

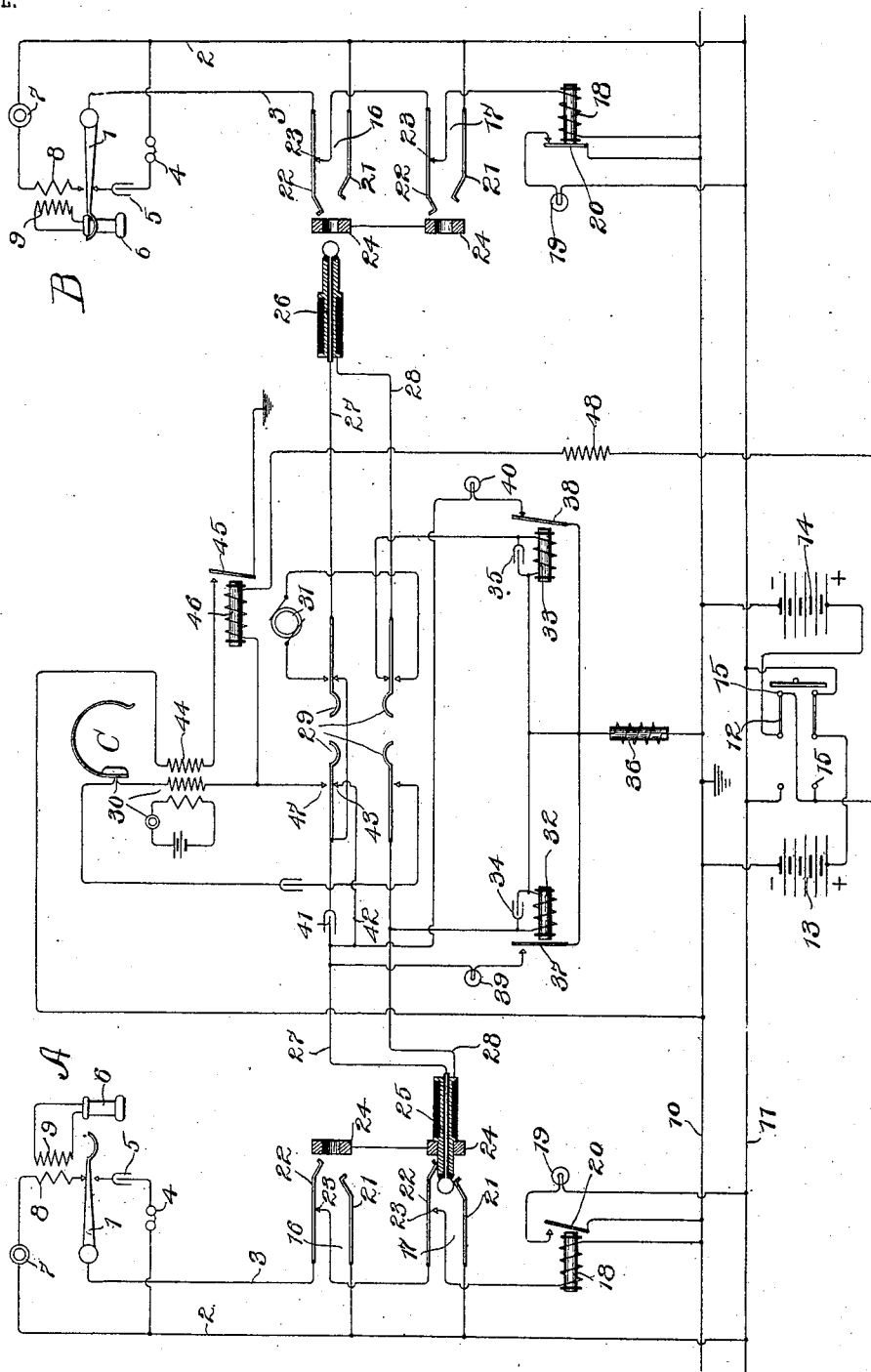
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W. M. DAVIS.
TELEPHONE SYSTEM.

