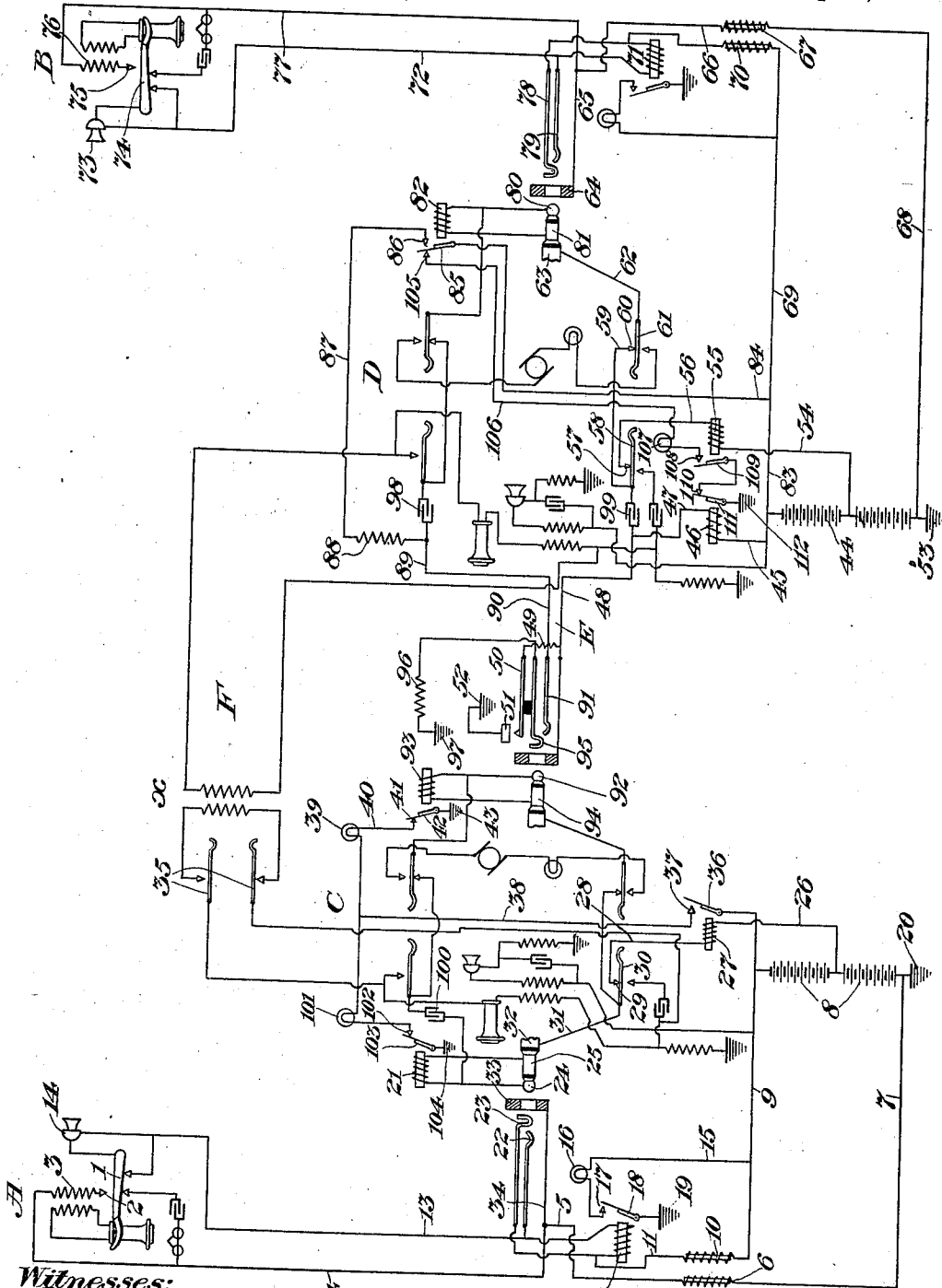


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TELEPHONE SYSTEM.
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UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

1,002,240.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, ALFRED H. DYSON, a citizen of the United States of America, and resident of Chicago, Cook county, Illinois, have invented a certain new and useful Improvement in Telephone Systems, of which the following is a specification.

