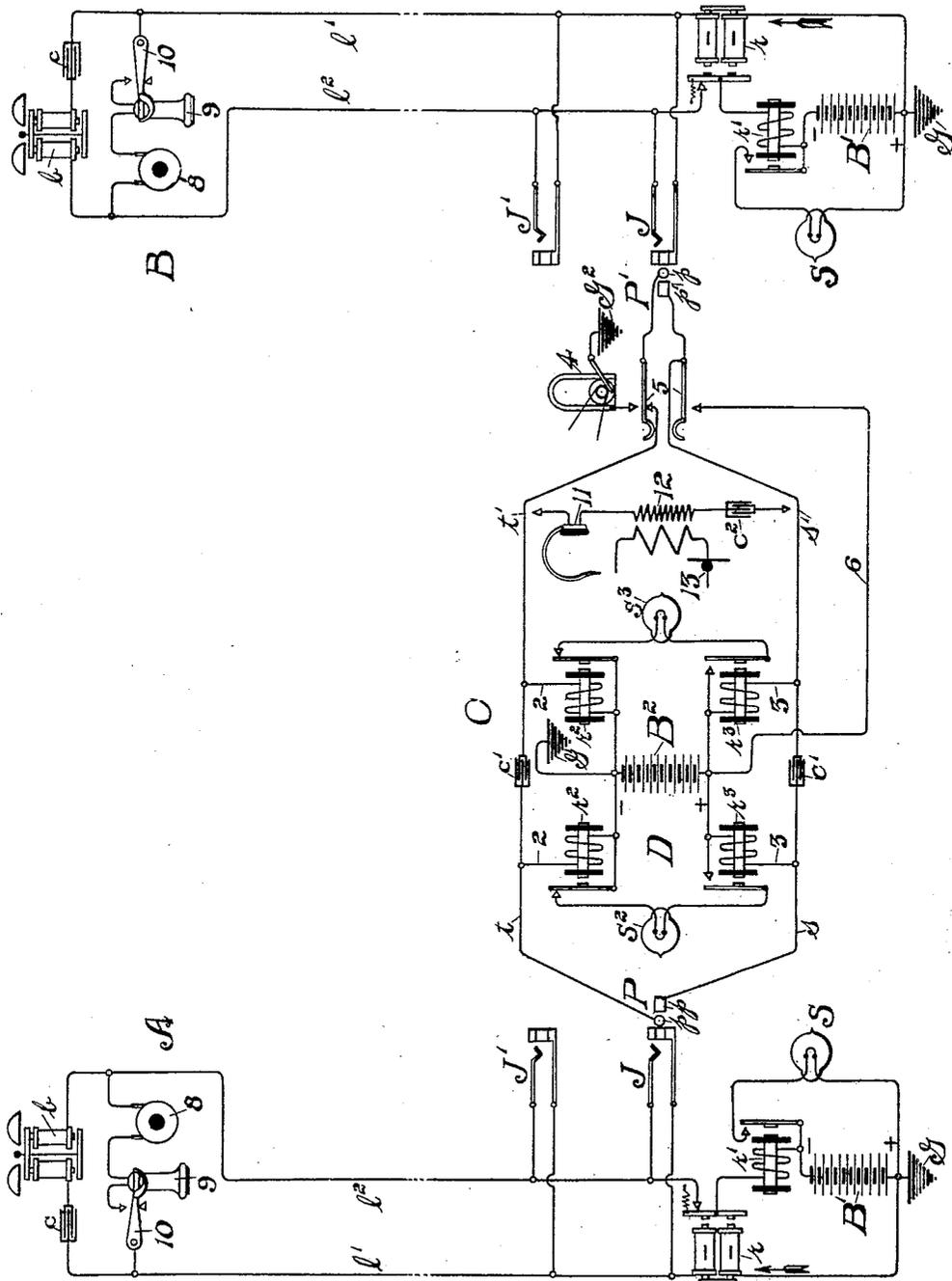


W. W. DEAN.
TELEPHONE SYSTEM.
APPLICATION FILED MAY 27, 1901.

NO MODEL.



Witnesses.
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UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 746,040, dated December 8, 1903.

Application filed May 27, 1901. Serial No. 62,031. (No model.)

