus confined or localized in each line-circuit and circulate independently therein. The particular location of the bridge 3 is not essential so long as it connects the ends of the repeating-coils with the opposite side of the talking-circuit. While I have illustrated two repeating-coils  $w$  and  $w'$ , it will be understood this is for the purpose of balancing the system and that one repeating-coil may be employed, if desired. While the battery  $r$  is shown as connected between the windings of one of the repeating-coils, this particular location of the battery is not essential.

It will be noted that with the structure as shown in Fig. 2 the hanging up of the telephone of either of the connected subscribers opens the circuit of battery  $r$ , and if the battery  $r$  be depended upon for actuating the supervisory signals at the central station one of the connected subscribers could not send in a further call until the operator had removed the plugs. In order that either of two connected subscribers may in the usual manner signal the operator for another connection before the connecting-plugs are withdrawn, I provide the auxiliary apparatus particularly illustrated in Fig. 1. If it be assumed that subscriber A desires to converse with subscriber B, he lifts his telephone from its hook, thereby closing the circuit of battery  $r'$  through indicator  $c$  and the limbs of the telephone-line in the customary manner. The indicator  $c$  is thus actuated, and the operator thereupon lifts the plug  $p$  from its seat and inserts the same in the switch-socket belonging to line A. The removal of the plug from its seat permits the spring  $m^2$  to engage

contact 11. Contacts  $v^2$  and 10 remain separated until the plug  $o$  is removed from its seat. The insertion of the plug  $p$  in the switch-socket closes the circuit of battery  $r$  over conductor 4, contacts  $m^2$  and 11, conductor 9, spring  $v$ , contact 14, resistance  $x'$ , winding  $w^4$ , magnet  $h$ , strand  $s$ , limb  $a'$ , limb  $a$ , strand  $t$ , and winding  $w^2$  to the opposite side of the battery. Magnet  $h$  is thus energized and lifts spring  $m$  from contacts 12 and 13. The current from battery  $r$  being thus sent through the apparatus at the substation, the operator may connect her telephone in circuit in the usual manner and receive the number of the called subscriber. Learning that subscriber B is called for, she lifts plug  $o$  from its seat and inserts the same in the switch-socket belonging to subscriber B. Contacts  $v^2$  and 10 are thus closed together. Having inserted the plug  $o$ , the operator sends ringing-current to substation B in the usual manner. When subscriber B responds and lifts his telephone from its hook, the circuit of battery  $r$  is closed over the limbs of the two telephone-lines in series, as shown in connection with Fig. 2, and magnet  $h$  is energized to lift spring  $v$  out of contact with contacts 14 and 15. The circuits through conductors 4 and 5 thus both remain open while the subscribers are in conversation.

When the subscribers have completed their conversation, they hang up their telephone-receivers and the circuit of battery  $r$  is interrupted, thereby deenergizing the magnets  $h$  and  $k$  and closing the circuit of battery  $r$ , through the lamps  $m'$  and  $v'$ . The circuit of battery  $r$  through the lamp  $m'$  may be traced over conductor 4, contacts  $m^2$  and 11, lamp  $m'$ , spring  $m$ , conductor 6, contacts 10 and  $v^2$ , and conductor 5 back to the battery. The circuit through lamp  $v'$  may be traced from battery  $r$  over conductor 4, contacts  $m^2$  and 11, conductor 9, spring  $v$ , lamp  $v'$ , contacts 10 and  $v^2$ , and conductor 5 back to the battery. The lamps being lighted to indicate to the operator that the conversation has been completed, she withdraws the plugs  $p$  and  $o$  and returns the same to their respective seats. The circuit through the lamps  $m'$  and  $v'$  are thereupon opened at the contacts by the plug-seat switches. Assuming that before the plugs are removed subscriber A desires a reconnection with another party, he vibrates his switch-hook in the usual manner. Magnet  $h$  is thus alternately energized and deenergized to open and close the circuit through the lamp  $m'$  to alternately light and extinguish the same. The circuit of battery  $r$  thus controlled by subscriber A may be traced over conductor 4 through contacts  $m^2$  and 11, conductor 9, spring  $v$ , contact 14, (magnet  $h$  being deenergized by the hanging up of the receiver of subscriber B,) resistance  $x'$ , winding  $w^4$ , strand  $s$ , limb  $a'$ , limb  $a$ , strand  $t$ , winding  $w^2$  back to the battery. Each subscriber may thus control

the circuit through his clearing-out indicator independently of the connected subscriber, and while the energizing-battery is connected in series with the connected lines so long as the same are connected for conversation the hanging up of the receiver of either subscriber immediately connects the central battery in an individual circuit controlled by the other subscriber and including his clearing-out indicator.

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 means for uniting the same for conversation through a repeating-coil bridged between the two limbs of the talking-circuit, and an energizing source of electricity adapted to send current through the two limbs of the two lines in series, substantially as described.

