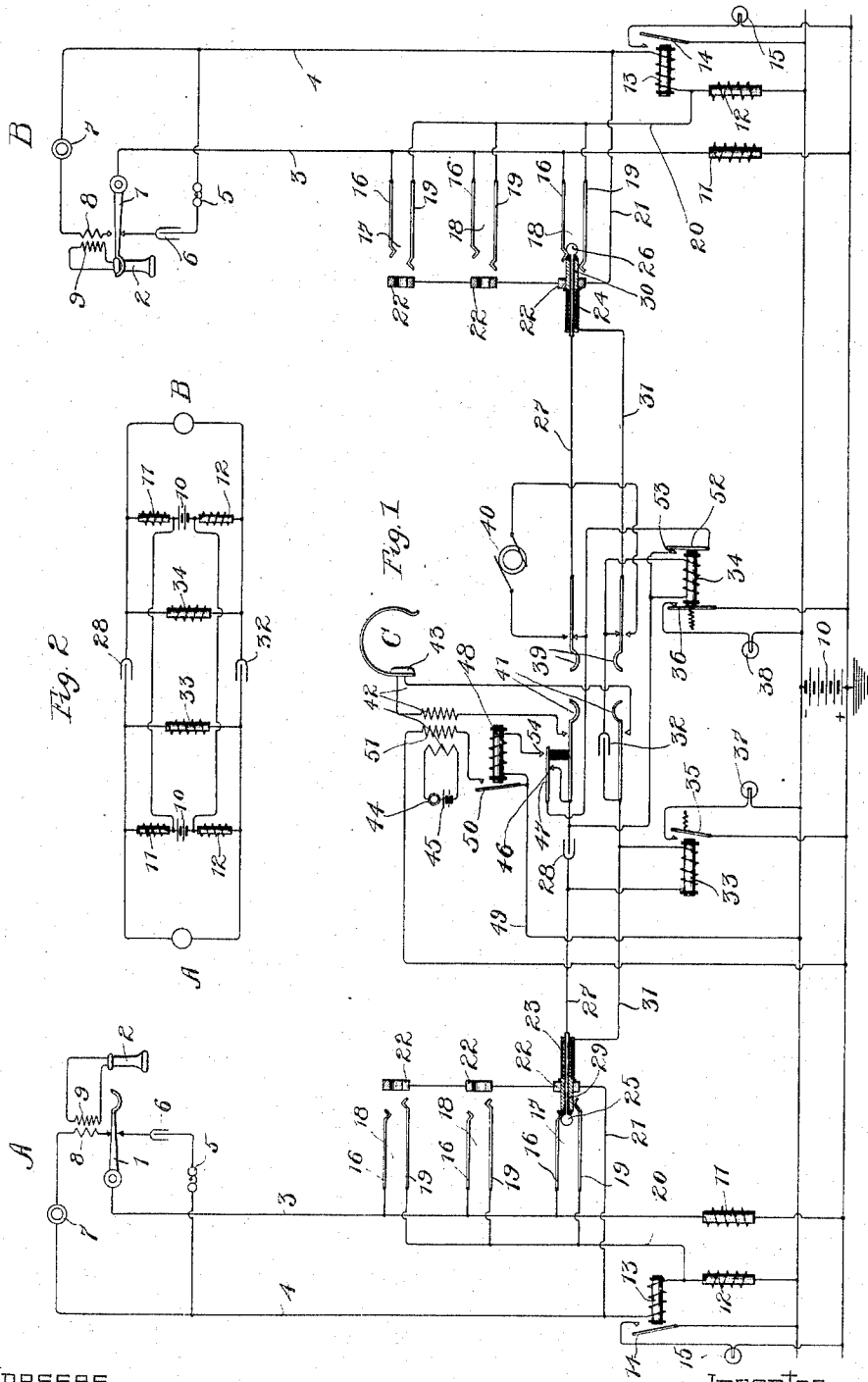


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W. M. DAVIS.
TELEPHONE EXCHANGE SYSTEM.
APPLICATION FILED MAY 20, 1903.



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TELEPHONE-EXCHANGE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 783,510, dated February 28, 1905.

Application filed May 20, 1903. Serial No. 158,011.