My invention relates to telephone systems in which the circuits are of such character that any subscriber of one exchange may converse with any subscriber of another exchange. Telephone circuits of this character are usually known as trunking systems, the connection between the two exchanges consisting of a number of lines known as trunk lines. With this arrangement, a subscriber of one exchange can send in a call, asking for connection with a subscriber of another exchange, and the originating operator, or operator receiving the call, can then signal the trunking operator of the second exchange, so as to ascertain what trunking line can be employed between the two exchanges. If the called subscriber is not busy, the trunking operator at the second exchange then instructs the originating operator to connect up with a certain trunk line, and at the same time connects this line with the line of the called subscriber. In a system of this character, it is desirable that the originating operator have complete supervision of the connections—that is to say, that suitable signals be provided whereby this operator may not only know when the calling subscriber has signaled for disconnection, but may also know when the called subscriber has finished talking and signaled for like disconnection. It is also desirable that suitable circuits and signal devices be provided for enabling the originating operator to signal the trunking operator to take down the connection. In view of certain approved methods of operation, it is also desirable in a system of this kind that current, both for talking and signaling purposes, be supplied from batteries located at the exchanges or central stations. In addition, line signals are provided which enable subscribers to signal the central operators, and the arrangements are preferably such that these line signals are restored or extinguished by the operators in answering calls. Systems thus operated are usually

known as common battery or central energy systems by reason of the current for all purposes being supplied from a common or central source.

Generally stated, it is one of the principal objects of my invention to provide a simple and efficient circuit arrangement whereby trunking may be successfully carried on between two common battery or central energy exchanges.

A special object of my invention is to provide suitable devices and circuit arrangements whereby such trunking may be carried on between two exchanges characterized by certain methods of operation, and by signaling circuits of a certain character, as will hereinafter more fully appear.

Another object is to provide a simplified and improved arrangement of circuits and signals whereby the originating operator in a system of this character may have complete control and supervision of the connections.

In addition to these, it is also an object to provide certain details and features of improvement tending to increase the general efficiency and to render a system of this character in every way serviceable and satisfactory.

To the foregoing and other useful ends, my invention consists in matters hereinafter set forth and claimed.

The accompanying drawing is a diagram illustrating a trunking telephone system embodying the principles of my invention. In this diagram it will be observed that both the exchanges are of the common battery or central energy type, and that complete metallic line connections are employed, both for the trunk lines between the two exchanges, and also between the substations and their respective exchanges. It will be understood that only such devices and connections are shown as are necessary to a full understanding of the invention.

As thus illustrated, A represents substation apparatus of a common battery or central energy system, and B represents like substation apparatus. The substation A is, it will be seen, connected with the switchboard at the exchange or central station C. In a similar manner, the substation B is connected with a similar exchange D. The

two exchanges are illustrated as being connected by a trunk line E, which is employed for establishing connection between subscribers of the two exchanges, and also by means of what is known as an order circuit or line F, which latter is practically a private line between the two operators at the different exchanges. An induction connection X preferably connects the two parts of the order line. Now assuming that the subscriber at substation A desires connection with the subscriber at substation B, the operations and circuit connections which then take place are as follows: When the subscriber at substation A sends in a call by removing the receiver from the hook-switch, a line circuit is completed from the said switch 1 through the contact-point 2 and the primary 3 of the usual induction coil, thence over the limb or line conductor 4, through conductor 5, through the impedance or retardation coil 6, through the conductor 7 to the battery 8, thence through the conductor 9 and the retardation or impedance coil 10, through the conductor 11, through the coil 12 of the line relay, thence through the other limb or line conductor 13, and through the transmitter 14 to said hook-switch. This, it will be seen, energizes the line relay causing it to attract its armature. The said armature when attracted completes a local circuit from the battery 8, through the conductors 9 and 15, through the line lamp 16, thence through contact 17 and armature 18, thence through the ground or common connections 19 and 20 to said battery. The flow of current through this local circuit causes the lamp 16 to glow. The central operator at the exchange indicated by C observing this signal, then inserts the answering plug in the spring jack connected with the calling subscriber's line. One effect of thus placing the plug in the jack is to short-circuit the coil of the line relay 12, thereby restoring or extinguishing the lamp 16. This short-circuiting is secured by connecting the coil 21 of the supervisory relay allotted to the answering plug with both tip and ring contacts of the said plug. Consequently when the plug is inserted the line circuit includes the jack springs 22 and 23, the plug tip 24, the plug ring 25, and the said coil 21, rather than the coil 12 of the line relay. Thus the line relay is shunted out, the supervisory relay being of comparatively low resistance. The insertion of the plug in the jack in this manner also establishes connection between the substation and the operator's talking set, and the subscriber then instructs the operator as to the character of the connection desired. Furthermore, the insertion of the plug in the jack of the calling subscriber establishes a short-local circuit from the battery 8 through conductor 26 and the coil

