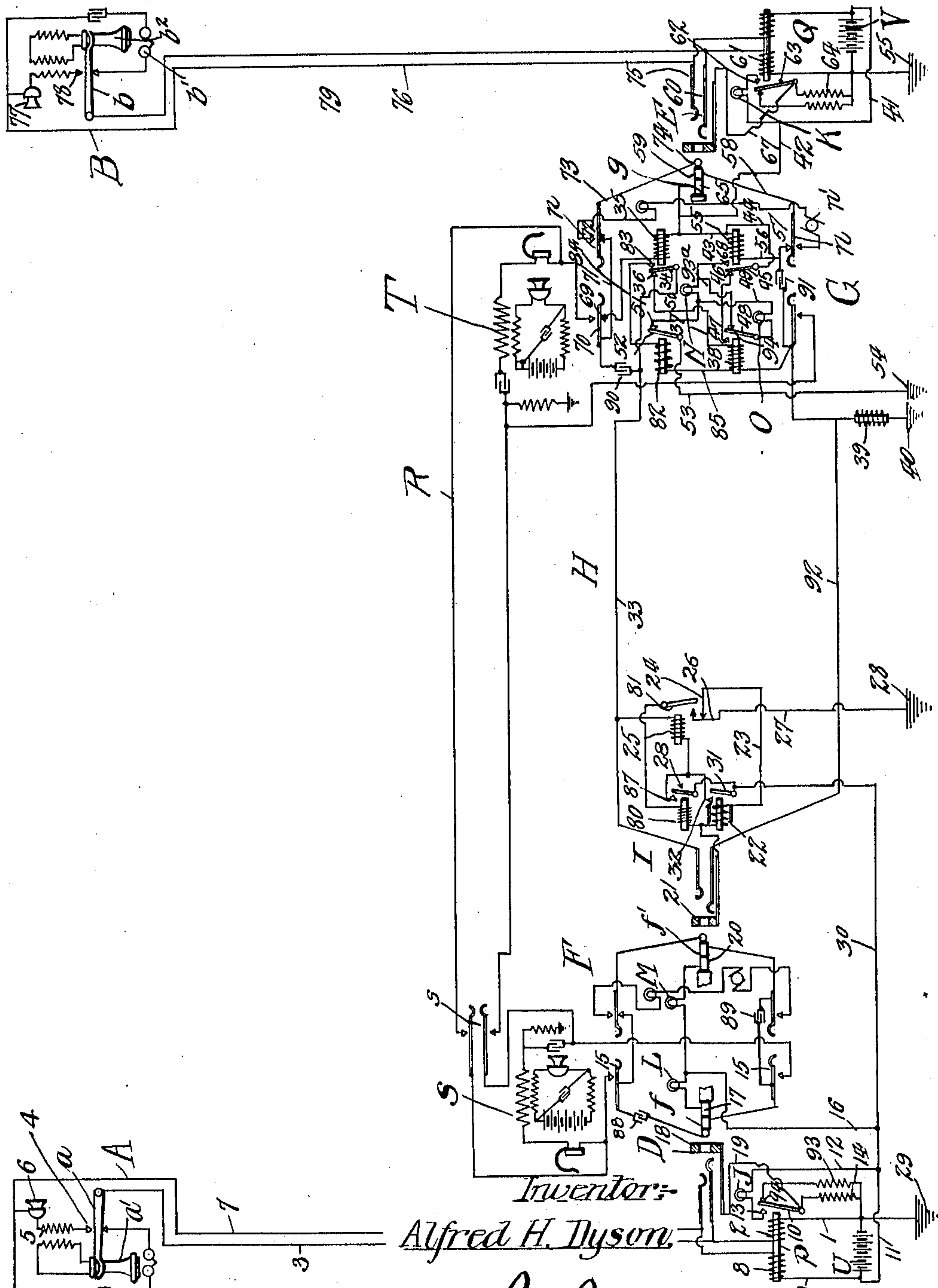


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 TELEPHONE APPARATUS.  
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Patented Aug. 13, 1912.



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# UNITED STATES PATENT OFFICE.

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## TELEPHONE APPARATUS.

1,035,173.

Specification of Letters Patent.

Patented Aug. 13, 1912.

Application filed July 24, 1903. Serial No. 166,798.

*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 Apparatus, of which the following is a specification.

My invention relates to telephone systems of that character in which means are provided for connecting the subscribers of one exchange with the subscribers of another exchange, or, in substantially the same manner, for connecting the subscribers of one division of an exchange with the subscribers of another division of the same exchange.

Telephone systems of this character are ordinarily known as trunking systems, it being necessary to employ what are called trunking lines in establishing connection between the exchanges, or in establishing connection between two divisions of the switchboard at the same exchange.

My invention also relates more particularly to telephone systems in which the current for both talking and signaling purposes is supplied from common batteries or centralized sources located at the exchanges.