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 invented a certain new and useful Improvement in Telephone-Exchange 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 telephone-exchange systems, and is particularly well adapted for use in connection with telephone-exchange systems in which the source of current for supplying current to the substations, both for signaling purposes and talking purposes, is located at the central exchange.

Such central energy exchange systems as have heretofore been employed have been objectionable on account of disagreeable clicks produced in the receiver of a subscriber's telephone set during the operation of connecting one subscriber with another for conversational purposes.

One of the principal objects of my invention is to provide a telephone-exchange system in which such disagreeable clicks shall be avoided. One of the principal means of producing such clicks in the receivers employed in systems of the prior art has been the changing of the circuits through which current has been supplied from the common source at the central station to the substation apparatus. The current has heretofore been supplied through line-signaling devices until an operator at the central station has made a connection with the line, usually through the instrumentality of a so-called "cord connecting apparatus" or "cord-circuit." Upon making a connection between the cord connecting apparatus and the line the current has frequently been supplied to the substation, at least partially, through circuits of the cord connecting apparatus, and the change from a circuit through the line-signaling devices to a circuit through the cord connecting apparatus has frequently resulted in the disagreeable clicks in the subscriber's receiver above referred to.

In accordance with my invention the cur-

rents for the operation of the apparatus of the cord-circuits are supplied from the line-jacks through the cord-strands. A supervisory signaling-relay which is employed is dependent for its operation upon the closure of a circuit through the subscriber's substation apparatus, the closure of the substation-circuit providing a comparatively low-resistance circuit in shunt of the supervisory relay, thereby partially deenergizing the same to cause a retraction of its armature.

In general my present invention may be described as an embodiment, in a telephone-line circuit and cord-circuit, of the invention disclosed in my copending application, Serial No. 84,376, filed December 2, 1901, in which my invention is shown as applied to so-called "trunk-circuits."

Other advantages of my invention reside in the simplicity of the cord connecting apparatus which may be employed and in the general efficiency of the telephone system as a whole.

My invention will be clearly understood by reference to the accompanying drawings, in which—

Figure 1 is a diagrammatic view illustrating the features of my improved telephone system, with the addition of a testing-circuit adapted to test the condition of a line to know whether it is in use; and Fig. 2 is a diagrammatic view illustrating the telephonic talking-circuit between two connected substations.

Referring more particularly to Fig. 1, I have illustrated at each of the substations A and B a telephone switch-hook 1, which when in its depressed condition, due to the weight of the receiver 2, connects the line-limbs 3 and 4 through a circuit including the signal-bell 5 and a serially-connected condenser 6. When relieved of the weight of the receiver 2, the switch-hook 1 closes a conductive circuit between the line-limbs 3 and 4, this circuit including the battery-transmitter 7 and the primary 8 of an induction coil whose secondary 9 is serially connected with the receiver 2. The line-limbs 3 and 4 each lead to the central station C, where they are permanently connected with the terminals of a common bat-

tery 10, whose positive pole may be connect-
 ed with the ground, as shown. The line-limb
 3 includes in its circuit an impedance-coil 11.
 The line-limb 4 includes in its circuit from
 5 the common battery 10 an impedance-coil 12
 and a line-relay 13, adapted upon energiza-
 tion by the passage of a suitable current from
 the battery 10 to attract its armature 14,
 thereupon closing a local circuit through the
 10 line signal-lamp 15. The line-limb 3 is per-
 manently and directly connected with the tip-
 springs 16 16 of the answering-jack 17 and
 the multiple calling-jacks 18 18, as shown.
 The sleeve-springs 19 19 of these jacks are con-
 15 nected, through a conductor 20, with a point
 in the line-circuit intermediate between the
 impedance-coil 12 and the line-relay 13. A
 conductor 21 leads from the line side of the
 relay 13 to the jack-thimbles 22 22. It will
 20 be seen that an electrical connection between
 a sleeve-spring 19 and a thimble 22 will close
 a circuit in shunt of the line-relay 13. The
 adjustment of the line-relay 13 is desirably
 made such that the closure of a low-resistance
 25 circuit between the conductors 20 and 21, as
 between the sleeve-spring 19 and a thimble
 22, will cause a sufficient deenergization of
 the line-relay to permit the retraction of the
 armature 14, thereby causing the extinguish-
 30 ment of the lamp 15.