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 new and useful Improvements in Telephone Systems, of which the following is a specification.

My invention relates to telephone systems wherein subscribers' lines terminate at a central office having means to interconnect the several lines for conversational purposes. It has special reference to those systems employing central sources of current-supply for the operation of all signals and in which signaling from the subscribers' stations to the central office is entirely automatic. Such lines commonly employ a central battery and an electromagnetic signaling device in the circuit which is adapted to be operated when the subscriber closes his line-circuit by taking up his receiver. A cut-off relay is also ordinarily provided for each line to render the said line-signal inoperative when a connection is established with the line, so that it will not be exposed during the connection. Cord or link circuits having supervisory signals associated therewith are also provided, together with means for ringing a subscriber and for inserting the operator's telephone in the lines.

Systems have been devised employing cut-off relays that are insensitive or unresponsive to calling-current, so that the line-signal will be exposed when a subscriber calls, but that are sensitive or responsive to current thrown upon the line in the establishment of a connection therewith to render the said signal inoperative.

In this system I prefer to make the cut-off relays insensitive or unresponsive to calling-current, as aforesaid, by polarizing them and so connecting the source of current with the lines that the calling-current will not affect them; but when a connection is established with the line for conversational purposes the current is passed through the cut-off relays in the proper direction to operate them to render the line-signals inoperative.

In the accompanying drawing, which is a diagrammatic view of two subscribers' line-circuits and a cord-circuit, the subscribers'

stations A and B are shown having the usual apparatus adapted for central-battery use, including a receiver 9 and a transmitter 8 in a normally open bridge of the line through the hook-switch 10, as well as a condenser *c*, and a bell *b* in a normally closed branch between the line conductors 1' and 1², which lead to the central office and are there connected with the multiple jacks J and J' and are continued through the polarized cut-off relay *r*, the line-relay *r'*, and the battery B', a ground connection G being also provided. The line-relay is adapted to close a local circuit through its armature and forward contact containing the line-signal S and the battery B'.

At the central office C a cord-circuit D is provided and comprises the plugs P and P', having the tip and sleeve contacts *p* and *p'*, the former being connected by the tip-straunds *t* and *t'*, while the latter are similarly connected by the sleeve-straunds *s* and *s'*, the condensers *c'* being inserted between the two portions of each strand to inductively connect them for the free passage of voice-currents. The strands *t* and *t'* are conductively connected, by means of branch conductors 2, with the grounded pole of the talking-battery B², said branches including the supervisory relays *r*², and the sleeve-straunds *s* and *s'* are connected in like manner by branch conductors 3 with the other pole of the talking-battery B² and likewise include supervisory relays *r*³. These relays control the continuity of the circuits of the supervisory signals S² and S³, which are associated, respectively, with the answering and calling plugs P and P' of the cord-circuit, the relays *r*³ serving to normally open said circuits to darken the lamps and the former being adapted to close the said circuits when deenergized.

The operator's set is adapted to be bridged between the strands *s'* and *t'* of the cord-circuit and includes the receiver 11, an induction-coil 12, and a condenser *c*³ in series in said bridge, the transmitter 13 being preferably charged from the main battery B². A grounded ringing-generator 4 is adapted to be connected with the calling-plug P' by the ringing-key 5 for the purpose of calling sub-

scribers, a branch conductor 6, parallel to the strand s' of the cord-circuit, being provided for the free passage of the ringing-current.