27 of the third or supplementary supervisory relay, thence through conductor 28 and the contact-point 29, through the listening key 30, through the sleeve-strand 31 of the cord-circuit, through the plug-sleeve 32 of the answering plug, through the testing ring or sleeve contact 33 of the jack, thence through the conductors 34 and 5, and through the impedance coil 6 and conductor 7 to said battery. This energizes the said supervisory relay 27, causing the latter to attract its armature, so as to close the normally open switch-point in the circuits of the two supervisory lamps to be hereinafter described. Upon receiving the order from the calling subscriber, the originating operator then presses the key 35, so as to establish connection between the talking sets of the two exchanges. The originating operator states to the trunking operator of exchange D that connection is desired with substation B. The trunking operator then assigns one of the many trunking lines usual between exchanges in a trunking circuit, which, in this case, it may be assumed is the trunk line E. After thus assigning a line for use between the two exchanges, the trunking operator then tests the line of substation B in any well known or approved way, and if the line is not busy the plug of the trunking cord-circuit at exchange D is then inserted in the said jack connected with the line of substation B. The trunking operator then projects ringing current onto the line, so as to ring the bell at substation B. The trunk line E having been assigned by the trunking operator for use between the two exchanges, the originating operator then inserts the calling plug of the cord-circuit at exchange C in the trunk jack, or jack connected with the trunk line. The insertion of the calling plug in the trunk jack, in this manner, completes a circuit from the battery 8, through the armature 36 and contact-point 37, thence through the conductor 38, supervisory lamp 39, through the conductor 40 and contact-point 41, and thence through the supervisory relay armature 42 and the ground or common connections 43 and 20 to said battery. The flow of current through this local circuit causes the supervisory lamp 39 to glow, indicating that the called subscriber has not answered the call. It will also be seen that the insertion of the calling plug in the trunk jack completes a circuit from the battery 44, at exchange D, through the conductor 45 and the coil 46 of the supervisory relay, thence through conductor 47 and line conductor 48, through the resistance 49 and the jack spring 50, through the contact-point 51, and thence through the ground or common connections 52 and 53 to said battery. This energizes the relay 46, causing it to attract its armature. In addition to

this, the insertion of the trunk plug in the jack connected with the line at substation B completes a circuit from the battery 44, through the conductor 54, and coil of the supervisory relay 55, through the conductor 56, through contact-point 57 and spring 58, thence through conductor 59 and contact-point 60, through the spring 61 of the ringing-key, thence through the cord-strand 62 and the plug sleeve 63, through the jack sleeve or testing ring 64, thence through conductors 65 and 66, and through impedance coil 67 and conductor 68 to said battery. The current flowing through this circuit energizes the relay 55, causing it to attract its armature.