The operator's cord connecting apparatus
 may desirably comprise an answering-plug 23
 and a calling-plug 24, the tip-contacts 25 and
 26 being connected through a tip-cord strand
 35 27, there being a condenser 28 serially in-
 cluded in this strand. The sleeve-contacts
 29 and 30 are connected by a sleeve-strand 31,
 whose conductive continuity is interrupted by
 the serially-connected condenser 32. Con-
 40 nected in bridge of the cord-strands leading
 from the condensers 28 and 32 to the answer-
 ing-plug 23 is a supervisory relay 33. Simi-
 larly, between the cord-strands leading from
 the condensers 28 and 32 to the calling-plug
 45 24 there is connected in bridge the supervi-
 sory relay 34. The supervisory relays 33 and
 34, respectively, control armatures 35 and 36,
 each serving upon its attraction due to the
 suitable energization of its associated relay-
 50 magnet to close a circuit through a super-
 visory signaling-lamp 37 or 38, as the case
 may be.

The usual operator's ringing-key 39 is pro-
 vided, an actuation of this key serving to con-
 55 nect the ringing-generator 40 in bridge of the
 cord-strands 27 and 31, leading to the call-
 ing-plug 24. The operator's listening-key 41
 serves when actuated to connect the opera-
 tor's telephone set 42 in bridge of the cord-
 60 circuit, the operator's telephone set in this
 case being shown as comprising an induction-
 coil whose secondary is connected with the
 receiver 43 and whose primary is connected
 by a local circuit through the transmitter 44
 65 and the local battery 45.

While the test-circuit herein disclosed forms
 no part of my present invention, I shall de-
 scribe its operation for the purpose of show-
 ing a complete telephone system. It will be
 70 seen that the conductive continuity of the tip-
 cord strand from the condenser 28 to the call-
 ing-plug 24 includes a contact-point 46 and a
 contact-spring 47, which is operated in unison
 with the upper spring of the operator's list-
 75 ening-key 41, a manipulation of the opera-
 tor's listening-key to connect her telephone
 set in bridge of the cord-circuit thus serving
 to interrupt the continuity of the tip-cord
 strand between the contact 46 and the spring
 47. A manipulation of the listening-key 41
 80 serves to connect one terminal of the high-
 resistance test-relay 48 with the tip-strand 27,
 leading to the tip-contact 26 of the call-
 ing-plug 24, the other terminal of the test-relay
 being connected, through a conductor 49, with
 85 the negative pole of the common battery 10.
 The test-relay 48 controls, by means of its
 armature 50, a local circuit through the test-
 winding 51, inductively associated with the
 windings of the induction-coil of the opera-
 90 tor's telephone set, an attraction of the arma-
 ture 50 serving to close a circuit through the
 test-winding 51, thereby producing a click in
 the operator's telephone in the manner well
 understood by those skilled in the art. 95

The supervisory relay 34 is provided with
 an auxiliary armature 52. The relay 34 and
 its armatures 36 and 52 are so adjusted that
 the armature 52 is very much more easily at-
 100 tracted than the armature 36, whereby a cur-
 rent which is insufficient to maintain the ar-
 mature 36 in its forward attracted position is
 amply sufficient to maintain the armature 52
 in its attracted position. The purpose of this
 adjustment of these armatures will herein-
 105 after more fully appear. The armature 52
 serves upon its attraction to close a circuit in
 shunt of the contacts 46 and 47. Thus when
 the supervisory relay 34 is so energized as to
 attract the armature 52 the manipulation of
 110 the listening-key 41 to disconnect the contacts
 46 and 47 does not conductively interrupt the
 continuity of the tip-cord strand 27 between
 the condenser 28 and the tip-contact 26, the
 circuit being in this case traced from the con-
 115 denser 28 through the front contact 53 and
 the armature 52 to the cord-strand 27, leading
 to the tip-contact 26.