5 The operation is substantially as follows: The subscriber at station A, for example, removes his receiver and closes the circuit from the battery B' over the metallic line and through the cut-off and line relays r and r' ; but as the cut-off relay r is polarized and so
10 biased as not to be operated by the current now flowing the line-relay r' only responds to close the circuit of line-lamp S. The operator upon observing the signal inserts the answering-plug P into a jack of the line, and
15 thereby connects the cord-circuit battery B^2 with the line and at the same time completes a local circuit from ground G' at the cord-circuit through the talking-battery B^2 , over the branch conductor 3, the strand s of the cord-circuit, the sleeve-contacts of the plug and jack, through a portion of the talking-circuit, the polarized cut-off relay r to ground at G. This, it will be observed, sends current
25 through the cut-off relay r in a reverse direction from that previously flowing and causes it to cut out the line-relay r' and extinguish the lamp S. To accomplish this purpose, the battery B^2 must have its opposite pole grounded from that of the battery B' , which
30 necessitates at least two sets of batteries for the exchange. The completion of the local circuit above traced also causes the energization of supervisory relay r^3 , which closes the circuit of supervisory lamp S^2 ; but inasmuch as the subscriber's telephone is off the hook the supervisory relay r^3 is likewise operated over the line-circuit and opens the circuit of
35 said lamp, thereby causing the same to remain dark. Upon learning the number of the subscriber wanted his line is tested, and if idle the calling-plug P' is inserted in a jack of the line and the ringing-key 5 operated. The path for the ringing-current may be traced
45 from ground G^2 through the generator to the subscriber's station and back through the parallel branch or by-path 6, the battery B^2 , to ground G' . It will be understood that the lower spring of the ringing-key 5 cannot be directly grounded, for the reason that the battery B^2 would be grounded or practically short-circuited instead of passing through the polarized cut-off relay r ; also, that while the parallel branch 6 may not be necessary it
55 serves to prevent any possible vibration of the armature of the supervisory relay r^3 in the strand s' . Before the called subscriber responds the supervisory relay r^3 and the cut-off relay r are operated over the local circuit, similar to the one before described. The line-relay r' is thus cut out, and the supervisory lamp S^3 is illuminated and remains so until the subscriber responds, when the supervisory relay r^3 is operated over the metallic
65 line to the station B to break the circuit of said lamp and extinguish it. The parties are now in conversation, the battery B^2 serving

to charge their transmitters while the voice-currents are transmitted through the condensers c' from one line to the other. The relays r^2 , it will be observed, are under the control of the respective subscribers, while the relays r^2 are energized as long as the plugs are in the line sockets or jacks. 70

In making the busy test it is only necessary to touch the tip of the calling-plug to the ring of the subscriber's jack, which ring if the line is busy is connected to the live side of the battery and a circuit is completed through the tip of the plug to the other side of said battery and causes a click in the operator's receiver. 80

At the termination of the conversation when the subscribers return their receivers to the hooks the metallic line-circuits from the battery B^2 will be opened at the hooks, thus causing the supervisory relays r^2 to release their armatures and close the circuits of the supervisory lamps S^2 and S^3 , which lamps become lighted and indicate to the operator that the conversation is terminated, when the plugs are withdrawn, relays r^3 and r deenergized, and all parts restored to normal condition. 85 90

The several ground connections referred to may be the common office return or ground connection; but, as before stated, separate batteries B' and B^2 must be used in order to send current in reverse directions through the cut-off relays when a subscriber calls and when a connection is established with the line. 95 100

Good results have been obtained with polarized cut-off relays of five hundred ohms resistance and line-relays of one hundred ohms resistance, with the other parts of the usual or desired dimensions, though these sizes are not absolutely essential and may be varied without departing from the spirit of my invention. Other signaling devices might also be employed; but those shown are deemed preferable. 105 110

What I claim is—

1. In a telephone system, the combination with a telephone-line, of a source of current with which the line is connected at the central office, a line signaling device responsive to current in the line when the subscriber is calling the central office, a polarized cut-off device connected with the line and adapted when operated to render the line-signal inoperative, said cut-off device being in the path of current in the line when the subscriber is calling the central office, but unresponsive to such current so that the said signaling device is not prevented from operation, and means for reversing current through said cut-off device when a connection is established with the line for conversation to thereby operate the said cut-off device and prevent the signal from operating, substantially as described. 115 120 125 130

2. In a telephone system, the combination with a telephone-line, a line-signal, of a polarized electromagnetic device for the line serving when operated to render the said sig-

nal inoperative, a common central source of current with which the lines of the system are connected, a switch at the substation of the line to control the flow of current in the line from the central office, and means to reverse current through said device when a connection is established with the line, whereby in the first instance the line-signal may be caused to operate from the substation and in the second instance is prevented from operation, substantially as described.