APPLICATION FILED MAR. 2, 1903.

NO MODEL.



Witnesses:

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UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 763,374, dated June 28, 1904.

Application filed March 2, 1903. Serial No. 145,848. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM M. DAVIS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have
 5 invented a certain new and useful Improvement in 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.
 10 My invention relates to telephone systems, and more particularly to telephone systems in which the current for the substation-transmitters is supplied by a battery or source of current located at the central exchange. It
 15 has heretofore been one of the disadvantages of such telephone systems that the means employed for testing the condition of a line to ascertain whether or not such line is in use has caused a disagreeable click in the sub-
 20 scriber's receiver. It is the principal object of my invention to provide testing means which shall avoid this disagreeable click. As is well known by those skilled in the art, it is common practice to provide for the source of
 25 current at the substation two storage batteries, either one of which alone is usually employed to supply current for talking and signaling purposes. It is the practice to charge, by means of a suitable generator, the
 30 battery which is not being utilized for the purpose of supplying current for the operation of the system. It is the purpose of my invention to employ this idle battery for the operation of the testing means employed.
 35 The testing-circuit of my invention is separate and distinct from the line or signaling circuit, whereby the currents used in affording the busy-test signal do not affect the substation-receivers to produce the disagreeable
 40 click hereinbefore referred to.
 My invention will be more clearly understood by reference to the accompanying drawing, in which is shown at each of the substations A and B the usual substation apparatus, comprising a switch-hook 1, which when
 45 in its lower depressed condition closes a circuit between the line-limbs 2 and 3 through the call-bell 4 and the serially-connected con-

denser 5. When in its upper position, due to the removal of the weight of the receiver
 50 6, the switch-hook closes a circuit between the line-limbs through a transmitter 7 and a primary coil 8 of an induction-coil whose secondary winding 9 is connected with the receiver 6.

There are provided at the central exchange
 C a pair of bus conductors 10 and 11, to which
 may be connected, by means of the switch 12,
 either the battery 13 or the battery 14. I
 have shown the negative terminals of both of
 60 these batteries permanently connected with the bus conductor 10. The switch 12 is shown in the position to connect the positive pole of the battery 13 with the bus-bar 11. When
 thrown in its alternate position, the switch
 65 connects the positive pole of the battery 14 with the bus-bar 11. A second set of contacts 15 is provided for a purpose to be hereinafter more fully explained. The limb 2 of the telephone-line leads to the bus-bar 11.
 70 The limb 3 of the telephone-line leads through contacts of the calling spring-jack 16 and the answering spring-jack 17 through the line-relay 18 to the bus-bar 10.

A local circuit containing the line-signal
 75 in the form of an incandescent lamp 19 is controlled by the armature 20 of the line-relay. The tip-springs 21 of the multiple spring-jacks are permanently connected with the limb
 80 2 of the telephone-line. The sleeve-springs 22 and contacts 23 form a serial path for the line-limb 3 through the multiple jacks associated therewith. Each of the spring-jacks is provided with a test-thimble 24; the test-thimbles for the multiple jacks associated with any
 85 one line being connected together, as shown.

The operator's cord-circuit comprises the usual answering-plug 25 and the calling-plug
 26, the tip-contacts of which are connected through a tip-strand 27 and the sleeve-con-
 90 tacts of which are connected through a sleeve-strand 28. The usual ringing and listening key 29 is provided, which when actuated in one direction serves to connect the operator's telephone set 30 in bridge of the cord-circuit
 95 and which when operated in the reverse di-