The operation of my improved telephone
 system may be described as follows: The re-
 120 moval of the receiver from the switch-hook
 at substation A causes the closure of a circuit
 which may be traced from the positive pole
 of the common battery 10 through the im-
 125 pedance-coil 11, the line-limb 3, the switch-
 hook 1, the primary coil 8, the transmitter 7,
 the line-limb 4, the line-relay 13, and the im-
 pedance-coil 12 to the negative pole of the
 battery 10. The passage of current over this
 circuit causes the attraction of the armature 130

14, thereby closing a local circuit through the lamp 15. The central operator answers the signal given by the illumination of the lamp 15 by inserting the answering-plug 23 of her cord connecting apparatus in the answering-jack 17, as shown. The sleeve 29 of the answering-plug produces a short-circuit connection between the sleeve-spring 19 and the thimble 22 of the jack 17, thereby closing a short-circuited path in shunt of the line-relay 13. The line-relay 13 is thus deprived of current to such an extent that it is deenergized to permit the retraction of the armature 14, whereupon the line signal-lamp 15 is extinguished to indicate that the subscriber's call has been answered. There are now provided from the battery 10, through the impedance-coils 11 and 12, two parallel circuits, one which has already been traced through the transmitter at substation A and the other which may be traced as follows: from the positive pole of the battery 10 through the impedance-coil 11, the tip-spring 16 of the answering-jack 17, the tip-contact 25, the tip-strand 27, the supervisory relay 33, the sleeve-strand 31, the sleeve-contact 29, the sleeve-spring 19, the conductor 20, and the impedance-coil 12 back to the negative pole of the battery 10.

The winding of the supervisory relay 33 is desirably made of such resistance and the adjustment of the relay-armature 35 is desirably made such that the comparatively low-resistance path through the substation-transmitter 7 deprives the supervisory relay 33 of current to such an extent that the armature 35 will not be attracted from its normal position shown.

The operator after inserting the plug 23 within the answering-jack 17 manipulates her listening-key 41 to connect her telephone set 42 in bridge of the cord-circuit and thereafter communicates with the subscriber at substation A to ascertain the number of the substation with which he desires telephonic communication. Learning that this is substation B, the central operator first applies the tip 26 of her calling-plug to a thimble 22 of a calling-jack 18 to ascertain if the line to substation B is in use. If the tested line to substation B is not already in use, the application of the test-contact 26 to a thimble 22 will not close a circuit through the test-relay 48; but if the plug of some other cord connecting apparatus has been inserted within one of the jacks associated with the line to substation B a test-circuit may be traced as follows: from the negative pole of the common battery 10 through conductor 49, test-relay 48, contact 54, contact-spring 47, tip-strand 27, tip-contact 26, test-thimble 22, (and if the plug of another cord-circuit is inserted within a connected line-jack,) through a sleeve-strand corresponding with the sleeve-strand 31 here shown, through a supervisory relay corresponding with relay 34,

through a tip-cord strand corresponding with strand 27, through a tip-contact corresponding with tip-contact 26, through a tip-spring 16 of a line-jack, and through the impedance-coil 11 to the positive pole of the battery 10. The closure of this circuit through the test-relay 48 causes the attraction of its armature 50, thereupon closing a local circuit through the test-winding 51 and causing a consequent click in the operator's telephone-receiver, thus notifying her of the busy condition of the tested line. Assuming, however, that the tested line to substation B is not in use, the application of the test-contact 26 to a test-thimble 22 will cause no click in the operator's telephone-receiver. She therefore inserts the plug 24 within a jack 18, thereby closing a low-resistance circuit in shunt of the line-relay 13 and at the same time closing a circuit through the supervisory relay 34, which circuit may be traced as follows: from the positive pole of the battery 10 through the impedance-coil 11, the tip-spring 16, the tip-contact 26, tip-strand 27, supervisory relay 34, sleeve-strand 31, sleeve-contact 30, sleeve-spring 19, and the impedance-coil 12 back to the negative pole of the battery 10. The current flowing through this circuit will cause an energization of the supervisory relay 34 sufficiently powerful to cause the attraction of both the armatures 36 and 52. The attraction of the armature 36 causes the closure of a local circuit through the supervisory signaling-lamp 38, thereby causing this lamp to glow, giving the operator a signal that the subscriber at substation B has not answered the signal-call by a removal of his receiver from its switch-hook. The attraction of the armature 52 to make electrical connection with the front contact 53 causes the closure of a circuit about the contacts 46 and 57, whereupon the listening-key 41 may be manipulated to connect the operator's telephone set in bridge of the cord-strands without conductively interrupting the continuity of the tip-strand 27 from the condenser 28 to the calling-plug 24. After inserting the calling-plug 24 within the jack 18 the operator manipulates her ringing-key 39 to connect the generator 40 in bridge of the cord-strands leading to the line-limbs 3 and 4 of the line to substation B, thereupon causing the actuation of the call-bell 5 to notify the subscriber at substation B that another subscriber desires communication with him. The removal of the receiver from its switch-hook at substation B causes the closure of a comparatively low-resistance circuit in multiple arc with the circuit already traced through the supervisory relay 34, the circuit in both instances including the impedance-coils 11 and 12. The current through the supervisory relay 34 is thus materially reduced by the closure of the circuit at substation B, causing a partial deenergization of the relay-magnet. The armature 36 is so adjusted