Now when the subscriber at substation B answers the call by removing the receiver from the hook-switch, a line circuit is completed from the battery 44, through conductor 69 and impedance coil 70, thence through the coil of line relay 71, through the limb or line conductor 72 and the transmitter 73, thence through the hook-switch 74 and the contact-point 75, through the primary 76 of the induction coil, through the other limb or line conductor 77, and thence through the conductor 66 and impedance coil 67, and through the conductor 68 to the said battery. It will also be seen that with the plug of the trunking cord-circuit in the jack, current is shunted around the relay 71, the shunt connection including the springs 78 and 79 of the jack, and the tip and ring contacts 80 and 81 of the plug, and also the coil of the supervisory relay 82. This supervisory relay, as in the case of the supervisory relays 21, is of relatively low resistance, so as to shunt current around the relay 71, as explained. The energizing of this relay 82 causes it to attract its armature. The said armature moving toward the magnet completes a trunking line circuit from the battery 44, through the conductors 83 and 84, thence through the armature 85, and contact-point 86, through the conductor 87 and the resistance 88, thence through the cord-strand 89, through the trunking line conductor 90 and the tip spring 91 of the trunking jack, through the tip 92 of the calling plug at exchange C, thence through the coil of supervisory relay 93, through the ring contact 94 of said plug, thence through the jack spring 95, through resistance 96, and through the ground connections 97 and 53 to said battery. The flow of current through this grounded trunking line circuit energizes the relay 93, causing it to attract its armature 42. This, it will be seen, breaks the circuit of the lamp 39, causing the latter to stop glowing. Thus, as previously stated, the subscriber at substation B in answering a call extinguishes the supervisory lamp 39. Consequently, the originating operator, as also stated, is in a position

to be advised as to when the subscribers answer calls, and has practically complete control of all connections. Both receivers being off the hooks at the substations, the two subscribers are now connected up for talking purposes. It will be understood that the talking circuit between the two substations includes the substation lines and the trunking line, and also includes the tip and sleeve contacts of the jacks and plugs, and also the talking strands of the cord-circuits. It will be observed that the condensers 98 and 99 are preferably located in the talking strands of the trunking cord-circuits, and that a condenser 100 is preferably located in the upper talking strand of the originating operator's cord-circuit. In this way, current is supplied from central stations out over the lines to the transmitters at the substations, so as to enable the subscribers to carry on conversation, and, furthermore, current is supplied from these batteries in various directions for operating the various signals. The various retardation or impedance coils and the resistance coils and the coils of the relays can be regulated or adjusted, it will be understood, in any suitable manner with respect to resistance, by those skilled in the art, and in accordance with varying conditions. When the subscriber at substation A hangs up the receiver, the line circuit of this substation is broken, and consequently the supervisory relay 21 is deenergized. The armature of this relay, when released, completes a local circuit from the battery 8, through armature 36 and contact point 37, thence through the conductor 38, through supervisory lamp 101, thence through the contact-point 102 and the armature 103, and thence through the ground or common connections 104 and 20. The flow of current through this local circuit causes the supervisory lamp 101 to glow. The signal thus displayed advises the originating operator that the calling subscriber has signaled for disconnection. In a similar manner, when the subscriber at substation B hangs up the receiver, the line circuit of this substation is broken, and consequently the supervisory relay 82 is deenergized. The armature of this supervisory relay, when released, opens up or breaks the aforescribed grounded trunking line circuit, and this in turn deenergizes the relay 93. The armature 42 of this relay when released closes the aforescribed circuit through the lamp 39, thereby giving the originating operator the signal to withdraw the calling plug from the trunking line jack. When the originating operator withdraws both plugs of the cord-circuit from the two jacks, the withdrawal of the calling plug breaks the previously described grounded circuit through the supervisory relay 46, which is associated with the trunking cord-circuit at exchange D. The armature of this

relay when released completes a local circuit from the battery 44, through conductors 83 and 84, thence through the armature 85 and the contact point 105, through the conductor 5 106, through the lamp 107, thence through the contact point 108 and the armature 109, through the contact point 110 and armature 111, and thence through the connections 112 and 53 to said battery. The flow 10 of current through this circuit causes the lamp 107 to glow, and the signal thus displayed advises the trunking operator that the originating operator has signaled for disconnection and that the plug of the trunking 15 cord-circuit may be withdrawn from the jack of the line leading to the substation B. Thus the trunking operator acts entirely on the instructions given by the originating operator. The circuit arrangement thus provided 20 affords a simple and economical method of carrying on trunking between two common battery or central energy exchanges.