2. The combination with a pair of telephone-lines, of means for uniting the same for conversation through a repeating-coil having its windings bridged between the two sides of the talking-circuit whereby the talking-currents may traverse each line independently, an energizing source of electricity adapted to send current through the two limbs of the two lines in series, and means for preventing the energizing-current from passing through the bridge for the talking-currents containing the windings of the repeating-coil, substantially as described.

3. The combination with a pair of telephone-lines, of means for uniting the same for conversation through a repeating-coil, and an energizing source of electricity adapted to send current through the two limbs of the two lines and through the primary and secondary windings of said repeating-coil in series, substantially as described.

4. The combination with a pair of telephone-lines, of means for uniting the same for conversation through a repeating-coil, the ends of the primary and secondary windings of said repeating-coil being joined together, an energizing source of electricity adapted to send current through the limbs of the two telephone-lines and through said primary and secondary windings in series and a bridge for the talking-currents connecting the united ends of said windings with the opposite side of the talking-circuit, substantially as described.

5. The combination with a pair of telephone-lines, of means for uniting the same for conversation through a repeating-coil, the primary and secondary windings of said coil being connected together, an energizing source of electricity adapted to send current through the limbs of said line, and said primary and secondary windings in series, and a bridge containing a condenser connecting the united ends of said windings with the opposite side of the talking-circuit, substantially as described.

6. The combination with a pair of telephone-

lines, of means for uniting the same for conversation through a repeating-coil, an energizing source of electricity connected between the primary and secondary windings of said coil having united ends, and adapted to send current through said primary and secondary windings and the limbs of the two lines in series, and a bridge for the talking-currents joining the united ends of said windings with the opposite side of the talking-circuit, substantially as described.

7. The combination with a pair of telephone-lines, and means for uniting the same for conversation, through a pair of repeating-coil windings having united ends, an energizing source of electricity connected between the primary and secondary windings of one pair and adapted to send current through the limbs of the two lines and the windings of the two pairs in series, and a bridge for the talking-currents connecting the united ends of one pair of windings with the united ends of the other pair of windings, substantially as described.

8. The combination with a pair of telephone-lines, of a charging source of electricity adapted to send current over the two limbs of the two lines in series, and means controlled by each telephone-line for connecting the other telephone-line in a complete circuit with said source of electricity, substantially as described.

9. The combination with a pair of telephone-lines, of a charging source of electricity adapted to send current over the limbs of the two lines in series, and a switch at each substation and additional means for connecting the other telephone-line in a complete circuit with said source of electricity, substantially as described.

10. The combination with a pair of telephone-lines, of a charging source of electricity adapted to send current over the limbs of the two lines in series, a pair of relays at the central station one individual to each line during a connection, means at each substation for controlling the relay corresponding to said line, and means controlled by the relay of each line for closing the other line in a complete circuit with said source of electricity, substantially as described.

11. The combination with a pair of telephone-lines, of a pair of cord connectors for uniting the same for conversation, a charging source of electricity included in series with one of the strands of said cord connectors, and means controlled by each telephone-line for connecting said source of electricity between the two strands of the cord connectors and in a complete circuit with the other telephone-line, substantially as described.

12. The combination with a pair of telephone-lines, of means for uniting the same for conversation including a repeating-coil bridged between the two sides of the talking-

circuit, and further means for sending current from the central office through the two sides of the two lines in series, substantially as described.

5 13. The combination with a pair of telephone-lines, of means for uniting the same for conversation including a repeating-coil having its windings bridged between the two sides of the talking-circuit whereby the talking-currents may traverse each line independently, and means for sending an energizing-current of electricity from the central office through the two sides of the two connected lines in series, and additional means for preventing the energizing-current from passing through the bridge for the talking-currents containing the windings of the repeating-coil, substantially as described.

10 14. The combination with a pair of telephone-lines, of means for uniting the same for conversation including a repeating-coil, means for sending an energizing-current of electricity through the two limbs of the two lines and through the primary and secondary windings of said repeating-coil in series, and means to confine the voice-currents independently to each line-circuit, substantially as described.

15 15. The combination with a pair of united telephone-lines, a current source at the central office arranged to send current over the two sides of the complete talking-circuit of the united lines in series, and means for localizing the voice-currents in each line of the united pair, substantially as described.

20 16. The combination with a pair of telephone-lines, of a current source at the central office adapted to send current over the limbs of the two lines in series, and means controlled from one substation for connecting the said current source in a circuit individual to the other line, substantially as described.

25 17. The combination with a pair of telephone-lines, of a charging source of electricity adapted to send current over the limbs of the two lines in series, and means controlled from one substation for causing current from said source to flow in a circuit individual to the other telephone-line, substantially as described.

30 18. The combination with a pair of telephone-lines, of a current source of electricity at the central office adapted to send current over the limbs of the two lines in series, and means controlled from each substation for causing current from said source to flow in a circuit individual to the telephone-line of the other substation, substantially as described.