re-
 5 tion serves to connect the ringing-genera-
 tor 31 with the cord-strands leading to the
 calling-plug 26. The sleeve-strand includes
 within its circuit the supervisory relays 32
 10 and 33, respectively bridged by the con-
 densers 34 and 35. A conductor including the
 impedance-coil 36 leads from the common ter-
 minal of the supervisory relays to the bus-
 bar 10. The armatures 37 and 38 of the su-
 15 pervisory relays serve when in their unat-
 tracted condition to close circuit through the
 associated supervisory signal-lamps 39 and
 40 when the associated plug of the calling-cir-
 20 cuit is inserted within a line-jack. A con-
 denser 41 is included in the tip-strand, as
 shown, this condenser being shunted, how-
 ever, by the conductor 42, which leads to con-
 tact 43, normally connected with the tip-spring
 25 of the listening-key. A test-winding 44 is
 inductively related to the induction-coil of the
 operator's telephone set, the battery-circuit
 through this test-winding being controlled by
 the armature 45 of test-relay 46. This test-
 30 relay is included in a circuit between the con-
 tact 47 and the switch-contacts 15, associated
 with the switch 12, a resistance 48 being in-
 cluded in the circuit. It will be seen that in
 the position shown the switch 12 connects the
 35 positive pole of the battery 14 with the con-
 ductor leading to the test-relay 46. The re-
 versal of the switch 12 causes a connection of
 the positive pole of the battery 13 with the
 conductor leading to the test-relay 46.

It is common practice in the telephone art
 35 to employ in central-energy systems two stor-
 age batteries, one of which is preferably con-
 nected with the telephonic apparatus, while
 the other is either idle or being charged by a
 suitable charging-generator. Thus the accom-
 40 panying drawing shows the battery 13 con-
 nected with the telephone system to supply
 talking and signaling currents, while the bat-
 tery 14 may be considered as idle or as con-
 nected with a charging-generator. The re-
 45 versal of the switch 12 serves to reverse the
 connections of the batteries 13 and 14.

The operation of my system may be de-
 scribed as follows: A subscriber at substation
 A upon removing his receiver from its hook
 50 causes the closure of a circuit through the
 line-relay 18, whereupon the same is ener-
 gized to cause the attraction of the armature
 20, which closes circuit through the line-sig-
 nal 19, thereby notifying the operator that
 55 the subscriber at substation A desires con-
 nection. The operator thereupon inserts the
 answering-plug 25 of her cord connecting ap-
 paratus within the answering-jack 17, thereby
 breaking the contact between the sleeve-
 60 spring 22 and the jack-contact 23, thereby in-
 terrupting the continuity of the circuit
 through the line-relay 18. The consequent de-
 energization of the line-relay 18 permits the
 retraction of the armature 20, thereby opening
 65 the circuit through the line-signal 19 to cause

its extinction. The operator manipulates her
 listening-key to connect her telephone set in
 bridge of the cord-circuit and ascertains the
 number of the desired connection. It will be
 70 seen that the insertion of the operator's an-
 swering-plug 25 within the jack of the calling
 subscriber closes a circuit through the supervi-
 sory relay 32, whereby the same is energized
 to cause the attraction of its armature 37 and
 the extinction of the lamp 39, which other-
 75 wise would have been illuminated upon the
 insertion of the plug within the jack. Upon
 ascertaining that the subscriber at substation
 B is desired the operator inserts her calling-
 80 plug within a multiple line-jack 16 and there-
 upon manipulates her ringing-key to connect
 the generator 31 in bridge of the cord strands
 connected with the line to substation B. The
 subscriber at substation B upon answering
 85 the calling-signal removes his receiver from
 its hook, thereby closing circuit through the
 supervisory relay 33, which attracts its arma-
 ture 38 to interrupt the flow of current previ-
 ously established through the line-lamp 40.
 90 The replacement of the telephone-receivers
 upon their hooks when the conversation has
 been finished causes the deenergization of the
 supervisory relays 32 or 33 to release the ar-
 matures 37 or 38, whereby a circuit is com-
 95 pleted through the associated supervisory
 lamp 39 or 40 to cause its illumination. The
 operator perceiving the disconnect-signal re-
 moves the plugs of her cord-circuit from the
 line-jacks, whereupon the line instrumentalities
 100 are restored to their normal condition.

