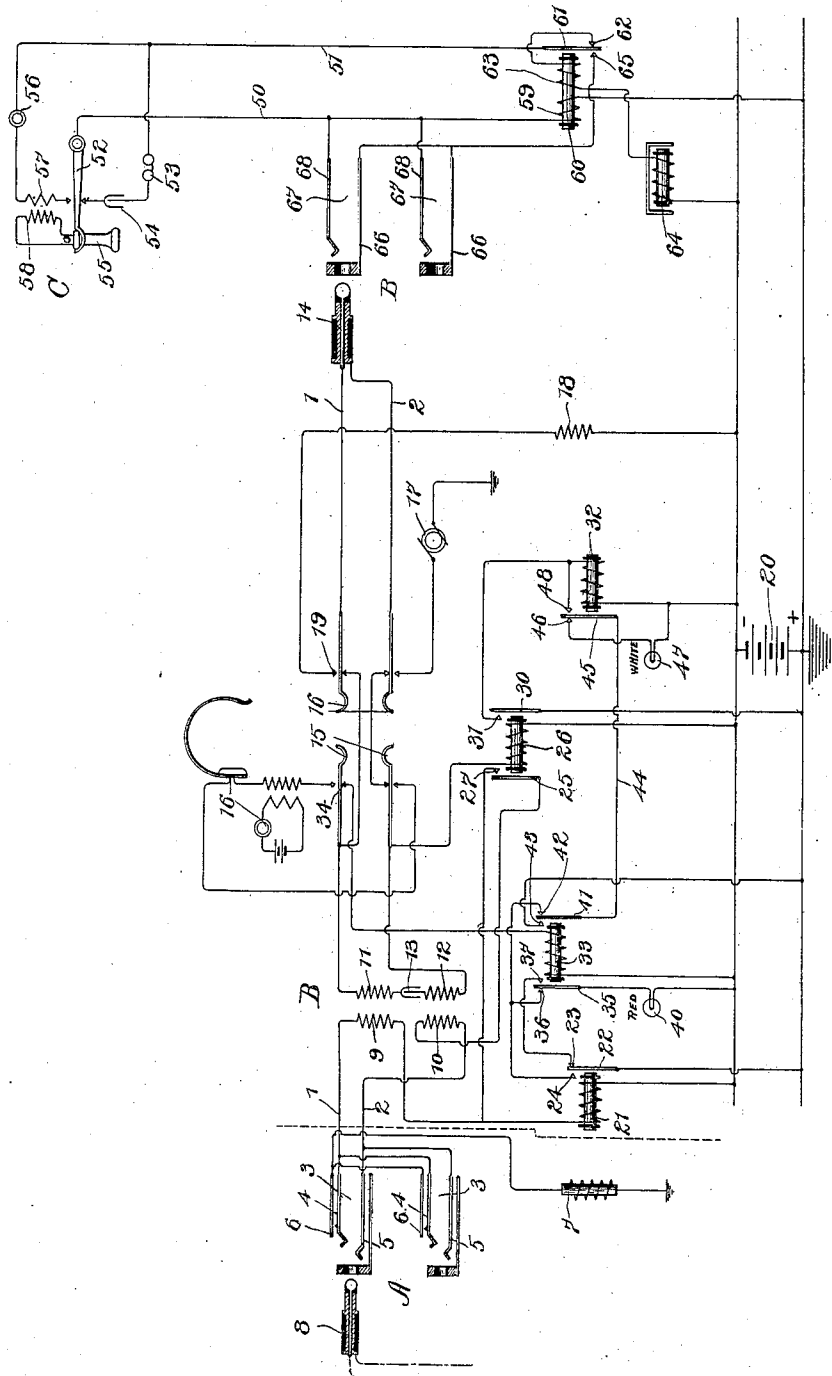


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H. G. WEBSTER.
TELEPHONE EXCHANGE SYSTEM.
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Witnesses,

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TELEPHONE-EXCHANGE SYSTEM.

No. 824,767.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, HARRY G. WEBSTER, 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 drawing, forming a part of this specification.

My invention relates to telephone-exchange systems, and more particularly to so-called "trunk-circuits" for use in connection with such systems.

In modern telephone practice it is customary to connect a large number of subscribers' lines with a central exchange and to afford means for communication between subscribers connected with different exchanges by means of trunk-circuits. These trunk-circuits consist, primarily, of metallic lines running from one telephone-exchange board to another. The operator at one board receiving a call from a subscriber who desires connection with a subscriber connected with another exchange-switchboard uses what is known as an "order-wire" to telephonically communicate with the operator at the second board, the operator at the second board designating which of a number of trunk-circuits is to be employed for the purpose of interconnecting the desired subscribers. The operator at the first board by means of her cord connecting apparatus then connects the calling subscriber with the proper trunk-circuit and the operator at the second board connects the other terminal of the trunk-circuit with the line leading to the called subscriber's substation. It is desirable that each of these trunk-circuits be provided with signaling apparatus which will indicate to a trunk operator the operative condition of the trunk-circuit. In addition to the usual supervisory signal, which should indicate whether or not the connected subscribers have finished their conversation, it is desirable that a signal should be provided to indicate whether or not the called subscriber has answered his calling-signal, and, furthermore, it is desirable that a signal be provided which shall indicate to the trunk operator whether or not the operator at the calling-board has selected the proper trunk-circuit in making connection with the calling

subscriber. The signal employed to indicate whether or not the proper trunk-circuit has been selected may be known as a "guard." The signal which indicates whether or not the called subscriber has answered his call may be known as the "ringing-signal," while the signal which indicates that the subscribers have finished their conversation may be known as the "disconnect-signal." Trunk-circuits have heretofore been devised in which these three signals have been employed; but much confusion has arisen due to the fact that the trunk-circuit signal-code has been materially different from the code commonly employed in connection with the ordinary operator's cord connecting apparatus, whereby an operator familiar with the use of the usual switchboard cord connecting apparatus is much confused in the use of trunk-circuit apparatus. It has become an almost universal custom in telephone practice where small electric lamps are used for visual signaling purposes to cause a single white lamp to glow in order to give the operator the ringing-signal to indicate that the called subscriber has not as yet answered the call.

As distinguished from trunk-circuits of the prior art it is the purpose of my invention to provide a trunk-circuit in which the ringing-signal shall be produced by the glow of a single white lamp to correspond with the ringing-signal commonly used in the usual cord connecting apparatus and circuit. In addition to the provision of means whereby the signal-code for the trunk-circuit corresponds with that for the usual cord-circuit I provide means whereby the signal-code employed positively indicates to the trunk operator the operative condition of the trunk-circuit at all times. While the principal object of my invention has been to provide a trunk-circuit having an improved signal-code, I have attained the desired results by the use of a circuit arrangement of great simplicity and reliability in operation. Many other improvements have been incorporated in the present system and will be more clearly understood by reference to the accompanying drawing diagrammatically illustrating the circuit arrangements and apparatus embodying my invention.