35 19. The combination with a pair of telephone-lines, of a charging source of electricity adapted to send current over the two limbs of the two lines in series, means controlled by each telephone-line for connecting the other telephone-line in a complete circuit with said source of electricity, and a supervisory-signal-controlling electromagnet associated with

each line and controlled during the connection and when one subscriber's line is open by the current in said complete circuit, substantially as described.

40 20. The combination with a pair of telephone-lines, of a charging source of electricity adapted to send current over the limbs of the two lines in series, a pair of magnets at the central station, one individual to each line during a connection, means at each substation for controlling the relay corresponding to said line, means controlled by the relay of each line for closing the other line in a complete circuit with said source of electricity, and a supervisory signal controlled by each of said magnets, substantially as described.

45 21. The combination with a pair of telephone-lines, of a pair of cord connectors for uniting the same for conversation, a charging source of electricity included in series in one of the strands of said cord connectors, means controlled by each telephone-line for connecting said source of electricity between the two strands of the cord connectors and in a complete circuit with the other telephone-line, and supervisory signals associated with each line and controlled by current from said source, substantially as described.

50 22. The combination with a pair of telephone-lines united for conversation, of supervisory-signal-controlling magnets associated with said lines, a signal controlled by each magnet, a source of current adapted to send current over the two lines in series during conversation, said magnets being located in the path of said series current and energized thereby during conversation, and each magnet being energized by current from said source over its own line only when the circuit of the other united line is opened, substantially as described.

55 23. The combination with a pair of united telephone-lines, of an inductive device to unite said lines for conversation, a current source at the central office arranged to send current over the two sides of the complete talking-circuit of the united lines in series, means for localizing the voice-currents in each line of the united pair, and a supervisory signal associated with each of the united lines and controlled from said source, substantially as described.

60 24. The combination with a pair of telephone-lines, of a current source at the central office adapted to send current over the limbs of the two lines in series, means controlled from one substation for connecting said current source in a circuit individual to the other line, and a supervisory-signal-controlling magnet for each line in the path of current in series over the line when current so flows and in the path of current individual to the lines when the other line is open, substantially as described.

65 25. In a telephone system, the combination

with a pair of telephone-lines, of means for uniting the same for conversation, a source of current adapted to send current over the two sides of the two lines in series, means for localizing the voice-currents in each of the lines, a relay associated with each line, a local circuit controlled by each relay, a supervisory signal in each local circuit, and means for normally opening said local circuit at another point and for closing the same during connections, substantially as described.

26. In a telephone system, the combination with a pair of telephone-lines, of a cord-circuit including connecting-plugs for uniting the same for conversation, a source of current adapted to send current over two sides of the lines in series during conversation, means for localizing the voice-currents in each of the lines, a relay associated with each end of the cord-circuit, a local circuit controlled by each relay, a supervisory signal in each local circuit, and plug-seat switches for the said plugs to normally open said circuits, substantially as described.

27. In a telephone system, the combination with a pair of telephone-lines, of means for uniting the same for conversation, a source of current adapted to send current over the two sides of the two lines in series, means for localizing the voice-currents in each of the lines, a relay associated with each line and adapted to include said source of current in a circuit individual to the other line, a local circuit for each relay, a supervisory signal in each local circuit, said local circuits and individual circuits being completed through normal contacts of said relays, substantially as described.

28. In a telephone system, the combination with a pair of telephone-lines, of a cord-circuit including connecting-plugs for uniting the same for conversation, a source of current associated with the cord-circuit adapted to send current over the two sides of the two lines in series during conversation and over

each line independently when the other line is not in use, means for localizing the voice-currents in each of the lines, a relay associated with each end of the cord-circuit, a plug-seat switch for each plug of the cord-circuit, said individual circuits being completed through the contacts of the associated plug-seat switch and the relay of the other line, substantially as described.

29. In a telephone system, the combination with a pair of telephone-lines, of a cord-circuit for connecting the same together for conversation and having a connecting-plug for each end, a source of current connected with the cord-circuit and adapted to send current over the two sides of the two lines in series, means for localizing the voice-currents in each of the lines, a relay associated with each end of the cord-circuit, a local circuit controlled by each relay, a supervisory signal in each local circuit, plug-seat switches for each of the plugs, the contacts of both of said switches being included in each local circuit, substantially as described.

30. In a telephone system, the combination with a pair of telephone-lines, of a common source of current at the central office, means to include said source in series in the metallic circuit of said two lines during conversation, a condenser to permit individualizing the voice-currents in each line, supervisory signals at the central office one for each line, a supervisory relay for each line, and local circuits for said signals, said local circuits including a short circuit of said condenser controlled by the corresponding relay-contacts and other switch-contacts, substantially as described.

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

WILLIAM W. DEAN.

Witnesses:

MELANCTHON R. NYMAN,  
W. CLYDE JONES.