The means for testing the condition of a
 called line in order to ascertain whether or
 not such line is in use is as follows: It will be
 seen that the negative pole of the idle battery
 105 is permanently connected with the bus-bar 10,
 with which the sleeve-contacts of the plugs of
 the cord-circuit are permanently connected
 through the supervisory relays and the im-
 pedance-coil 36. Thus the insertion of a plug
 110 within a line-jack raises the potential of the
 test-thimble to that of the negative pole of
 the idle battery. The manipulation of the
 listening-key 29 connects the tip-strand lead-
 ing to the calling-plug through the test-relay
 46, the resistance 48, a switch-contact 15, and
 115 switch 12 to the positive pole of the idle bat-
 tery 14. Thus the application of the tip-con-
 tact of a calling-plug 26 to a test-thimble of
 a line with which other cord connecting ap-
 120 paratus is connected causes the closure of a
 circuit through the idle battery 14 and the
 test-relay 46. The energization of the test-
 relay causes the attraction of its armature 45
 to close a circuit through the test-winding 44,
 which produces a click in the operator's tele-
 125 phone-receiver to notify her of the busy con-
 dition of the tested line.

It will be seen that I have provided a test-
 circuit and means for supplying test-current
 130 entirely independent of the means and cir-

cuits employed for the operation of the signaling and talking instrumentalities of the system.

My invention provides a further improvement in the fact that the test-circuit employs for its energizing-currents the idle set of storage batteries which is not connected with the signaling or talking circuits of the system.

While I have herein shown and described one particular embodiment of my invention, it will be apparent that many modifications therein may be employed without departing from the spirit of my invention. I do not, therefore, wish to limit myself to the precise disclosure herein set forth; but,

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

1. In a telephone-exchange system, the combination with a telephone-line extending by its limbs from a substation to an exchange, of a common source of current at the exchange for supplying talking and signaling currents to said line, multiple spring-jacks associated with said line, test-thimbles for said spring-jacks, cord connecting apparatus for connecting said line with another for conversation, a test-contact associated with said cord connecting apparatus, an auxiliary source of current, and a test-relay adapted when testing to be energized by said auxiliary source of current to close a local circuit through a test-winding and said common source of current.

2. In a telephone-exchange system, the combination with a telephone-line extending by its limbs from a substation to an exchange, of a common source of current at the exchange for supplying talking and signaling currents to said line, multiple spring-jacks associated with said line, test-thimbles for said spring-jacks, cord connecting apparatus for connecting said line with another for conversation, a test-contact associated with said cord connecting apparatus, an auxiliary source of current, a test-relay, and means whereby the application of said test-contact to one of said test-thimbles when said line is busy causes the closure of a circuit through said test-relay and said auxiliary source of current.

3. In a telephone-exchange system, the combination with a telephone-line extending by its limbs from a substation to an exchange, of a common source of current at the exchange for supplying talking and signaling currents to said line, multiple spring-jacks associated with said line, test-thimbles for said spring-jacks, cord connecting apparatus for connecting said line with another for conversation, a test-contact associated with said cord connecting apparatus, an auxiliary source of current, a test-relay, a test-winding inductively associated with the operator's telephone set, a local circuit for said test-winding controlled by said test-relay, and means whereby the application of said test-contact to one of said test-thimbles when said line is busy causes the

closure of a circuit through said test-relay and said auxiliary source of current to close the local circuit through said test-winding.