When the subscribers are connected up, it will be seen that the current from the batteries 25 is supplied directly to the lines, rather than through the cord-circuit strands, and that when the plugs of the cord-circuits are in the jacks the only battery current flowing through the cord-circuits is the small 30 amount of line current necessary to energize the supervisory relays 21, 93 and 82. Practically, therefore, there is no direct battery connection between the cord-strands and the batteries, the current, regardless of the 35 polarity of the batteries, flowing through the line before it passes through the coils of the supervisory relays. In other words, the coils of these supervisory relays are adapted to be placed in the line, so as to serve as line 40 shunts for shunting out the line relays. In this way I provide suitable trunking connections and adapt them for use in connection with cord-circuits and signaling circuits which operate in a way to make it unnecessary 45 to supply excessive battery current to the lines through the talking strands of the cord-circuit. This, it will be seen, increases the life of the cord-strands, inasmuch as there is very little liability of their burning 50 out.

What I claim as my invention is—

1. In a trunking telephone system, the combination of an originating operator's cord-circuit at one exchange, a calling subscriber's line connected with said exchange, 55 a line relay in said calling subscriber's line, a supervisory relay in the originating operator's cord-circuit adapted to be placed in the line to short-circuit said relay, a supervisory signal controlled by said supervisory relay, a trunking operator's cord-circuit located at another exchange, a trunk line extending between the two exchanges, said 60 trunk line terminating in a spring jack at the originating operator's exchange and hav-

ing permanent connection with the trunking operator's cord-circuit at the other exchange, a supervisory relay associated with the originating operator's cord-circuit and adapted to be included in a grounded circuit including one limb of the said trunk 70 line, a called subscriber's line connected with the trunking operator's exchange, a line relay associated with the called subscriber's line, a supervisory relay associated 75 with the trunking operator's cord-circuit and adapted to be placed in the called subscriber's line to short-circuit the line relay, a supervisory lamp controlled by the said supervisory relay which is adapted to be 80 placed in the grounded trunk line circuit, and a normally open switch-point located in the said grounded trunk line circuit and controlled by the said supervisory relay associated with the trunking operator's cord- 85 circuit.

2. In a trunking telephone system, the combination of an operator's cord-circuit at one exchange, a calling subscriber's line connected with said exchange, a trunking operator's cord-circuit located at another exchange, a trunk line extending between the two exchanges, an electro-magnet associated with the originating operator's cord-circuit, 90 a grounded circuit including said electro-magnet and one limb of the said trunk line, a clearing-out or supervisory signal controlled or operated by said electro-magnet, a called subscriber's line connected with the 95 trunking operator's exchange, a line relay associated with the called subscriber's line, a supervisory relay associated with the trunking operator's cord-circuit and adapted to be placed in the called subscriber's line 100 to short-circuit said line relay, and a normally open switch-point in said grounded line circuit controlled by said supervisory relay. 105

3. The combination of a calling subscriber's line terminating in a spring jack, 110 a trunk line terminating in a spring jack at the same exchange, an originating operator's cord-circuit provided with answering and calling plugs adapted for insertion in said jacks, a line signal associated with the calling 115 subscriber's line, a shunt in the cord-circuit adapted to be placed in the calling subscriber's line to short-circuit said line signal, an electro-magnet connected with the said calling plug and adapted to be placed 120 in a grounded circuit including one limb of said trunk line, a supervisory lamp controlled by said electro-magnet, a supplemental supervisory relay for controlling a normally open switch-point in the circuit of 125 said supervisory lamp, a trunking operator's cord-circuit connected with the trunk line at another exchange, a called subscriber's line terminating in a jack at the trunking operator's exchange, a line signal asso- 130

ciated with the called subscriber's line, a supervisory relay associated with the trunking operator's cord-circuit and adapted to be placed in the called subscriber's line to
 5 restore the line signal, a normally open switch-point in the said grounded trunk line circuit controlled by said supervisory relay in the trunking operator's cord-circuit, a supervisory lamp associated with the
 10 trunking operator's cord circuit, a local circuit for said supervisory lamp having two normally closed switch-points, one switch-point being controlled by the said supervisory relay in the trunking operator's cord-
 15 circuit, another supervisory relay for controlling said other normally closed switch-point, a normally open switch-point in the circuit of the trunking operator's supervisory lamp, and another relay for control-
 20 ling said normally open switch-point.