In the drawing I have illustrated the trunk-lines 1 and 2 running between the

switchboard A and the switchboard B. At the switchboard A these lines terminate in multiple spring-jacks 3 3, the line 1 being connected to the tip-springs 4 and the line 2 being connected to the sleeve-springs 5 5. These spring-jacks are provided with multiple contact-springs 6, connected, through an impedance-coil 7, with the ground. The insertion of the plug 8 of the operator's cord connecting apparatus at the switchboard A within one of the spring-jacks 3 causes the closure of the circuit between the limb 1 of the trunk-line and the ground by means of the contact between the tip-spring 4 and the contact-spring 6. The limbs 1 and 2 of the trunk-line lead to the switchboard B, where they are connected, respectively, with the outer terminals of repeating-coil windings 9 and 10. Inductively associated with the repeating-coil windings 9 and 10 are the windings 11 and 12, whose inner terminals are connected to the condenser 13 and whose outer terminals are led through a ringing and listening key to the calling-plug 14 of the trunk-circuit. A manipulation of the listening-key 15 serves to connect the operator's telephone set 16 in bridge of the trunk-circuit, while the manipulation of the ringing-key 16 connects the ringing-generator 17 with the cord-strands leading to the calling-plug 14. I have found it desirable to connect the resistance 18 between the upper contact-spring 19 of the ringing-key and the negative side of the common battery 20, whose positive pole is connected with the ground, as shown. There is connected between the inner terminal of the repeating-coil winding 9 and the negative pole of the common battery a relay 21, which controls an armature 22 to actuate the same between its back contact 23 and its front contact 24. The inner terminal of the repeating-coil winding 10 is connected to the armature 25 of a relay 26, whose winding is connected between the negative pole of the battery 20 and the sleeve-strand of the trunk-circuit. The front contact 27 for the armature 25 is connected, as shown, with the inner terminal of the repeating-coil winding 9. The relay 26 is provided with a second armature 30, which when attracted by the relay 26 makes connection with the front contact 31 to close a circuit through the locking-relay 32. A fourth relay 33 is connected between the negative pole of the battery 20 and a contact 34, normally making connection with the tip-strand of the trunk-circuit. This relay 33 is provided with an armature 35, whose normal back contact 36 is connected with the contact 24 and whose front contact 37 is connected with the contact 23. The armature 35 is connected, through a red signaling-lamp 40, with the negative pole of the battery. The second armature 41 of this relay 33 rests normally in contact with the back contact 42, which is connected with

contacts 36 and 24. The front contact 43 for this armature is connected directly with the positive grounded side of the battery 20. The armature 41 is permanently connected, through the conductor 44, with the armature 45 of the locking-relay 32. The back contact 46 of the armature 45 is connected, through the white signaling-lamp 47, with the negative pole of the battery 20. The front contact 48 for this armature is connected with the contact 31 of the relay 26.

I have also illustrated at substation C a subscriber's telephone set, to which the line-limbs 50 and 51 lead from the B exchange-board. The usual switch-hook 52 normally serves to connect between the line-limbs 50 and 51 the call-bell 53 and the condenser 54. Upon the removal of the receiver 55 from the switch-hook 52 a circuit is closed through the transmitter 56 and the primary 57 of an induction-coil whose secondary 58 is connected with the receiver 55. While my invention may be employed in connection with a great variety of line-circuits, I have shown it applied to a system in which the line 50 is connected, through the winding 59 of a differential cut-off relay 60, with the positive grounded pole of the common battery 20. The line 51 is connected with the armature 61 of the differential cut-off relay, which when normally in contact with the back contact 62 connects this line, through the winding 63 of the differential cut-off relay and the visual line-signal 64, with the negative terminal of the battery 20. The front contact 65 of the armature 61 is connected with the sleeve-contacts 66 of the multiple jacks 67, associated with the line to substation C. The tip-springs 68 of these multiple jacks are permanently connected with the line-limb 50. As the precise nature of the line-circuits associated with the switchboard A and the nature of the cord connecting-circuits at the switchboard A are immaterial so far as my present invention is concerned, I have not fully illustrated the circuits at this calling-switchboard, and I shall now proceed to describe the method of operation of my improved trunk-circuit without particular reference to the means or methods employed at the switchboard A.

An operator at switchboard A upon answering a calling subscriber connected with her board and ascertaining that the calling subscriber desires connection with a subscriber connected with switchboard B communicates with the operator at switchboard B over an order-wire, which not being a part of my present invention is not shown in the accompanying drawing. The operator at the switchboard B designates which of a number of similar trunk-circuits is to be employed for the purpose of making the desired trunk connection. Assuming this to be the particular trunk-circuit shown in the ac-

accompanying drawing, the operator at switchboard A inserts the plug 8 of her cord connecting apparatus within a spring-jack 3. This, it will be seen, causes an electrical connection between the tip-spring 4 and the spring-contact 6 of the jack. This causes the closure of the following electric circuit: from the negative pole of the common battery 20, through the winding of the relay 21, the winding 9 of the repeating-coil, the tip-spring 4 of the jack 3, the spring-contact 6, the impedance-coil 7 to the ground, and thence to the positive pole of the common battery 20. It will thus be seen that the operation of the relay 21 is under the control of the A operator. The energization of the relay 21, due to the insertion of the plug 8 within a jack 3, causes the attraction of the armature 22 to make connection with its front contact 24, whereupon a circuit is established through the red lamp 40 and the white lamp 47. The circuit through the red lamp may be traced as follows: from the positive side of the battery 20 to the armature 22, to front contact 24, to back contact 36, to armature 35, and through the red lamp 40 to the negative side of the battery 20. The circuit through the white lamp 47 may be traced as follows: from the positive side of the battery 20 to the armature 22, to the front contact 24, to the back contact 42 of the relay 33, to the armature 41, through the conductor 44, to the armature 45 of the relay 32, to the back contact 46, and through the white lamp 47 to the negative pole of the battery 20. Now if through some misunderstanding as to the trunk-line to be employed in making this trunking connection the operator at the B board attempts to use some other calling-plug similar to the plug 14 instead of the plug 14, which is associated with the trunk-line into whose jack 3 the operator at the A board has inserted her plug 8, the continued glow of the two lamps—that is, the red lamp 40 and the white lamp 47—provides what is known as a “guard-signal,” indicating to the operator at the B board that there has been some mistake as to the proper trunk-circuit to be employed. Under the usual operative conditions the operator at the B board will have inserted the plug 14 within a jack 67, associated with the line leading to the called substation, almost simultaneously with the insertion of the plug 8 within a jack 3 at the A switchboard. Assuming for the time being that at the time the plug 14 is inserted within a jack 67 the operator at the A board has not inserted her calling-plug 8 within the jack 3 of the same trunk-circuit to which the strands leading to the plug 14 are connected, a circuit will be closed through the B operator’s relay 33, which may be traced as follows: from the negative pole of the battery 20, through the winding of the relay 33,

through the tip-strand leading to the tip-contact of the plug 14, through the tip-spring 68 and the winding 59 of the differential cut-off relay 60 to the positive pole of the battery 20. The current flowing through the winding of the relay 33 will cause its energization to attract the armatures 35 and 41. The attraction of the armature 35 will cause the closure of a circuit through the red lamp 40, which may be traced as follows: from the negative pole of the battery 20, through the lamp 40, the armature 35, the front contact 37, to the back contact 23, through the armature 22, to the positive pole of the battery. The attraction of the armature 41 causes the closure of a circuit through the white lamp 47, which may be traced as follows: from the negative pole of the battery 20, through the lamp 47 to the contact 46, through the armature 45, the conductor 44, the armature 41 to the front contact 43, and thence to the positive pole of the battery 20. Thus the signal produced by the simultaneous illumination of the lamps 40 and 47 gives the B operator a guard-signal, indicating that the operator at the A board has not as yet inserted her plug 8 within a jack 3, associated with the same trunk-circuit. If, however, there has been no mistake between the operators at the A and B boards as to the trunk-line to be employed in making the connection between the calling and called subscribers, both the relays 21 and 33 will have been energized. Assuming now that the plug 14 has been inserted within the jack 67 of the line leading to the called substation C and that the relay 33 has been energized to cause the attraction of its armatures 35 and 41, the energization of the relay 21 and the attraction of its armature 22 causes a break in the circuit previously traced through the lamp 40, this circuit being traced through a connection between the armature 22 and its back contact 23. The circuit previously traced through the white lamp 47 is not affected, however, by the energization of the A operator’s relay 21 after the B operator’s relay 33 has been energized to attract its armature 41. The B operator upon noting either that the red lamp is not illuminated upon the insertion of her calling-plug 14 within the jack 67 or upon noting, even if this red lamp 40 is illuminated, that it is very shortly thereafter extinguished, due to the insertion of the plug 8 within a jack 3, manipulates her ringing-key 16 to connect the ringing-generator 17 with the line leading to the substation C.