4. In a telephone-exchange system, the combination with a telephone-line extending by its limbs from a substation to an exchange, of a common source of current at the exchange for supplying talking and signaling currents to said line, multiple spring-jacks associated with said line, test-thimbles for said spring-jacks, cord connecting apparatus for connecting said line with another for conversation, a test-contact associated with said cord connecting apparatus, an auxiliary source of current having one pole connected with the sleeve-strand leading to a sleeve-contact of a connecting-plug of the cord connecting apparatus, and the other pole connected with the test-contact of the cord connecting apparatus when testing; signaling apparatus adapted to be actuated by an electric current, and means whereby the application of said test-contact to one of said test-thimbles when said line is busy causes the closure of a circuit through said signaling apparatus and said auxiliary source of current.

5. In a telephone-exchange system, the combination with a telephone-line extending by its limbs from a substation to an exchange, of a common source of current at the exchange for supplying talking and signaling currents to said line, multiple spring-jacks associated with said line, test-thimbles for said spring-jacks, cord connecting apparatus for connecting said line with another for conversation, a test-contact associated with said cord connecting apparatus, and an auxiliary source of current having one pole connected with the sleeve-strand leading to a sleeve-contact of a connecting-plug of the cord connecting apparatus and the other pole connected through a test-relay with the test-contact of the cord connecting apparatus when testing, whereby the application of said test-contact to one of said test-thimbles when said line is connected with other duplicate cord connecting apparatus causes the closure of a circuit through said test-relay and said auxiliary source of current.

6. In a telephone-exchange system, the combination with a telephone-line extending by its limbs from a substation to an exchange, of a common source of current at the exchange for supplying talking and signaling currents to said line, multiple spring-jacks associated with said line, test-thimbles for said spring-jacks, cord connecting apparatus for connecting said line with another for conversation, a test-contact associated with said cord connecting apparatus, an auxiliary source of current having one pole connected with the sleeve-strand leading to a sleeve-contact of a connecting-plug of the cord connecting apparatus and the other pole connected through a test-relay with the test-contact of the cord connecting apparatus when testing, whereby the applica-

tion of said test-contact to one of said test-thimbles when said line is connected with other duplicate cord connecting apparatus causes the closure of a circuit through said test-relay and said auxiliary source of current, a test-winding inductively associated with the operator's telephone set, and a local circuit for said test-winding controlled by said test-relay.

7. In a telephone-exchange system, the combination with a telephone-line extending by its limbs from a substation to an exchange, of a common battery at the exchange for supplying talking and signaling currents to said line, a second relay-battery adapted to be used alternately with said first battery for supplying talking and signaling currents to said line, multiple spring-jacks associated with said line, test-thimbles for said spring-jacks, duplicate cord connecting apparatus for connecting said line with another for conversation, a test-contact associated with each of said cord connecting apparatus, signaling apparatus adapted to be actuated by an electric current, and means whereby the application of a test-contact of one of said cord connecting apparatus to one of said test-thimbles when said line is connected with another cord connecting apparatus causes the closure of a circuit through said signaling apparatus and said second battery.

8. In a telephone-exchange system, the combination with a telephone-line extending by its limbs from a substation to an exchange, of a common battery at the exchange for supplying talking and signaling currents to said line, a second relay-battery adapted to be used alternately with said first battery for supplying talking and signaling currents to said line, multiple spring-jacks associated with said line, test-thimbles for said spring-jacks, duplicate cord connecting apparatus for connecting said line with another for conversation, a test-contact associated with each of said cord connecting apparatus, a test-relay, a test-winding inductively associated with the operator's telephone set, a local circuit for said test-winding controlled by said test-relay, and means whereby the application of a test-contact of one of said cord connecting apparatus to one of said test-thimbles when said line is connected with another of said cord connecting apparatus causes the closure of a circuit through said test-relay and said second battery.