4. In a trunking telephone system, the combination of a calling subscriber's line, an originating operator's cord-circuit, two supervisory lamps associated with said origi-
 25 nating operator's cord-circuit, two normally closed switch-points in the circuits of said supervisory lamps, supervisory relays for controlling said normally closed switch-
 30 points, a normally open switch-point in the circuits of said supervisory lamps, another relay for controlling the said normally open switch-point, a trunking operator's cord-circuit at another exchange, a trunk line be-
 35 tween the two exchanges, a supervisory lamp associated with said trunking operator's cord-circuit, two normally closed switch-points in the local circuit of the trunking operator's supervisory lamp, two
 40 relays for controlling said normally closed switch-points, a normally open switch-point in the circuit of the trunking operator's supervisory lamp, another relay for controlling said normally open switch-point, a
 45 called subscriber's line connected with the trunking operator's exchange, and a line signal associated with each subscriber's line, one of the supervisory relays in each cord-circuit being connected and arranged to be
 50 placed in the line to restore the line signal associated therewith.

5. In a trunking circuit the combination of an originating operator's supervisory relay, a supervisory lamp controlled by said supervisory relay, a trunk line, a trunking operator's
 55 supervisory relay, a normally open switch-point controlled by said trunking operator's supervisory relay, a grounded trunking line circuit including said normally open switch-point and said originating operator's super-
 60 visory relay, a trunking operator's supervisory lamp, and a normally closed switch-point in the circuit of said lamp controlled by said trunking operator's supervisory relay.

6. In a trunking telephone system, the

combination of a trunk line terminating at one end in a trunking jack, an originating operator's cord-circuit provided with a plug adapted for insertion in said jack, a trunk-
 70 ing operator's cord-circuit connected with the other end of said line, a grounded trunk line circuit including normally open contacts adapted to be closed by the insertion of said plug in said jack, a trunking oper-
 75 ator's supervisory relay included in said grounded trunk line circuit, a battery associated with the trunking operator's cord-circuit and forming a part of said grounded line circuit, and a supervisory lamp located
 80 in a local circuit having a normally closed switch-point controlled by said supervisory relay, the said lamp being caused to glow when the originating operator breaks the
 85 said grounded line circuit by withdrawing the plug from the trunking jack.

7. In a telephone system, and in conjunction with calling and called subscribers' telephone sets connected with different ex-
 90 changes, and adapted to be connected through the medium of a trunking line extending between the two exchanges, or between the two divisions of the same ex-
 95 change, the combination of an operator's cord-circuit, spring jacks adapted to receive the plugs of said cord-circuit, lines connected with said jacks, two supervisory
 100 lamps associated with said cord-circuits, normally closed switch-points in the circuits of said lamps controlled by two supervisory relays, a normally open switch-point in the
 105 circuits of said supervisory lamps, a third or supplemental relay for controlling said normally open switch-point, a normally open local circuit including said third relay, and
 also including normally open contacts in one of said jacks, said contacts being closed
 when the plug is inserted, and a battery included in the local circuit with the relay and normally open contacts.

8. In a trunking telephone system, the
 110 combination of a calling subscriber's line, an originating operator's cord-circuit, a battery associated with said cord-circuit and permanently connected with said line, a
 115 trunking operator's cord-circuit, a called subscriber's line, a battery associated with the trunking operator's cord-circuit and permanently connected with said called sub-
 120 scriber's line, a trunk line permanently connected with the said trunking operator's cord-circuit and terminating at the other end in a trunking jack adapted to receive
 one of the plugs of the said originating operator's cord-circuit, subscribers' micro-
 125 phone transmitters receiving current from said batteries, and suitable line and super-
 visory signal apparatus also operated by current from said batteries.

9. In a trunking telephone system, the combination of a called subscriber's line, a

line relay associated with the line, a trunking operator's cord-circuit, a supervisory relay associated with said cord-circuit and adapted to be placed in the line to short-circuit said line relay, an originating operator's supervisory relay and cord-circuit, a trunk line between the two cord-circuits, a battery connected and arranged to energize the supervisory relay in the trunking operator's cord-circuit when the called subscriber's line is closed, and a battery and suitable connections whereby the originating operator's supervisory relay is deenergized when the called subscriber's line is opened and the trunking operator's supervisory relay thereby deenergized.