In addition, it relates preferably to systems in which complete metallic line connection is employed between the sub-stations and the exchanges.

Generally stated, the object of my invention is the provision of an improved and highly efficient trunking telephone system of the foregoing character.

A special object of my invention is to combine subscribers' line circuits of a particular type with subscribers' line circuits of the same type, and to organize these subscribers' line circuits of the same type into an operative trunking telephone system.

Another object is to provide an improved and efficient arrangement of relays whereby subscribers' line circuits of the said particular type may be satisfactorily connected for conversation without interfering with approved methods of practice in respect to signaling and talking, and particularly in respect to the supervision which the originating operator—that is to say, the operator at whose board the call originates—has over

the disconnecting or disestablishing of the connection between the subscribers' lines.

It is also an object to provide certain details and features of improvement tending to increase the general efficiency and serviceability of a trunking telephone system of this particular character. To the foregoing and other useful ends my invention consists of matters hereinafter set forth and claimed.

In the accompanying drawings, the diagram illustrates a trunking telephone system embodying the principles of my invention, and while for convenience of illustration and description only two sub-stations are shown, and only one originating operator's cord circuit and one trunking operator's cord circuit, it will be readily understood that the system may include as many sub-stations as the size and growth of the exchange or exchanges may demand, and as many cord circuits as are necessary or desirable to enable the operators to establish the connections with facility and promptness.

As thus illustrated, my improved system comprises a sub-station A and another sub-station B, the former having complete metallic line connection with a spring jack D located on the switchboard at the exchange in which this line terminates, while a similar line connection extends from sub-station B and terminates in a spring jack E at another exchange. Or, on the other hand, these two spring jacks may simply be located on different divisions of a switchboard at the same exchange. In either case it will be understood that it is desirable to employ means for trunking between the two exchanges, or between the two divisions of the switchboard. As illustrated, subscriber A is the calling subscriber and the line from the subscriber's station terminates at a switchboard which is equipped with what is known as an originating operator's cord circuit F. As many more spring jacks can be connected with the line leading to sub-station A as are necessary. It will also be understood that as many more spring jacks can be connected with the line leading from sub-station B as are necessary and desirable. The jack E is located on a switchboard equipped with what is known as a trunking operator's cord



circuit G. The originating operator's cord circuit is provided with answering and calling plugs  $f$  and  $f^1$ , while the trunking operator's cord circuit is provided only with a single plug  $g$ , ordinarily termed a trunk plug. All of these plugs are adapted for insertion in the said jacks in the manner hereinafter explained.

A trunk line H extends between the two exchanges, or between the two divisions of the switchboard at one exchange, as the case may be. At one end this trunk line terminates in a trunk jack I, while at its other end this line is preferably permanently connected with the trunking operator's cord circuit G. The plug  $f^1$  is adapted to be inserted by the originating operator in the said trunk jack. Sub-station A is provided with a line signal J, preferably associated with the answering plug D, while sub-station B is provided with a similar line or calling signal K, the latter being associated with a jack E, which may be a multiple jack. Supervisory signals L and M are associated with the originating operator's cord circuit, while similar signals N and O are associated with the trunking operator's cord circuit. Said signals can be of any suitable form or character, but are preferably in the form of small incandescent lamps, known as lamp signals. The lamp J is adapted, owing to the provision of the line relay P, to glow when subscriber A removes his receiver from the switch hook  $a$ . In a similar manner the lamp K is adapted to glow when subscriber B removes his receiver from the switch hook  $b$ . It will be understood, of course, that these lamps only glow when the subscribers are calling-in—that is to say, when the subscribers are endeavoring to attract the attention of the operators, no connections having previously been made with their lines. The line relay Q, located in the line circuit of sub-station B, is similar to the line relay P. The lamp L is also controlled by the relay P and is adapted to glow when subscriber A has finished talking and hangs up his receiver. The lamps M and N are adapted to be controlled by relays in the trunk line and trunking operator's cord circuits, and are adapted to glow when subscriber B is through talking and hangs up his receiver. In other words, the lamps L, M, N give the operators complete supervision over the connections and permit the subscribers to signal for disconnection. The lamp O is what is sometimes called an O. K. or check lamp, or, in other words, a designating lamp, and is adapted to glow when the originating operator establishes connection with the trunk line. By this provision the trunking operator will, if the lamp glows, know that the originating operator has correctly understood the instructions given over the private order line R which

extends between the head telephones or talking circuits S and T of the two operators, and that the originating operator has established connection with the trunk line designated by the trunking operator. This lamp O is also adapted to be of service as a disconnecting signal, as it again glows when the originating operator withdraws the plug  $f^1$  from the jack I. As will hereinafter more fully appear, the trunking operator, observing this signal, understands that the proper time has arrived for withdrawing the plug  $g$  from the jack E. All current, both for talking and signaling purposes, is supplied to the line and local circuits from common batteries or centralized sources U and V. The functions of the various relays, lamps and other devices shown in the diagram, and the mode of operation of my improved system, will, however, be more clearly understood by considering the manner in which the operators establish connection between the two lines.