3. In a telephone system, the combination with a multiple-switchboard telephone-line, of a line-signal therefor, a polarized device adapted when operated to render said signal inoperative, said device being in the path of current in the line from the central office when the subscriber is calling but unresponsive to current of that direction, a cord-circuit to establish connections for conversation, a source of current to furnish current over the telephone-line for conversation, and means for including said source and said device in a local circuit when connection is established with the line, the current in said local circuit from said source being in the reverse direction through said device and serving to operate the same to render the said signal inoperative, substantially as described.

4. In a telephone system, the combination with a line-circuit, of a polarized cut-off relay for said circuit unresponsive to current flowing therethrough in one direction but responsive to current in the opposite direction, a line-relay, a source of current, and means to operate the cut-off relay to cut out the line-relay.

5. In a telephone system, the combination with a line-circuit, of a polarized cut-off relay for said circuit, a line-relay, means for sending current in one direction through said polarized relay when the subscriber calls, and further means for sending current in the other direction therethrough when a connection is established with the line.

6. In a telephone system, the combination with a line-circuit, of a polarized cut-off relay in the line-circuit, a line-relay, a source of current also in said circuit so connected that the polarized relay will not be operated when a subscriber calls, another source of current, and means to connect the same to the line for talking and so as to operate the cut-off relay.

7. In a telephone system, the combination with a line-circuit, of a polarized cut-off relay in the line-circuit unresponsive to current flowing therethrough in one direction but responsive to current in the opposite direction, a line-relay, a source of current also in the line-circuit so connected that the polarized relay will not operate when a subscriber calls, and means for sending current through said cut-off relay in a direction to operate it when a connection is established with the line.

8. In a telephone system, the combination with a line-circuit, of a polarized cut-off relay in the line-circuit, a line-relay, a source of

current also in the line-circuit so connected that the polarized relay will not operate when a subscriber calls, a cord-circuit, and another battery connected with the cord-circuit to furnish current for talking and to operate said cut-off relay when the cord-circuit is connected with the line.

9. In a telephone system, the combination with a line-circuit, of a polarized cut-off relay for said circuit, a line-relay, and means for sending current through said cut-off relay in reverse directions when a subscriber calls and when a connection is established with the line.

10. In a telephone system, the combination with a line-circuit, of a polarized cut-off relay for said circuit, a line-relay, and means for rendering the same unresponsive when a subscriber calls and responsive when a connection exists with the line to cut out the line-relay.

11. In a telephone system, the combination with a line-circuit, of a polarized cut-off magnet for said circuit unresponsive to current flowing therethrough in one direction but responsive to current in the opposite direction, a line-relay and a source of current all in series in said circuit, a line-signal controlled by said line-relay, and means for operating said cut-off magnet to render said line-signal inoperative, substantially as described.

12. The combination with a telephone-line, of a polarized cut-off relay and a line-relay in the line, a battery to furnish current for talking, and means to close said cut-off relay and battery in a local circuit when a connection is established with the line, substantially as described.

13. The combination with a telephone-line, of a central battery with which the limbs of said line are connected, a line-relay in one limb of the line, and a polarized cut-off relay having its winding in the other limb of the line and adapted to open the first-named limb to render the line-relay inoperative, substantially as described.

14. The combination with a telephone-line, of a central battery, a polarized cut-off relay unresponsive to current flowing therethrough in one direction but responsive to current in the opposite direction and a line-relay in the line, a line-signal controlled by the line-relay and a third conductor adapted to be connected about the cut-off relay and battery whereby the cut-off relay is actuated when a connection is established with the line to render the line-signal inoperative, substantially as described.

15. The combination with a telephone-line, of a line-relay, a battery and a polarized cut-off relay in the line, and means to close a circuit through the cut-off relay when a connection is established with the line, said circuit including a portion of one side of the talking-circuit, substantially as described.

16. The combination with a telephone-line, of a line-relay, a battery, a polarized cut-off relay permanently connected with the line

and unresponsive to current flowing there-
through in one direction but responsive to
current in the opposite direction, and means
to close a circuit through the cut-off relay
5 when connection is established with the line
through which current flows in the proper di-
rection to operate the cut-off relay, said cir-
cuit including a portion of one side of the
talking-circuit, substantially as described.