10. In a trunking telephone system, the combination of subscriber's lines, line relays, originating and trunking operator's cord-circuits provided with shunts adapted to be placed in the line to short-circuit said line relays, a trunk line between the two cord-circuits, supervisory relays located in said shunts, a supervisory signal associated with the originating operator's cord-circuit, and means including electro-magnetic means whereby said signal is displayed or brought into action when the supervisory relay associated with the trunking operator's cord-circuit is deenergized.

11. In a trunking telephone system, the combination of a trunk line terminating at one end in a jack and connected at the other end with a trunking operator's cord-circuit, an originating operator's cord-circuit provided with a plug adapted for insertion in said jack, a supervisory signal associated with the trunking operator's cord-circuit, means for supplying current, a called subscriber's line, a line relay associated with said called subscriber's line, a supervisory relay associated with the trunking operator's cord-circuit and adapted to be placed in the line to short-circuit said line relay, and a relay and suitable connections whereby said supervisory lamp is caused to glow when the originating operator withdraws the plug from said jack.

12. In a trunking telephone system, the combination of suitable switchboard apparatus located at two different exchanges, substations metallically connected with said exchanges, a trunk line extending between the two exchanges, an operator's order line extending between the two exchanges, an inductive connection in said order line, an originating operator's talking set normally disconnected from the order line, a trunking operator's talking set having the receiver thereof permanently connected with said order line, and a normally open key-switch in said order line, controlled by the originating operator, a central source of current for furnishing talking current to one operator's set and the subscriber's line of one ex-

change, and another source for furnishing talking current to the other set and the lines of the other exchange.

13. In a trunking telephone system, the combination of an originating operator's cord-circuit located at one exchange, a substation connected with said exchange, a trunking operator's cord-circuit located at another exchange, a substation connected with said second exchange, a metallic trunk line terminating in a jack at the originating operator's exchange and connected permanently with the trunking operator's cord-circuit at the other exchange, head telephones or talking sets for the said operators at the different exchanges, a two-wire order line extending between the two exchanges, said order line being normally disconnected from the originating operator's talking set and permanently connected with the trunking operator's head telephone, and a normally open key-switch in said order line, a central source of current for furnishing talking current to one operator's set and the subscriber's line of one exchange, and another source for furnishing talking current to the other set and the lines of the other exchange.

14. In a trunking telephone system, the combination of one exchange provided with an originating operator's cord-circuit, a substation connected with said exchange, a line relay associated with the line of said substation, a line signal controlled by said line relay, a shunt in said originating operator's cord-circuit adapted to be placed in the line to short-circuit said line relay, a trunking operator's cord-circuit at another exchange, a trunk line between the two exchanges, a substation suitably connected with said second exchange, another line relay associated with the line of said second substation, a shunt in the trunking operator's cord-circuit adapted to be placed in the line to short-circuit said second line relay, a line signal controlled by the latter, and energizing circuits for said line relays, each energizing circuit including both sides of the line, said shunts normally disconnected at each end thereof.

15. In a telephone system, a trunk line, means for grounding one side thereof, when connection is made therewith, two supervisory relays, a circuit for energizing one relay over one side only of said trunk line to ground, a circuit for energizing the other relay over a portion of the same side of the trunk circuit to ground, said relays located at different stations, and signaling means controlled by said relays.

16. In a telephone system, a trunk circuit, means for supplying current, two relays each totally disconnected from the means of current supply, an energizing circuit for one relay controlled by the other and including one side of the trunk circuit, and signaling means controlled by said relays.

17. In a telephone system, two relays, one controlling the other, a line signal device shunted by the coil of the one relay, and a supervisory signal controlled by the other

connected from the trunk line and the central source of current. 10

5 relay.

Signed by me at Chicago, Cook county, Illinois, this 4th day of April 1902.

ALFRED H. DYSON.

18. In a telephone system, a trunk line, means for controlling a relay over said trunk line, said relay having both terminals of the winding thereof normally totally dis-

Witnesses:

ARTHUR F. DURAND,
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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."