It may be desirable here to digress for a moment in order to describe the operation of the line-circuit which is shown as associated with my improved trunk-circuit. A subscriber—such, for instance, as the subscriber located at substation C—upon desiring to call the central operator removes his receiver

from its hook, thereby closing a conductive circuit from the common battery 20 through both windings 59 and 63 of the differential cut-off relay 60 and the winding of the visual line-signal 64. The flow of current through this circuit passing, as it does, through the two differentially-related windings of the differential cut-off relay causes no net energization thereof to cause the attraction of the armature 61. The visual signal 64 is operated, however, to attract the attention of the operator, who thereupon inserts a plug of her cord connecting apparatus within a jack 67. This, as in the case of the trunk-circuit apparatus, causes the closure of a circuit of decreased resistance through the winding 59 of the differential cut-off relay, this circuit in the case of the trunk connecting apparatus being traced as follows: from the positive pole of the battery 20, through the winding 59 of the differential cut-off relay, the tip-spring 68 of the jack 67, the tip-strand leading to the plug 14, the winding of the relay 33 to the negative pole of the battery 20. This circuit of decreased resistance through a single winding of the differential cut-off relay causes a net energization thereof, whereupon its armature 61 is attracted to make contact with the front contact 65, the connection from the line 51 through the winding 63 and the signal 64 being thereupon broken. The line-limb 51 is thereby connected directly with the sleeve-springs 66 of the jacks 67. Upon the replacement of the receiver 55 upon the switch-hook 52 and the consequent removal of the plug 14 from the jack 67 the circuit of decreased resistance through the winding 59 is broken, thereby causing the deenergization of the differential cut-off relay 60 and the retraction of the armature 61 to its normal position.

Returning now more particularly to the operation of the system as employed in connection with the improved trunk-circuit herein described, the manipulation of the ringing-key serves to interrupt the circuit through the relay 33 and the winding 59 of the differential cut-off relay 60; but the contact 19 making connection with the upper spring of the ringing-key 16 causes the closure of a circuit through the resistance 18 and the winding 59 of the differential cut-off relay 60. Thus the attraction of the armature 61, due to the energization of the relay 60, is maintained. The ringing-generator 17 being connected between the ground and the sleeve-strand leading to the plug 14, a ringing-current is sent to the call-bell 53 over a circuit which may be traced as follows: from the ringing-generator through the sleeve-strand to the plug 14, through the sleeve-contact 66 of the jack 67, the armature 61, the line-limb 51, the call-bell 53, the condenser 54, the switch-hook 52, the line-limb 50, the winding

59 of the differential cut-off relay to the ground, to which the other terminal of the ringing-generator is also connected. It will be remembered that the operators at the A and B boards having both selected the proper trunk-circuit, the white lamp 47 is alone illuminated. The illumination of this lamp 47 continues until the removal of the receiver 55 from its switch-hook at substation C, whereupon this lamp 47 will be extinguished, due to the energization of the subscriber's relay 26, a circuit through which is established upon the removal of the receiver at the substation C. The circuit thus established through this subscriber's relay 26 may be traced as follows: from the negative pole of the battery 20, through the winding of the relay 26, the sleeve-strand leading to the plug 14, to the spring 66 of the jack 67, through the contact 65, the armature 61, the line-limb 51, the transmitter 56, the primary winding 57, the switch-hook 52, the line-limb 50, the winding 59 of the differential cut-off relay to the positive grounded side of the battery 20. The consequent energization of the subscriber's relay 26 causes the attraction of its armatures 25 and 30. The attraction of the armature 25 closes a conductive circuit between the limbs 1 and 2 of the trunk-line, this circuit being traced through the line-limb 1, repeating-coil winding 9, the contact 27, the armature 25, the repeating-coil winding 10, and back through the trunk-line limb 2. Thus the usual supervisory signaling apparatus associated with the operator's cord-circuit at the switchboard A is controlled by the continuity of the circuit between the trunk-line limbs 1 and 2 in a manner exactly similar to that in which an operator's supervisory signaling apparatus is ordinarily controlled by the continuity of the circuit through a subscriber's substation apparatus—that is to say, the continuity of a conductive circuit between the line-limbs 50 and 51, leading to substation C, simultaneously and similarly affects the continuity of a conductive circuit between the limbs 1 and 2 of the trunk-line. The supervisory apparatus at the switchboard A is thus affected and controlled exactly as though the plug 8 were inserted directly within the jack 67. The attraction of the armature 30 of the subscriber's relay 26 causes the closure of a circuit through the locking-relay 32, which may be traced as follows: from the positive pole of the battery 20 through the armature 30, the contact 31, and the winding of the relay 32 to the negative pole of the battery 20. The relay 32 is thereupon energized to cause the attraction of its armature 45. The immediate result is the interruption of the previously-traced circuit through the white lamp 47, thereby causing the immediate extinction of this lamp. The connection es-

established between the armature 45 and its front contact 48 causes the closure of a locking-circuit through the locking-relay 32.

Remembering that the armature 41 is attracted, due to the energization of its relay 33, through which a circuit has been established and maintained by the insertion of the plug 14 within a jack 67, an additional circuit through the locking-relay 32 can be traced as follows: from the negative pole of the battery 20, through the winding of the relay 32 to the contact 48, through the armature 45, the conductor 44, and the armature 41 to the front contact 43, and thence to the positive pole of the battery 20. Thus during the conversation by the connected subscribers neither the white nor the red lamp is illuminated. Upon the completion of the conversation and supposing the operator at switchboard A to receive a disconnect-signal from the calling subscriber connected with her board she removes the plug 8 from the jack 3, within which it has been inserted. The circuit previously traced through the A operator's relay 21 is broken, due to the disconnection of the tip-spring 4 with the spring-contact 6. Thus the relay 21 is deenergized and its armature 22 retracted into contact with the back contact 23. The retraction of this armature 22 causes the immediate illumination of the red lamp 40, the circuit being traced as follows: from the positive pole of the battery 20, through the armature 22, the contact 23, the contact 37, the armature 35, and the lamp 40 to the negative pole of the battery 20. The B operator, perceiving the illumination of the lamp 40, removes the plug 14 from the jack 67. This causes the deenergization of the B operator's relay 33, and if the subscriber at substation C has not previously replaced his receiver upon its hook it also causes the deenergization of the subscriber's relay 26. If the subscriber at substation C has been the first to replace his receiver upon the completion of the conversation, the subscriber's relay 26 will be immediately deenergized, due to the interruption in the previously-traced circuit therethrough. This causes the retraction of the armatures 25 and 30, the retraction of the armature 25 breaking the connection with the contact 27, whereby the continuity of the conductive circuit between the trunk-line limbs 1 and 2 is broken, thus causing an actuation of the A operator's supervisory apparatus to notify her of the desired disconnection. The retraction of the armature 30 breaks one of the circuits previously traced through the locking-relay 32, this circuit being traced through the contact 31 of the armature 30. The armature 45 of the locking-relay 32 is, however, maintained in its attracted position, due to the current which traverses the winding of the locking-relay