10 17. The combination with a telephone-line,
of a line-relay, a battery, a polarized cut-off
magnet in the line, and means to close a cir-
cuit through the cut-off magnet when a con-
nection is established with the line over which
15 current flows in the proper direction to oper-
ate the cut-off magnet, said circuit including
a portion of the telephone-line and cord-cir-
cuit, substantially as described.

18. The combination with a telephone-line,
20 of a line-relay, a battery and a polarized cut-
off device in the line, the said device being
unresponsive to current flowing therethrough
in one direction but responsive to current in
the opposite direction, a cord-circuit, and
25 means to close a circuit through the cut-off
device when a connection is established with
the line over which current flows in the proper
direction to operate said cut-off device, said
circuit including a portion of one side of the
30 talking-circuit of the telephone-line and cord-
circuit, substantially as described.

19. The combination with a telephone-line,
of a line-relay and a polarized cut-off device
in the line, a cord-circuit, and two supervi-
35 sory relays connected with said circuit, one of
said relays being adapted to be closed in a
local circuit with the winding of said cut-off
device over which current flows in the proper
direction to operate said cut-off device, where-
40 by one relay of the two is controlled by the
operator and the other of said relays is con-
trolled by the subscriber over the line-circuit,
substantially as described.

20. In a telephone system, the combination
45 with a subscriber's line, of a signal-controll-
ing electromagnet and a source of continuous
current in the line at the central office, a po-
larized cut-off relay in the line in the path of
current from said source when the subscriber
50 is calling the central office, said relay being
unresponsive to said calling-current, and
means to operate the relay when a connection
is established with the line to render the sig-
nal-controlling electromagnet inoperative to
55 cause a signal, substantially as described.

21. In a telephone system, the combination
with a subscriber's line, of a signal-controll-
ing electromagnet and a source of continuous
60 current in the line at the central office, a po-
larized cut-off relay unresponsive to current
flowing therethrough in one direction but re-
sponsive to current in the opposite direction
having a winding connected directly in the
path of current from said source flowing in
65 the line when the subscriber is calling the
central office but unresponsive thereto, and
means to operate the said cut-off relay when

the connection is established with the line to
render said signal-controlling electromagnet
inoperative, substantially as described. 70

22. In a telephone system, the combination
with a subscriber's line having conductors
normally extending to opposite poles of a
source of current, of a signal-controlling elec-
75 tromagnet in one of said conductors, a switch
in said conductor between said magnet and
the subscriber's station, and a polarized cut-
off relay having a winding connected in the
other conductor and controlling said switch,
substantially as described. 80

23. In a telephone system, the combination
with a subscriber's line normally extending
to opposite poles of a source of current, of a
signal-controlling electromagnet in one of said
85 conductors, and a polarized cut-off relay hav-
ing a winding connected in the opposite con-
ductor and controlling the continuity of the
first-named conductor, said winding being
energized over a portion of the talking-circuit
when a connection is established with the line
90 to render the signal-controlling electromag-
net inoperative, substantially as described.

24. The combination with a subscriber's line
normally extending to opposite poles of a
source of current, of a signal-controlling elec-
95 tromagnet in one of said conductors, a polar-
ized cut-off relay in the second conductor con-
trolling the continuity of the first-named con-
ductor, a cord-circuit adapted to be connected
with the line in response to a call of the sub-
100 scriber, and connections from said cord-cir-
cuit to a battery so as to include the same to-
gether with the winding of said cut-off relay
in a local circuit, whereby said cut-off relay
is operated upon the connection of the cord-
105 circuit with the line to render the signal-
controlling electromagnet inoperative, said local
circuit including a portion of the talking-cir-
cuit and said battery serving also to furnish
current to the transmitter for talking pur-
110 poses, substantially as described.

25. In a telephone system, the combination
with a subscriber's line, of a source of current
connected between the limbs thereof, a signal-
controlling electromagnet in one of said limbs,
115 a polarized cut-off relay unresponsive to cur-
rent flowing therethrough in one direction
but responsive to current in the opposite direc-
tion having an actuating-winding in the other
of said limbs, and normally closed switch-
120 contacts of the said relay included in the first-
named limb, substantially as described.