that this partial deenergization of the relay-magnet permits the retraction of the armature 36, thereby causing the extinction of the lamp 38, to indicate that the subscriber at substation B has answered the call. The armature 52, however, is so adjusted that the slight current flowing through the winding of the relay 34 is sufficient to maintain this armature in its attracted position. Therefore if at any time the calling-plug 24 is inserted within a line-jack sufficient current will flow through the winding of the supervisory relay 34 to cause the attraction of the armature 52, whereupon the continuity of the tip-cord strand from the condenser 28 to the calling-plug is maintained. This is desirable for the reason that the operator frequently finds it convenient to manipulate her listening-key to connect her telephone set in bridge of the cord-circuit, whereupon she may ascertain whether or not the subscribers are in conversation and whereby she may put herself in telephonic communication with either one or both of the subscribers connected with the cord-circuit. If it were not for the continuity of the tip-strand circuit maintained by the attraction of the armature 52, the manipulation of the listening-key 41 would interrupt the continuity of the tip-cord strand between the contacts 46 and 47, thereby interrupting the circuit over which the connected subscribers might be conversing. The contacts 46 and 47 provide means whereby the testing-tip contact at the time of making a busy test is freed from an electrical connection with everything from the testing-relay 48. At the same time the provision of the auxiliary armature 52 for the supervisory relay 34 provides means whereby the continuity of the cord-circuit is maintained whenever two substations have been connected for communication notwithstanding the manipulation of the key 41 and the consequent break in electrical connection between the contacts 46 and 47. Either of the connected subscribers at substations A and B upon finishing the conversation replaces his receiver upon the switch-hook 1, thereby causing a break in the continuous electrical circuit between the line-limbs 3 and 4. Thus the continuity of the electrical path in shunt of the corresponding supervisory relay is broken, whereupon the current flowing through the supervisory relay is increased to cause an attraction of the main armature 35 or 36, as the case may be. The attraction of the main armature of a supervisory relay causes the closure of a local circuit through the corresponding supervisory signaling-lamp, the illumination of which gives the operator a positive signal that the connected subscriber has finished the conversation and that the cord-connecting plug may be removed, thus restoring the apparatus to its normal condition.

In Fig. 2 I have diagrammatically illus-

trated the talking-circuit between substations A and B. The reference characters applied in this figure will indicate that the connection between the substations includes the serially-connected condensers 28 and 32. In bridge of the conductors connecting the substations are the supervisory relays 33 and 34 and two similarly-connected impedance-coils 11 and 12, there being interposed between each impedance-coil 11 and the corresponding impedance-coil 12 the common battery 10.

The resistance of the impedance-coils and the relays employed in connection with my invention may be varied to meet the special conditions of a given case. In ordinary practice, however, I have found it desirable to make the resistance of each of the impedance-coils 11 and 12 approximately two hundred ohms and the resistance of the line-relay 13 approximately two hundred ohms, while the supervisory relays are desirably wound to a comparatively high resistance—for instance, eight hundred ohms each.

While I have herein shown and described one preferred embodiment of my invention, it will be apparent to those skilled in the art that many modifications may be employed without departing from the spirit thereof. I do not wish to limit myself, therefore, 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 bimetallic telephone-line extending by its limbs from a substation to an exchange, of a source of current at the exchange permanently connected with both limbs of said line, a cord-circuit at the exchange for telephonically connecting said line with another for conversation, a condenser included in each of the cord-strands of the cord-circuit to divide the cord-circuit into two sections, and a supervisory relay for each section connected independently in bridge of the cord-strands, connection of either section with the line causing the corresponding relay to be connected in bridge of the source of current and the line-limbs, actuation of substation apparatus causing the closure of a shunt-circuit about said relay to prevent actuation thereof.