through the contact 46, the armature 45, the conductor 44, the armature 41, the front contact 43, and the battery 20. The operator at the A board answers the disconnect-signal given by the subscriber at substation C by removing the plug 8 from the jack 3. As previously pointed out, this causes the deenergization of the relay 21, whereupon the armature 22 is retracted to cause the illumination of the red lamp 40. The illumination of the red lamp alone giving the B operator a disconnect-signal, she answers the same by the removal of her calling-plug 14 from the jack 67, whereupon the circuit through the B operator's relay 33 is broken, causing the deenergization thereof and the retraction of its armatures 35 and 41. The retraction of the armature 35 causes a break in the circuit through the red lamp 40, whereupon the latter is extinguished. The retraction of the armature 41 and its consequent disconnection from the front contact 43 causes a break in the locking-circuit through the locking-relay 32, whereupon the relay 32 is deenergized and its armature 45 retracted to its normal position in contact with the back contact 46. Thus all of the trunk-circuit apparatus is restored to its normal condition on the removal of the plug 8 from the jack 3 and the removal of the plug 14 from the jack 67.

As previously stated, the removal of the plug 14 from the jack 67 causes the restoration of the line apparatus. It will thus be seen that my improved system provides a positive guard-signal which consists in the simultaneous illumination of both the red and the white lamps. The ringing-signal, which consists in the illumination of the white lamp alone, corresponds with the ringing-signal commonly employed in most cord connecting-circuits, and the disconnect-signal consists in the illumination of the red lamp alone. This signal-code is an improvement over the codes heretofore employed in connection with trunk-circuits. Nevertheless the system and apparatus employed in the operation of these signals is one of great simplicity and reliability and one which can be readily adapted to a great variety of line-circuits. Many of the important advantages gained by my invention are due to the permanent connection of the A operator's relay 21 to but one limb of the trunk-line. This peculiar manner of connecting the relay 21 avoids the use of a large number of switch-contacts which are necessary in other circuits.

While I have herein shown and described one particular 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, and 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 bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange to contacts of which the terminals of said line are connected, a relay at the B exchange permanently connected to but a single limb of said line, a signal at the B exchange normally controlled by said relay, and means whereby the insertion of a cord connecting-plug within said jack causes an actuation of said relay independently of exchange A cord-circuit conductors.

2. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange of a spring-jack at the A exchange to contacts of which the terminals of said line are connected, a relay at the B exchange connected to but a single limb of said line, a signal at the B exchange normally controlled by said relay, and means whereby the insertion of a cord connecting-plug within said jack causes an actuation of said relay independently of exchange A cord-circuit conductors.

3. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange to contacts of which the terminals of said line are connected, a relay at the B exchange connected to but a single limb of said line, a signal at the B exchange normally controlled by said relay, a source of current at the B exchange, and switching means associated with said spring-jack whereby the insertion of a cord-connecting plug within said spring-jack causes the closure of an electrical circuit through said source of current and said relay independently of exchange A cord-circuit conductors.

4. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange to contacts of which the terminals of said line are connected, a relay at the B exchange permanently connected to but a single limb of said line, a signal at the B exchange normally controlled by said relay, a source of current at the B exchange, and switching means associated with said spring-jack whereby the insertion of a cord connecting-plug within said spring-jack causes the closure of an electrical circuit through said source of current and said relay independently of exchange A cord-circuit conductors.

5. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange to contacts of which the terminals of said line are con-

nected, an impedance-coil at the A exchange, a relay at the B exchange permanently connected through a source of current between one limb of said line and the ground, a signal normally controlled by said relay, and switching means associated with said spring-jack whereby the insertion of a cord connecting-plug within said spring-jack causes the closure of a circuit through said relay and said impedance-coil between said line-limb and the ground independently of exchange A cord-circuit conductors.

6. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange to contacts of which the terminals of said line are connected, a repeating-coil at the B exchange to the outer terminals of one winding of which said metallic-line limbs are connected, a subscriber's line-circuit connected to the terminals of the second winding of said repeating-coil, subscriber's telephone apparatus connected with said line-circuit, a subscriber's relay at the B exchange controlled by the operative condition of said telephone apparatus, the continuity of the trunk-line circuit through the first winding of said repeating-coil being controlled by said subscriber's relay, an A operator's relay at the B exchange permanently connected to one limb of said line, a signal at the B exchange normally controlled by said A operator's relay, and means whereby the insertion of a cord connecting-plug within said jack causes an actuation of said relay.

7. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange to contacts of which the terminals of said line are connected, a repeating-coil at the B exchange to the outer terminals of one winding of which said metallic line-limbs are connected, a subscriber's line-circuit connected to the terminals of the second winding of said repeating-coil, subscriber's telephone apparatus connected with said line-circuit, a subscriber's relay at the B exchange controlled by the operative condition of said telephone apparatus, the continuity of the trunk-line circuit through the first winding of said repeating-coil being controlled by said subscriber's relay, an A operator's relay at the B exchange permanently connected to but a single limb of said line, a signal at the B exchange normally controlled by said A operator's relay, and means whereby the insertion of a cord connecting-plug within said jack causes an actuation of said relay.

8. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange to contacts of which the terminals of said line are con-

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ected, a repeating-coil at the B exchange to the outer terminals of one winding of which said metallic-line limbs are connected, a subscriber's line-circuit connected to the terminals of the second winding of said repeating-coil, subscriber's telephone apparatus connected with said line-circuit, a subscriber's relay at the B exchange controlled by the operative condition of said telephone apparatus, the continuity of the trunk-line circuit through the first winding of said repeating-coil being controlled by said subscriber's relay, an A operator's relay at the B exchange permanently connected to one limb of said line, a signal at the B exchange normally-controlled by said A operator's relay, a source of current at the B exchange, and switching means associated with said spring-jack whereby the insertion of a cord connecting-plug within said spring-jack causes the closure of an electrical circuit through said source of current and said relay.

9. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange to contacts of which the terminals of said line are connected, a repeating-coil at the B exchange to the outer terminals of one winding of which said metallic-line limbs are connected, a subscriber's line-circuit connected to the terminals of the second winding of said repeating-coil, subscriber's telephone apparatus connected with said line-circuit, a subscriber's relay at the B exchange controlled by the operative condition of said telephone apparatus, the continuity of the trunk-line circuit through the first winding of said repeating-coil being controlled by said subscriber's relay, an A operator's relay at the B exchange permanently connected to but a single limb of said line, a signal at the B exchange normally controlled by said A operator's relay, a source of current at the B exchange, and switching means associated with said spring-jack whereby the insertion of a cord connecting-plug within said spring-jack causes the closure of an electrical circuit through said source of current and said relay.

10. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange to contacts of which the terminals of said line are connected, a repeating-coil at the B exchange to the outer terminals of one winding of which said metallic-line limbs are connected, a subscriber's line-circuit connected to the terminals of the second winding of said repeating-coil, subscriber's telephone apparatus connected with said line-circuit, a subscriber's relay at the B exchange controlled by the operative condition of said telephone apparatus, the continuity of the trunk-line

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circuit through the first winding of said repeating-coil being controlled by said subscriber's relay, an A operator's relay at the B exchange permanently connected to one limb of said line, a signal at the B exchange normally controlled by the said A operator's relay, a source of current, and switching means associated with said spring-jack whereby the insertion of a cord connecting-plug within said spring-jack causes the closure of an electrical circuit through said source of current and said relay.

11. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange to contacts of which the terminals of said line are connected, a repeating-coil at the B exchange to the outer terminals of one winding of which the said metallic-line limbs are connected, a subscriber's line-circuit connected to the terminals of the second winding of said repeating-coil, subscriber's telephone apparatus connected with said line-circuit, a subscriber's relay at the B exchange controlled by the operative condition of said telephone apparatus, the continuity of the trunk-line circuit through the first winding of said repeating-coil being controlled by said subscriber's relay, an A operator's relay at the B exchange permanently connected through a source of current between one limb of said line and the ground, a signal at the B exchange normally controlled by said A operator's relay, and switching means associated with said spring-jack whereby the insertion of a cord connecting-plug with said spring-jack causes the closure of a circuit through said relay between said line-limb and the ground.

12. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange to contacts of which the terminals of said line are connected, a relay at the B exchange permanently connected to but a single limb of said line, two signals at the B exchange normally controlled by said relay, and means whereby the insertion of a cord-connecting plug within said jack causes an actuation of said relay and signals controlled thereby independently of exchange A cord-circuit conductors.

13. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange to contacts of which the terminals of said line are connected, a relay at the B exchange connected to but a single limb of said line, two signals at the B exchange normally controlled by said relay, and means whereby the insertion of a cord connecting-plug within

said jack causes an actuation of said relay and signals controlled thereby independently of exchange A cord-circuit conductors.

14. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange to contacts of which the terminals of said line are connected, an impedance-coil at the A exchange, a relay at the B exchange permanently connected through a source of current between one limb of said line and the ground, two signals controlled by said relay, and switching means associated with said spring-jack whereby the insertion of a cord connecting-plug within said spring-jack causes the closure of a circuit through said relay and said impedance-coil between said line-limb and the ground independently of exchange A cord-circuit conductors to actuate both signals.

15. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange to contacts of which the terminals of said line are connected, a repeating-coil at the B exchange to the outer terminals of one winding of which said metallic-line limbs are connected, a subscriber's line-circuit connected to the terminals of the second winding of said repeating-coil, subscriber's telephone apparatus connected with said line-circuit, a subscriber's relay at the B exchange controlled by the operative condition of said telephone apparatus, the continuity of the trunk-line circuit through the first winding of said repeating-coil being controlled by said subscriber's relay, an A operator's relay at the B exchange permanently connected to one limb of said line, two signals at the B exchange normally controlled by said A operator's relay, a source of current at the B exchange, and switching means associated with said spring-jack whereby the insertion of a cord connecting-plug within said spring-jack causes the closure of an electrical circuit through said source of current and said relay.

16. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange to contacts of which the terminals of said line are connected, a relay at the B exchange permanently connected to one limb of said line, a red and a white signal-lamp at the B exchange each having an illuminating-circuit normally controlled by said relay, and means whereby the insertion of a cord connecting-plug within said jack causes an actuation of said relay independently of exchange A cord-circuit conductors.

17. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange,

of a spring-jack at the A exchange to contacts of which the terminals of said line are connected, a relay at the B exchange permanently connected to but a single limb of said line, a red and a white signal-lamp at the B exchange each having an illuminating-circuit normally controlled by said relay, and means whereby the insertion of a cord connecting-plug within said jack causes an actuation of said relay independently of exchange A cord-circuit conductors.

18. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange to contacts of which the terminals of said line are connected, a relay at the B exchange connected to but a single limb of said line, a red and a white signal-lamp at the B exchange each having an illuminating-circuit normally controlled by said relay, and means whereby the insertion of a cord connecting-plug within said jack causes an actuation of said relay independently of exchange A cord-circuit conductors.

19. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange to contacts of which the terminals of said line are connected, a relay at the B exchange permanently connected to one limb of said line, a red and a white signal-lamp at the B exchange each having an illuminating-circuit normally controlled by said relay, a source of current at the B exchange, and switching means associated with said spring-jack whereby the insertion of a cord connecting-plug within said spring-jack causes the closure of an electric circuit through said source of current and said relay independently of exchange A cord-circuit conductors.

20. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange to contacts of which the terminals of said line are connected, a relay at the B exchange permanently connected through a source of current between one limb of said line and the ground, a red and a white signal-lamp at the B exchange each having an illuminating-circuit normally controlled by said relay, a source of current at the B exchange, and switching means associated with said spring-jack whereby the insertion of a cord connecting-plug within said spring-jack causes the closure of a circuit through said relay between said line-limb and the ground independently of exchange A cord-circuit conductors.

21. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange to contacts of which the terminals of said line are

connected, a repeating-coil at the B exchange, to the outer terminals of one winding of which said metallic-line limbs are connected, a subscriber's line-circuit connected to the terminals of the second winding of said repeating-coil, subscriber's telephone apparatus connected with said line-circuit, a subscriber's relay at the B exchange controlled by the operative condition of said telephone apparatus, the continuity of the trunk-line circuit through the first winding of said repeating-coil being controlled by said subscriber's relay, an A operator's relay at the B exchange permanently connected to one limb of said line, a red and a white signal-lamp at the B exchange each having a local illuminating-circuit normally controlled by said A operator's relay, and means whereby the insertion of a cord connecting-plug within said jack causes an actuation of said relay.

22. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange to contacts of which the terminals of said line are connected, a repeating-coil at the B exchange to the outer terminals of one winding of which said metallic-line limbs are connected, a subscriber's line-circuit connected to the terminals of the second winding of said repeating-coil, subscriber's telephone apparatus connected with said line-circuit, a subscriber's relay at the B exchange controlled by the operative condition of said telephone apparatus, the continuity of the trunk-line circuit through the first winding of said repeating-coil being controlled by said subscriber's relay, an A operator's relay at the B exchange permanently connected to one limb of said line, a red and a white signal-lamp at the B exchange each having a local illuminating-circuit normally controlled by said A operator's relay, a source of current at the B exchange, and switching means associated with said spring-jack whereby the insertion of a cord connecting-plug within said spring-jack causes the closure of an electric circuit through said source of current and said relay.

23. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange telephonically associated with said trunk-line, an A operator's relay at the B exchange, permanently connected to but a single limb of said line, a signal at the B exchange normally controlled by said A operator's relay, means whereby the insertion of a cord connecting-plug within said spring-jack causes an actuation of said A operator's relay independently of exchange A cord-circuit conductors, and a B operator's relay controlled by the B operator, adapted upon energization to destroy the control of said signal by said A operator's relay.

24. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange to contacts of which the terminals of said line are connected, an A operator's relay at the B exchange connected to but a single limb of said line, a signal at the B exchange normally controlled by said A operator's relay, a source of current, switching means associated with said spring-jack, whereby the insertion of a cord connecting-plug within said spring-jack causes the closure of an electrical circuit through said source of current and said A operator's relay independently of exchange A cord-circuit conductors, and a B operator's relay controlled by the B operator, adapted upon energization to destroy the control of said signal by said A operator's relay.

25. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange telephonically associated with said trunk-line, an impedance-coil at the A exchange, an A operator's relay at the B exchange permanently connected through a source of current between one limb of said line and the ground, a signal controlled by said relay, means associated with said spring-jack whereby the insertion of a cord connecting-plug within said spring-jack causes the closure of a circuit through said A operator's relay and said impedance-coil between said line-limb and the ground independently of exchange A cord-circuit conductors, and a B operator's relay controlled by the B operator, adapted upon energization to destroy the control of said signal by said A operator's relay.

26. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange to contacts of which the terminals of said line are connected, a repeating-coil at the B exchange, to the outer terminals of one winding of which said metallic-line limbs are connected, a subscriber's line-circuit connected to the terminals of the second winding of said repeating-coil, subscriber's telephone apparatus connected with said line-circuit, a subscriber's relay at the B exchange, controlled by the operative condition of said telephone apparatus, the continuity of the trunk-line circuit through the first winding of said repeating-coil being controlled by said subscriber's relay, an A operator's relay at the B exchange permanently connected to one limb of said line, a signal at the B exchange normally controlled by said A operator's relay, means whereby the insertion of a cord connecting-plug within said spring-jack causes an actuation of said A operator's relay, and a B operator's relay controlled by the B operator, adapted upon energization to destroy the

control of said signal by said A operator's relay.

27. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange to contacts of which the terminals of said line are connected, a repeating-coil at the B exchange to the outer terminals of one winding of which said metallic-line limbs are connected, a subscriber's line-circuit connected to the terminals of the second winding of said repeating-coil, subscriber's telephone apparatus connected with said line-circuit, a subscriber's relay at the B exchange controlled by the operative condition of said telephone apparatus, the continuity of the trunk-line circuit through the first winding of said repeating-coil being controlled by said subscriber's relay, an A operator's relay at the B exchange permanently connected to but a single limb of said line, a signal at the B exchange normally controlled by said A operator's relay, means whereby the insertion of a cord connecting-plug within said spring-jack causes an actuation of said A operator's relay, and a B operator's relay controlled by the B operator, adapted upon energization to destroy the control of said signal by said A operator's relay.

28. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange, to contacts of which the terminals of said line are connected, a repeating-coil at the B exchange, to the outer terminals of one winding of which said metallic-line limbs are connected, a subscriber's line-circuit connected to the terminals of the second winding of said repeating-coil, subscriber's telephone apparatus connected with said line-circuit, a subscriber's relay at the B exchange controlled by the operative condition of said telephone apparatus, the continuity of the trunk-line circuit through the first winding of said repeating-coil being controlled by said subscriber's relay, an A operator's relay at the B exchange permanently connected through a source of current between one limb of said line and the ground, a signal at the B exchange normally controlled by said A operator's relay, switching means associated with said spring-jack whereby the insertion of a cord connecting-plug within said spring-jack causes the closure of a circuit through said A operator's relay between said line-limb and the ground, and a B operator's relay controlled by the B operator, adapted upon energization to destroy the control of said signal by said A operator's relay.

29. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange,

of a spring-jack at the A exchange telephonically associated with said trunk-line, an A operator's relay at the B exchange, permanently connected to one limb of said line, two signals at the B exchange normally controlled by said A operator's relay, means whereby the insertion of a cord connecting-plug within said spring-jack causes an actuation of said A operator's relay independently of exchange A cord-circuit conductors, and a B operator's relay controlled by the B operator, adapted in conjunction with said A operator's relay to absolutely control one of said signals, and upon energization to destroy the control of the other signal by the A operator's relay.

30. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange telephonically associated with said trunk-line, an A operator's relay at the B exchange permanently connected to one limb of said line, two signals at the B exchange partly controlled by said A operator's relay, a source of current, means associated with said spring-jack whereby the insertion of a cord connecting-plug within said spring-jack causes the closure of an electrical circuit through said source of current and said relay independently of exchange A cord-circuit conductors, and a B operator's relay controlled by the B operator, adapted, in conjunction with said A operator's relay, to absolutely control one of said signals, and upon energization to destroy the control of the other signal by the A operator's relay.

31. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange telephonically associated with said trunk-line, an impedance-coil at the A exchange, an A operator's relay at the B exchange permanently connected through a source of current between one limb of said line and the ground, two signals controlled by said A operator's relay, means associated with said spring-jack whereby the insertion of a cord connecting-plug within said spring-jack causes the closure of an electrical circuit through said A operator's relay and said impedance-coil between said line-limb and the ground, and a B operator's relay controlled by the B operator, adapted, in conjunction with said A operator's relay, to absolutely control one of said signals, and upon energization to destroy the control of the other signal by the A operator's relay.

32. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange to contacts of which the terminals of said line are connected, a repeating-coil at the B exchange

to the outer terminals of one winding of which said metallic-line limbs are connected, a subscriber's line-circuit connected to the terminals of the other winding of said repeating-coil, a subscriber's telephone apparatus connected with said line-circuit, a subscriber's relay at the B exchange controlled by the operative condition of said telephone apparatus, the continuity of the trunk-line circuit through the first winding of said repeating-coil being controlled by said subscriber's relay, an A operator's relay at the B exchange permanently connected to one limb of said line, two signals at the B exchange normally controlled by said A operator's relay, a source of current, switching means associated with said spring-jack whereby the insertion of a cord connecting-plug within said spring-jack causes the closure of an electrical circuit through said source of current and said A operator's relay, and a B operator's relay controlled by the B operator, adapted, in conjunction with said A operator's relay, to absolutely control one of said signals, and upon energization to destroy the control of the other signal by said A operator's relay.

33. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange telephonically associated with said trunk-line, an A operator's relay at the B exchange, permanently connected to one limb of said line, a red and a white signal-lamp at the B exchange, each having an illuminating-circuit normally controlled by said A operator's relay, means whereby the insertion of a cord connecting-plug within said spring-jack causes an actuation of said A operator's relay, and a B operator's relay controlled by the B operator, adapted, in conjunction with said A operator's relay, to absolutely control the illuminating-circuit for said red signal-lamp, and upon energization to destroy the control of the illuminating-circuit for said white signal-lamp by said A operator's relay.

34. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange telephonically associated with said trunk-line, an A operator's relay at the B exchange permanently connected to one limb of said line, a red and a white signal-lamp at the B exchange, each having an illuminating-circuit normally controlled by said A operator's relay, a source of current at the B exchange, means associated with said spring-jack whereby the insertion of a cord connecting-plug within said spring-jack causes the closure of an electrical circuit through said source of current and said A operator's relay, and a B operator's relay controlled by the B

operator, adapted, in conjunction with said A operator's relay, to absolutely control the illuminating-circuit for said red signal-lamp, and upon energization to destroy the control of the illuminating-circuit for said white signal-lamp by said A operator's relay.

35. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange of a spring-jack at the A exchange to contacts of which the terminals of said line are connected, a repeating-coil at the B exchange, to the outer terminals of one winding of which said metallic-line limbs are connected, a subscriber's line-circuit connected to the terminals of the second winding of said repeating-coil, subscriber's telephone apparatus connected with said line-circuit, a subscriber's relay at the B exchange controlled by the operative condition of said telephone apparatus, the continuity of the trunk-line circuit through the first winding of said repeating-coil being controlled by said subscriber's relay, an A operator's relay at the B exchange permanently connected to one limb of said line, a red and a white signal-lamp at the B exchange, each having a local illuminating-circuit normally controlled by said A operator's relay, means whereby the insertion of a cord connecting-plug within said spring-jack causes an actuation of said relay, and a B operator's relay controlled by the B operator, adapted, in conjunction with said A operator's relay, to absolutely control the illuminating-circuit for said red signal-lamp, and upon energization to destroy the control of the illuminating-circuit for said white signal-lamp by said A operator's relay.

36. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange, to contacts of which the terminals of said line are connected, a repeating-coil at the B exchange to the outer terminals of one winding of which said metallic-line limbs are connected, a subscriber's line-circuit connected to the terminals of the second winding of said repeating-coil, subscriber's telephone apparatus connected with said line-circuit, a subscriber's relay at the B exchange controlled by the operative condition of said telephone apparatus, the continuity of the trunk-line circuit through the first winding of said repeating-coil being controlled by said subscriber's relay, an A operator's relay at the B exchange permanently connected to one limb of said line, a signal at the B exchange normally controlled by said A operator's relay, means whereby the insertion of a cord connecting-plug within said spring-jack causes an actuation of said A operator's relay, and a B operator's relay controlled by the B operator, adapted, in conjunction with said A operator's relay, to absolutely control said signal.

37. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange of a spring-jack at the A exchange, to contacts of which the terminals of said trunk-line are connected, a repeating-coil at the B exchange to the outer terminals of one winding of which said metallic-line limbs are connected, a subscriber's line-circuit connected to the terminals of the second winding of said repeating-coil, subscriber's telephone apparatus connected with said line-circuit, a subscriber's relay at the B exchange controlled by the operative condition of said telephone apparatus, the continuity of the trunk-line circuit through the first winding of said repeating-coil being controlled by said subscriber's relay, an A operator's relay at the B exchange permanently connected to one limb of said line, a red and a white signal-lamp at the B exchange, each having a local illuminating-circuit normally controlled by said A operator's relay, means whereby the insertion of a cord connecting-plug within said spring-jack causes an actuation of said A operator's relay, a B operator's relay controlled by the B operator adapted, in conjunction with said A operator's relay, to absolutely control the illuminating-circuit for said red signal-lamp, and upon energization to destroy the control of the illuminating-circuit for said white signal-lamp by said A operator's relay, a locking-relay absolutely controlling said illuminating-circuit for said white signal-lamp, and switching mechanism associated with said subscriber's relay initially controlling said locking-relay, the subsequent control of said locking-relay being effected by said B operator's relay.

38. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange, to contacts of which the terminals of said line are connected, a repeating-coil at the B exchange, to the outer terminals of one winding of which said metallic-line limbs are connected, a subscriber's line-circuit connected to the terminals of the second winding of said repeating-coil, subscriber's telephone apparatus connected with said line-circuit, a subscriber's relay at the B exchange, controlled by the operative condition of said telephone apparatus, the continuity of the trunk-line circuit through the first winding of said repeating-coil being controlled by said subscriber's relay, an A operator's relay at the B exchange permanently connected to one limb of said line, a red and a white signal-lamp at the B exchange, each having a local illuminating-circuit normally controlled by said A operator's relay, a source of current, means associated with said spring-jack whereby the insertion of a cord-connecting plug within said spring-jack causes the

closure of an electric circuit through said source of current and said relay, a B operator's relay controlled by the B operator, adapted, in conjunction with said A operator's relay, to absolutely control the illuminating-circuit for said red signal-lamp, and upon energization to destroy the control of the illuminating-circuit for said white signal-lamp by said A operator's relay, a locking-relay absolutely controlling the illuminating-circuit for said white signal-lamp, and switching mechanism associated with said subscriber's relay initially controlling said locking-relay, the subsequent control of said locking-relay being effected by said B operator's relay.

39. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange telephonically associated with said trunk-line, a relay at the B exchange connected to but a single limb of said line, a signal at the B exchange normally controlled by said relay, and means whereby the insertion of a cord connecting-plug within said spring-jack causes an actuation of said relay independently of exchange A cord-circuit conductors.

40. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange of a spring-jack at the A exchange telephonically associated with said trunk-line, an impedance-coil at the A exchange, a relay at the B exchange permanently connected through a source of current between one limb of said line and the ground, a signal normally controlled by said relay, and means associated with said spring-jack whereby the insertion of a cord connecting-plug within said spring-jack causes the closure of a circuit through said relay and said impedance-coil between said line-limb and the ground independently of exchange A cord-circuit conductors.

41. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange telephonically associated with said trunk-line, a relay at the B exchange permanently connected to but a single limb of said line, two signals at the B exchange normally controlled by said relay, and means whereby the insertion of a cord connecting-plug within said spring-jack causes an actuation of said relay and signals controlled thereby independently of station A cord-circuit conductors.

42. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange telephonically associated with said trunk-line, a relay at the B exchange permanently connected to one limb of said line, a red and a white signal-lamp at the B exchange, each having an illu-

minating-circuit normally controlled by said relay, and means whereby the insertion of a cord connecting-plug within said spring-jack causes an actuation of said relay and lamps controlled thereby independently of exchange A cord-circuit conductors.

43. In a telephone-exchange system, the combination with a bimetallic trunk-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange telephonically associated with said trunk-line, a relay at the B exchange permanently connected to but a single limb of said line, a red and a white signal-lamp at the B exchange, each having an illuminating-circuit normally controlled by said relay, and means whereby the insertion of a cord connecting-plug within said spring-jack causes the actuation of said relay and lamps controlled thereby independently of exchange A cord-circuit conductors.

44. In a telephone-exchange system, the combination with a bimetallic telephone trunk-line leading from an A exchange to a B exchange, of connecting means at the A exchange for connection with said trunk-line, a subscriber's line-circuit leading to the B exchange and provided with means for connection with the trunk-line, two signals at the B exchange, means whereby the connection of said trunk-line with the subscriber's line-circuit leading to the B exchange causes the actuation of both of said signals, and means whereby the subsequent connection of the trunk-line with the connecting apparatus of the A exchange causes a restoration of one of said signals independently of exchange A cord-circuit conductors.

45. In a telephone-exchange system, the combination with a bimetallic telephone-line leading from an A exchange to a B exchange, of a spring-jack at the A exchange to contacts of which the terminals of said line are connected, an impedance-coil at the A exchange permanently connected from one jack-spring to ground, a relay at the B exchange permanently connected from a source of current between another spring of said spring-jack and ground, and a signal normally controlled by said relay, the insertion of the cord connecting-plug within said spring-jack causing engagement of said jack-springs to close circuit through said relay and said impedance-coil, whereby said signal is actuated.

46. In a telephone-exchange system, the combination with a bimetallic trunk-line for connecting substations from an exchange A with substations from an exchange B, of two signal-circuits at the exchange B, a relay at the exchange B controlled by the exchange A apparatus and controlling the current-supply to said signal-circuits, energization of said relay causing activity of both said signal-circuits, and a cut-off relay serving upon energization to break the current-supply to one

of said signal-circuits and to maintain the current-supply of the other signal-circuit through a substitute path.