26. In a telephone system, the combination
with a subscriber's line, of a source of current
connected between the limbs thereof, a signal-
125 controlling electromagnet in one of said limbs,
a polarized cut-off relay having an actuating-
winding connected in the other of said limbs,
normally closed switch-contacts of said relay
included in the first-named limb of the line,
130 said relay being unresponsive to current in
the line from said source when the subscriber
is calling central office, and means for send-
ing an actuating-current through said relay-

winding as long as the line is switched for use to operate said relay and open its normal contacts to cut out said electromagnet, substantially as described.

5 27. The combination with a telephone-line, of a line-relay, a polarized cut-off relay unresponsive to current flowing therethrough in one direction but responsive to current in the opposite direction and a source of current normally in circuit with the line, the line-relay only being responsive to current from said source when the subscriber is calling, a cord-circuit adapted to be connected with the line, a supervisory signal and a battery asso-
10 ciated therewith to furnish current for talking, and means for establishing a path for current over one side of said cord-circuit to operate said cut-off relay and supervisory signal, and a relay adapted to render said
15 signal inoperative and having its winding disposed in a path of current over the other side of said circuit and telephone-line, said relay being controlled by the subscriber, substantially as described.

25 28. The combination with a telephone-line, a line-relay, a polarized cut-off device and source of current normally in circuit with the line, the line-relay only being responsive to current from said source when the subscriber
30 is calling, a cord-circuit adapted to be connected with the line, a source of current for talking and supervisory signal associated therewith, and means for establishing a path for current over one side of said cord-circuit
35 to operate the cut-off device and supervisory signal, an electromagnetic device adapted to render said supervisory signal inoperative and having its winding disposed in the path of current over the other side of the cord-circuit and telephone-line, whereby said elec-
40 tromagnetic device is placed under the control of the subscriber, substantially as described.

45 29. The combination with a telephone-line, of a line-relay, a polarized cut-off magnet unresponsive to current flowing therethrough in one direction but responsive to current in the opposite direction, and a source of current normally in circuit with the line, the line-relay
50 only being responsive to current from said source when the subscriber is calling, a cord-circuit adapted to be connected with the line, a supervisory signal and a battery for talking associated therewith, an electromagnetic de-
55 vice and means for establishing a path for current over one side of said cord-circuit and through said electromagnetic device and cut-off device to operate them, said electromag-
60 netic device serving to render the supervisory signal operative, and a second electro-
magnetic device having its winding disposed in the path of current over the other side of said cord-circuit and telephone-line, said
65 second electromagnetic device being controlled by the subscriber and serving to render said supervisory signal inoperative when

current is flowing in the said path, substantially as described.

30. The combination with a telephone-line, of a line-signal, a polarized cut-off relay and source of current normally in circuit with the line, the cut-off relay being unresponsive to current from said source when the subscriber is calling, a cord-circuit adapted to be connected with the line, a supervisory signal and
75 a battery for talking associated therewith, means for operating said signal and cut-off relay over a local circuit when said cord-circuit is connected with the line, said local circuit including a portion of the talking-circuit,
80 and means controlled by the subscriber for rendering said signal inoperative by current passed over the line-circuit, said cord-circuit and battery serving also to furnish current to the transmitter for conversational purposes,
85 substantially as described.

31. In a telephone system, the combination with a telephone-line and a polarized cut-off relay therefor, said relay being unresponsive to current flowing therethrough in one direc-
90 tion but responsive to current in the opposite direction, of a cord-circuit adapted to be connected with said line, a supervisory signal associated with said cord-circuit and adapted to be operated by current passed over one side
95 of the cord-circuit when connected with the line, the actuating-winding of the cut-off relay being included in the path of said current, whereby it is operated, and means controlled by the subscriber for rendering said signal
100 inoperative by current passing over the line-circuit, substantially as described.

32. In a telephone system, the combination with a subscriber's-telephone-line circuit normally discontinuous to direct currents at the
105 subscriber's station, of a polarized cut-off relay therefor at the central office, a main-line terminal for the line consisting of two normally open contact-pieces at the central office, a cord-circuit consisting of two strands
110 and with contact-terminals adapted to connect with the contact-terminals of the line when the line is connected for conversation, a source of current associated with said cord-circuit and adapted to send current over the
115 telephone-line to feed the subscriber's transmitter, a supervisory signal associated with said cord-circuit and adapted to be operated over one side thereof when connected with the line, the circuit for operating said signal
120 being completed over a local circuit at the central office and including the winding of said cut-off relay through which current flows in the proper direction to operate the same, and means under the control of the sub-
125 scriber to render said signal inoperative by closing the line-circuit at the subscriber's station to form a path for current over the line-circuit, substantially as described.