2. In a telephone-exchange system, the combination with a telephone-line extending by its limbs from a substation to an exchange, of a source of current at the exchange permanently connected with both limbs of said line, a cord-circuit at the exchange, a condenser serially included in each of the cord-strands to divide the cord-circuit into two sections, and a high-resistance supervisory relay for each section connected independently in bridge of the cord-strands, connection of either section with the line causing the corresponding relay to be connected in bridge of the source of current and the line-limbs, actuation

of substation apparatus causing the closure of a low-resistance shunt about said relay to prevent actuation thereof.

3. In a telephone-exchange system, the combination with a bimetallic telephone-line extending by its limbs from a substation to an exchange, of a source of current at the exchange permanently connected with both limbs of said line, a cord-circuit at the exchange, a condenser serially included in each of the cord-strands to divide the cord-circuit into two sections, and a supervisory relay connected in bridge of said cord-strands and normally disconnected from said source of current, connection of said cord-circuit with said line causing said relay to be bridged across said source of current and said line-limbs, the adjustment of said relay being such that actuation by said source is prevented by the continuity of the line-circuit through the telephone instrument at the substation.

4. In a telephone-exchange system, the combination with a bimetallic line extending by its limbs from a substation to an exchange, of a source of current at the exchange permanently connected with both limbs of said line, a cord-circuit at the exchange, and a supervisory relay connected in bridge of said cord-strands and normally disconnected from said source, connection of said cord-circuit with said line causing said relay to be connected in bridge of said source and said line-limbs, the adjustment of said relay being such that its actuation is prevented by the continuity of the line-circuit through the substation apparatus.

5. In a telephone-exchange system, the combination with a telephone-line extending by its limbs from a substation to an exchange, of a source of current at the exchange permanently connected with both limbs of said line, two cord-strands at the exchange for telephonically connecting said line with another for conversation, there being a condenser serially included in each of said cord-strands, and a supervisory relay connected in bridge of said cord-strands, the adjustment of said supervisory relay being such that its actuation is controlled by the continuity of the line-circuit through the telephone-transmitter at the substation, there being no electrical connection between said cord-strands and said source of current when the cord-strands are disconnected from the said line.

6. In a telephone-exchange system, the combination with a telephone-line extending by its limbs from a substation to an exchange, of a source of current at the exchange permanently connected with both limbs of said line, two cord-strands at the exchange for telephonically connecting said line with another for conversation, and a supervisory relay connected in bridge of said cord-strands, the adjustment of said supervisory relay being such that its actuation is controlled by the continuity of the line-circuit through the tele-

phone-transmitter at the substation, there being no electrical connection between said cord-strands and said source of current when the cord-strands are disconnected from said line.

7. In a telephone-exchange system, the combination with a telephone-line extending by its limbs from a substation to an exchange, of a source of current at the exchange connected with both limbs of said line, two cord-strands at the exchange for telephonically connecting said line with another for conversation, there being a condenser serially included in each of said cord-strands, and a supervisory relay connected in bridge of said cord-strands, the adjustment of said supervisory relay being such that its actuation by said source is prevented by the continuity of the line-circuit through the telephone-transmitter at the substation, there being no electrical connection between said cord-strands and said source of current when the cord-strands are disconnected from said line.

8. In a telephone-exchange system, the combination with a telephone-line extending by its limbs from a substation to an exchange, of a source of current at the exchange permanently connected with both limbs of said line, two cord-strands at the exchange for telephonically connecting said line with another for conversation, and a supervisory relay connected independently in bridge of said cord-strands, the adjustment of said supervisory relay being such that its actuation by said source is controlled by the continuity of the line-circuit through the telephone-transmitter at the substation, there being no electrical connection between said cord-strands and said source of current when the cord-strands are disconnected from said line.

9. In a telephone-exchange system, the combination with a telephone-line extending by its limbs from a substation to an exchange, of a source of current at the exchange permanently connected with both limbs of said line, two cord-strands at the exchange for telephonically connecting said line with another for conversation, there being a condenser serially included in each of said cord-strands, signaling devices at the exchange, jointly controlled by switching apparatus at the substation and the connection of said cord-strands with said line, and a high-resistance supervisory relay connected in bridge of said cord-strands, the adjustment of said supervisory relay being such that its actuation is controlled by the continuity of the line-circuit through the telephone-transmitter at the substation, there being no electrical connection between said cord-strands and said source of current when the cord-strands are disconnected from said line.