47. In a telephone-exchange system, the combination with a bimetallic trunk-line for connecting substations from an exchange A with substations from an exchange B, of a source of current at the exchange B, two signals at said exchange connected with one pole of said source, a relay controlled from the exchange A and serving when energized to connect both signals with the other pole of said source, and a cut-off relay at the B exchange adapted to destroy the control of said other relay, whereby said signals are destroyed said cut-off relay serving also to reconnect one of said signals with said source of current through a substitute path.

48. In a telephone-exchange system, the combination with a bimetallic trunk-line for connecting substations from an exchange A with substations from an exchange B, of a source of current at the B exchange, an annunciator-relay at exchange B controlled from exchange A, a cut-off relay at the B exchange provided with two armatures, a signal included in a circuit from each armature to one pole of said source, and a common path controlled by said annunciator-relay for connecting both signals with the other pole of said source upon connection from exchange A with said trunk-line, connection from exchange B with a line leading therefrom causing energization of said cut-off relay to disconnect both signals from said common path and to reconnect one of said signals with said source of current through another path.

49. In a telephone-exchange system, the combination with a bimetallic trunk-line for connecting substations from an exchange A with substations from an exchange B, of a source of current at the exchange B, an annunciator-relay controlled from the exchange A, a cut-off relay provided with two armatures, an annunciator-signal connected in a circuit from one of said armatures to one pole of said source, a supervisory signal connected in a circuit from the other armature and to the same pole of said source, a common path controlled by said annunciator-relay for connecting both said armatures with the other pole of said source upon connection from exchange A with said trunk-line, connection of said trunk-line with an exchange B station-line causing energization of said cut-off relay to disconnect both its armatures from said common path, whereby both signals become inactive, and to reconnect said supervisory signal with the source of current through a substitute path to maintain its activity, and an additional relay adapted upon actuation of the apparatus at the connected substation for opening the circuit through said supervisory signal.

50. In a telephone-exchange system, the combination with a bimetallic trunk-line for connecting substations from an exchange A with substations from an exchange B, of a source of current at the exchange B, an annunciator-relay controlled from the exchange A, a cut-off relay provided with two armatures, an annunciator-signal connected in a circuit from one of said armatures to one pole of said source, a supervisory signal connected in a circuit from the other armature and to the same pole of said source, a common path controlled by said annunciator-relay for connecting both said armatures with the other pole of said source upon connection from exchange A with said trunk-line, connection of said trunk-line with an exchange B substation-line causing energization of said cut-off relay to disconnect both its armatures from said common path, whereby both signals become inactive, and to reconnect said supervisory signal with the source of current through a substitute path to maintain its activity, a repeating-coil dividing said trunk-line into two parts, the part associated for connection with the A exchange being normally discontinuous, and an additional relay serving also upon energization thereof to establish the continuity of said normally discontinuous part.

51. In a telephone-exchange system, the combination with a bimetallic normally telephonically discontinuous trunk-line for connecting substations from an exchange A with substations from an exchange B, of a source of current at the B exchange, an annunciator-relay controlled from the exchange A, a supervisory signal partly controlled by said annunciator-relay, and an additional relay for destroying the annunciator-relay control of said supervisory signal and for establishing the continuity of said trunk-line.

52. In a telephone-exchange system, the combination with a bimetallic trunk-line for connecting substations from exchange A with substations from exchange B, of a source of current at the B exchange, an annunciator-relay controlled from exchange A, an annunciator-signal and a supervisory signal at the B exchange, a cut-off relay for normally connecting both signals with one pole of said source, a common path controlled by said annunciator-relay for connecting both signals with the other pole of said source upon connection from exchange A with said trunk-line, connection of said trunk-circuit with a line from exchange B causing energization of said cut-off relay to disconnect both signals from said common path and to reconnect the supervisory signal with the source of current through a different path, an armature included in circuit with said supervisory signal, a third relay controlling said armature, and an additional relay adapted to be energized upon actuation of apparatus at

the substation connected with exchange B to control said third relay to break circuit through said supervisory signal.

53. In a telephone-exchange system, the combination with a normally telephonically discontinuous trunk-line for connecting substations from exchange A with substations from exchange B, of a source of current at the B exchange, an annunciator-relay controlled from exchange A, an annunciator-signal and a supervisory signal at the B exchange, a cut-off relay for normally connecting both signals with one pole of said source, a common path controlled by said annunciator-relay for connecting both signals with the other pole of said source upon connection from exchange A with said trunk-line, connection of said trunk-circuit with a line from exchange B causing energization of said cut-off relay to disconnect both signals from said common path and to reconnect the supervisory signal with the source of current through a different path, an armature included in circuit with said supervisory signal, a third relay controlling said armature, and an additional relay adapted to be energized upon actuation of apparatus at the substation connected with exchange B to control said third relay to break circuit through said supervisory signal, said additional relay serving also upon energization to establish the continuity of said trunk-line.

54. In a telephone-exchange system, the combination with a bimetallic trunk-line for connecting substations from the A exchange with substations from the B exchange, of a source of current at the B exchange, an annunciator-relay controlled from the A exchange, a signal at the B exchange connected with one pole of said source, said annunciator-relay serving to connect said signal through one path with the other pole of said source, a cut-off relay adapted upon connection of the trunk-line with a line from exchange B to disconnect said signal from said path and to connect said signal through a substitute path with said source of current, an armature and a contact of a supervisory relay normally included in said signal-circuit, and an additional circuit including the winding of said supervisory relay and another contact, actuation of the apparatus at the substation connected with the exchange B causing energization of said supervisory relay to engage its armature with said other contact whereby said signal is maintained inactive.

55. In a telephone-exchange system, the combination with a bimetallic trunk-line for connecting substations from the A exchange with substations from the B exchange, of a source of current at the B exchange, an annunciator-relay controlled from the A exchange, a signal at the B exchange connected with one pole of said source, said annunciator-relay serving to connect said signal

through one path with the other pole of said source, a cut-off relay adapted upon connection of the trunk-line with a line from exchange B to disconnect said signal from said path and to connect said signal through a substitute path with said source of current, an armature and a contact of a supervisory relay normally included in said signal-circuit, and an additional relay adapted to be energized upon actuation of apparatus at the substation connected with exchange B to close a local circuit containing said source of current and said supervisory-relay winding, whereby said supervisory-relay armature engages said other contact to close another circuit through said winding and to open the circuit through the supervisory signal.

56. In a telephone-exchange system, the combination with a normally telephonically discontinuous bimetallic trunk-line for connecting substations from the A exchange with substations from the B exchange, of a source of current at the B exchange, an annunciator-relay controlled from the A exchange, a signal at the B exchange connected with one pole of said source, said annunciator-relay serving to connect said signal through one

path with the other pole of said source, a cut-off relay adapted upon connection of the trunk-line with a line from exchange B to disconnect said signal from said path and to connect said signal through a substitute path with said source of current, an armature and a contact normally included in said signal-circuit, a supervisory relay controlling said armature, and an additional relay adapted to be energized upon actuation of apparatus at the substation connected with exchange B to close a local circuit containing said source of current and said supervisory-relay winding, whereby said supervisory-relay armature engages said other contact to close another circuit through said winding and to open the circuit through the supervisory signal, said additional relay serving also upon energization to close said normally discontinuous trunk-line.

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

HARRY G. WEBSTER.

Witnesses:

LYNN A. WILLIAMS,
CHARLES A. BROWN.