33. In a telephone system, the combination
130 with a main line normally open or discontinuous at the subscriber's station, of a tele-

phone instrument at said subscriber's station, of a calling-signal normally associated with the line at the central office, a polarized cut-off relay at the central office, said relay being unresponsive to current flowing therethrough in one direction but responsive to current in the opposite direction adapted to render the calling-signal inoperative when connection is made with the line, a plurality of connection-terminals for said line, a cord-circuit consisting of two conductors and adapted to be placed in connection with the said connection-terminals, a source of current associated with said cord-circuit and adapted to send current over the line-circuit for energizing the subscriber's transmitter during conversation, a supervisory signal associated with said cord-circuit and adapted to be operated when connection is made with the line over a local circuit including the cut-off relay, and means controlled by the subscriber for rendering the said supervisory signal inoperative by current from the said source located in the cord-circuit and sent over the line, substantially as described.

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

35. The combination with a multiple-switchboard common-battery telephone-line, of a battery connected between one line conductor and a third conductor, the other line conductor being also connected with said third conductor, two or more busy-testing terminals connected with the latter line conductor, a polarized cut-off relay located in said latter conductor between the testing-terminals and the third conductor whereby said portion of the conductor possesses an appreciable resistance and when a subscriber calls and connects two conductors together the testing-terminals are raised to a potential above that of the third conductor and the line is in condition to test busy, and a cord-circuit having a

busy-testing conductor connected to said third conductor to enable the operator to complete a busy-testing circuit and to receive a busy-test signal, substantially as described.

36. The combination with a multiple-switchboard common-battery telephone-line, of a battery normally connected between one line conductor and a third conductor, the other line conductor being also connected with said third conductor, two or more busy-testing terminals connected with the latter line conductor, a polarized cut-off relay in a portion of said conductor between the testing-terminals and the third conductor whereby said conductor possesses an appreciable resistance and when a subscriber calls and connects two conductors together the testing-terminals are raised to a potential above that of the third conductor, and an operator's busy-testing conductor also connected with said third conductor to enable her to complete the testing-circuit normally connected with the third conductor to enable the operator to complete a testing-circuit when the busy line is tested, substantially as described.

37. The combination with a multiple-switchboard common-battery telephone-line, of a battery connected between one line conductor and the third conductor, the other line conductor being also connected with said third conductor, two or more busy-testing terminals permanently connected with the latter line conductor, a polarized cut-off relay located in the portion of said conductor between the testing-terminals and the third conductor, and having an appreciable resistance, and a cord-circuit having a busy-testing strand connected with said third conductor whereby when the subscriber calls his line is in condition to test busy and the operator is enabled to complete a testing-circuit to cause a test-signal, substantially as described.

38. In a telephone system, the combination with a telephone-line, of a common source of current with which the line is normally connected, a line-signal, a switch at the substation to normally control the flow of current in the line from said source to operate said line-signal, a polarized cut-off device in the line in the path of calling-current but unresponsive to such current, a cord-circuit to establish conversational circuits with the line, a common source of current associated therewith and adapted to be included in the metallic line during connections to furnish current for talking, said latter source serving to reverse the direction of current through said cut-off device to operate the same and render the line-signal inoperative, substantially as described.

39. In a telephone system, the combination with a telephone-line having a plurality of connection-terminals connected permanently therewith, of a line-signal therefor, a polarized cut-off device having its winding connected in the line, a switch at the substation to cause the flow of current in the line from

the central office to operate the line-signal, said cut-off device being unresponsive to current of that direction, a cord-circuit to establish connections with the line for conversation, a common source of current associated therewith and adapted to be included in the metallic line to furnish current for talking, the current from said source during connections being directed through said cut-off device in the opposite direction and over a path

including part of the talking-circuit to operate the same and thereby render the line-signal inoperative, substantially as described.

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

WILLIAM W. DEAN.

Witnesses:

E. F. BECK,

W. A. FRICKE.