10. In a telephone-exchange system, the combination with a bimetallic telephone-line extending by its limbs from a substation to an exchange, of a source of current at the ex-

change permanently connected with both limbs and said line, a two-strand cord-circuit comprising two conductively-insulated portions inductively related to each other, and a supervisory relay connected in bridge of the cord-strands at each of said inductively-related portions of the cord-circuit, said relay being normally disconnected from said source, connection of said cord-circuit with said line causing the corresponding relay to be connected in bridge of said source of current and of the line-limbs, the adjustment of said relays being such that the actuation thereof is prevented by the continuity of the line-circuit through substation apparatus.

11. In a telephone-exchange system, the combination with a telephone-line extending by its limbs from a substation to an exchange, of a source of current at the exchange permanently connected with both limbs of said line, a cord-circuit comprising two conductively-insulated portions inductively related to each other, and a high-resistance supervisory relay connected independently in bridge of the cord-strands of each of said inductively-related portions, said relays being normally disconnected from said source of current, connecting of said cord-circuit with said line causing the corresponding relay to be connected in bridge of said source of current and the line-limbs, actuation of substation apparatus causing a low-resistance shunt about said supervisory relay to prevent actuation thereof.

12. In a telephone-exchange system, the combination with a bimetallic telephone-line extending by its limbs from a substation to an exchange, of a source of current at the exchange permanently connected with both limbs of said line, a two-strand cord-circuit comprising two conductively-insulated portions inductively related each to the other adapted to connect telephonically said line with another for conversation, and a high-resistance supervisory relay connected in bridge of the cord-strands of each of said inductively-related portions of the cord-circuit, there being no electrical connection between said cord-strands and said source of current when the cord-strands are disconnected from said line.

13. In a telephone-exchange system, the combination with a telephone-line extending by its limbs from a substation to an exchange, of a source of current at the exchange connected with both limbs of said line, a two-strand cord-circuit comprising two conductively-insulated portions inductively related each to the other adapted to connect telephonically said line with another for conversation, and a supervisory relay connected in bridge of the cord-strands of each of said inductively-related portions of the cord-circuit

to be actuated by said source only when the cord-circuit is in connection with the telephone-line, there being no electrical connection between said cord-strands and said source of current when the cord-strands are disconnected from said line.

14. In a telephone-exchange system, the combination with a telephone-line extending by its limbs from a substation to an exchange, of a source of current at the exchange connected with said line, a cord-circuit comprising two conductively-insulated portions inductively related each to the other adapted to connect telephonically said line with another for conversation, and a supervisory relay connected in bridge of the cord-strands of one of said inductively-related portions of the cord-circuit to be actuated by said source only upon connection of the cord-circuit with the line, there being no electrical connection between said cord-strands and said source of current when the cord-strands are disconnected from said line.

15. In a telephone-exchange system, the combination with a bimetallic 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 to the terminals of which said line-limbs are permanently connected each through a serially-connected impedance-coil, a line-relay serially included in one of said line-limbs adapted to be actuated by the closure of the line-circuit at the substation, a line-jack having contacts permanently connected with the line-limbs, the two cord-strands terminating at either end in a connecting-plug adapted for insertion within said line-jack, said cord-strands serving to connect telephonically said line with another for conversation, there being a condenser serially included in each of said cord-strands, means whereby the insertion of one of said plugs within said jack causes the closure of a low-resistance circuit in shunt of said line-relay to destroy the substation control thereof, and a supervisory relay connected in bridge of said cord-strands on either side of said condensers, the resistance and adjustment of each of said supervisory relays being such that the actuation of the supervisory-relay armature is controlled by the conductive continuity of the line-circuit through the substation apparatus within whose corresponding line-jack the plug connected with said supervisory relay is inserted.

In witness whereof I hereunto subscribe my name this 18th day of May, A. D. 1903.

WILLIAM M. DAVIS.

Witnesses:

LYNN A. WILLIAMS,
JOHN STAHR.