9. In a telephone-exchange system, the combination with a telephone-line extending by its limbs from a substation to an exchange, of a common battery at the exchange for supplying talking and signaling currents to said line, a second relay-battery adapted to be used alternately with said first battery for supplying talking and signaling currents to said line, multiple spring-jacks associated with said line, test-thimbles for said spring-jacks, duplicate cord connecting apparatus for connecting said

line with another for conversation, a test-contact associated with each of said cord connecting apparatus, a test-relay, and means whereby the application of a test-contact of one of said cord connecting apparatus to one of said test-thimbles when said line is connected with another of said cord connecting apparatus causes the closure of a circuit through said test-relay and said second battery.

10. In a telephone-exchange system, the combination with a telephone-line extending by its limbs from a substation to an exchange, of a common battery at the exchange for supplying talking and signaling currents to said line, a second relay-battery adapted to be used alternately with said first battery for supplying talking and signaling currents to said line, multiple spring-jacks associated with said line, test-thimbles for said spring-jacks, duplicate cord connecting apparatus for connecting said line with another for conversation, a test-contact associated with each of said cord connecting apparatus, and a test-relay adapted when testing to be energized by said relay-battery to close a local circuit including a test-winding and said common battery.

11. In a telephone-exchange system, the combination with a telephone-line extending by its limbs from a substation to an exchange, of a common battery at the exchange for supplying talking and signaling currents to said line, a second relay-battery adapted to supply talking and signaling currents to said line in place of said first battery, multiple spring-jacks associated with said line, test-thimbles for said spring-jacks, duplicate cord connecting apparatus for connecting said line with another for conversation, a test-contact associated with each of said cord connecting apparatus, a test-circuit, and means whereby either of said batteries may be connected with the telephone-line and cord connecting apparatus while the other of said batteries is connected with the test-circuit.

12. In a telephone-exchange system, the combination with a telephone-line extending by its limbs from a substation to an exchange, of a common battery at the exchange for supplying talking and signaling currents to said line, a second relay-battery adapted to supply talking and signaling currents to said line in place of said first battery, multiple spring-jacks associated with said line, test-thimbles for said spring-jacks, duplicate cord connecting apparatus for connecting said line with another for conversation, a test-contact associated with each of said cord connecting apparatus, a test-circuit, and switching means whereby either of said batteries may be connected with the telephone-line and cord connecting apparatus while the other of said batteries is connected with the test-circuit.

13. In a telephone-exchange system, the combination with a telephone-line extending by its limbs from a substation to an exchange,

of a common battery at the exchange for supplying talking and signaling currents to said line, a second relay-battery adapted to supply talking and signaling currents to said line in place of said first battery, multiple spring-jacks associated with said line, test-thimbles for said spring-jacks, duplicate cord connecting apparatus for connecting said line with another for conversation, a test-contact associated with each of said cord connecting apparatus, a test-circuit, and means whereby either of said batteries may be connected with the telephone-line and said cord connecting apparatus while one pole of the other of said batteries is connected with the sleeve-strands leading to the sleeve-contacts of the connecting-plugs of said cord connecting apparatus and the other pole is connected with the test-contact of a cord connecting apparatus when testing, whereby the application of said test-contact to one of said test-thimbles when said line is connected with another of said cord connecting apparatus causes the flow of current through said test-circuit.

14. In a telephone-exchange system, the combination with a telephone-line extending

by its limbs from a substation to an exchange, of two relay-batteries, either one of which is adapted to supply talking and signaling currents to said line, multiple spring-jacks associated with said line, test-thimbles for said spring-jacks, duplicate cord connecting apparatus for connecting said line with another for conversation, a test-contact associated with each of said cord connecting apparatus, switching means adapted to connect either of said batteries with the line and cord circuits and to connect the other battery with a test-circuit, one pole of said second battery being connected to the sleeve-strands of said cord-circuit and the other pole of said battery being connected through a test-relay with the test-contact of a testing cord connecting apparatus when testing, and a signal-receiving means controlled by said test-relay.

In witness whereof I hereunto subscribe my name this 20th day of February, A. D. 1903.

WILLIAM M. DAVIS.

Witnesses:

HARVEY L. HANSON,
JOHN STAHR.