Suppose, for example, that subscriber A desires to converse with subscriber B. In such case subscriber A removes his receiver  $a^1$  from the switch hook  $a$  and thereby closes a line circuit including the battery U. This circuit extends from the said battery through the conductor 1, through the coil 2 of the line relay P, through the limb or line conductor 3, thence through the said switch hook  $a$ , through the contact 4 and the winding 5 of the inductive connection between the receiver and the line circuit, through the transmitter 6, through the other limb or line conductor 7, thence through the other coil 8 of the winding of the relay P, and through the conductor 9 to said battery. The current flowing in this circuit is sufficient to energize the relay P, the windings of the latter being of such character as to, although they are both in the line circuit, permit of such energizing when the circuit is closed. This relay when energized attracts its armature 10, thereby closing a local circuit from the battery U through the conductors 11 and 12, through the line lamp signal J, through the contact 13, through the said armature 10, and thence through the resistance coil 14 to said battery. The resistance of the coil 14 is such that only sufficient current passes to cause the lamp J to glow. Observing this signal, the originating operator then inserts the plug  $f$  in the spring jack D. In order to converse with the calling subscriber, the originating operator then presses the listening key 15, so as to bridge her talking set S across the cord circuit. She can then receive the order for connection from the calling subscriber. The insertion of the plug  $f$  in the jack D completes a local circuit in the battery U through the conductors 11 and 16, through the supervisory signal L, through the sleeve 17 of said plug,



through the testing ring 18 of jack D, through the conductor 19, and thence through the resistance coil 14 to said battery. Thus in answering the call the originating operator places the lamp L in parallel with the lamp J; and as the resistance of the coil 14 is, as stated, of such character as to permit the flow of only sufficient current to light the lamp J, it follows that when the two lamps are placed in parallel neither one can glow. In other words, the originating operator in answering the call automatically shunts out and restores the line lamp signal to its normal condition.

In order that she may converse with the trunking operator at the other exchange, or at the other division of the switchboard at the same exchange, the originating operator then presses the key *s*, so as to connect her talking set S with the trunking operator's talking set T. After learning the number of the connection desired, it then devolves upon the trunking operator to select and designate a trunk line for use between the two exchanges, or between the two divisions of the switchboard. It will be understood, of course, that a number of trunk lines can be employed, and after the trunking operator has ascertained which are idle and which are busy, she then selects an idle one for use between the two cord circuits, and instructs the originating operator accordingly. The originating operator then inserts the plug *f*<sup>1</sup> in the jack I, which latter is connected with the trunk line H, assuming that this is the trunk line which has been designated for use by the trunking operator. The insertion of the plug *f*<sup>1</sup> in the jack I causes the lamp M to glow as a result of a circuit completed from battery U, through the conductors 11 and 16, through the lamp M, through the plug sleeve 20, through the ring or thimble 21 of the trunk jack, through the coil of relay 22, through the conductor 23, through the back contact 24 of the relay 25, through the armature 26 of this relay 25, through the conductor 27, and thence through the ground or common connections 28 and 29 to said battery. The resistance of the relay 22 is of such character as to permit just sufficient current to pass to light the lamp M. This relay may be made slow-acting by the use of the well-known copper coil, if desired. The current flowing through this circuit is also sufficient to energize the relay 22 and in attracting its armature it closes a circuit from the battery U through the conductors 11 and 30, through the armature 31 and the contact 32, through the coil of relay 25, through the limb or line conductor 33 of the trunk line, through the armature 34 of the supervisory relay 35, through the back contact 36 of said armature, through the conductor 37, through the coil of the supervisory relay 38,

through impedance coil 39, and through the ground or common connections 40 and 29 to said battery. Relay 38 can be of say 5,000 ohms resistance, and the resistance of the relay 25 can be adjusted accordingly and in such manner that the said relay 25 will not be energized by the closing of this circuit. The contacts of relay 25 may be of the make-before-break character. The closing of this circuit does, however, energize the relay 38, causing it to attract its armature and thereby complete a circuit from battery V through the conductors 41 and 42, through conductors 43 and 44, through the armature 45, through the contact 46, thence through the contact 47 and the armature 48, through the lamp O, thence through the conductors 49 and 50, through the contact 51 and the armature 52, through the conductor 53, and thence through the ground or common connections 54 and 55 to said battery. Current flowing through this circuit causes the lamp O to glow, thereby advising the trunking operator that the originating operator has established connection with the correct trunk line. The trunking operator then inserts the plug *g* in the jack E, and presses her ringing key *n*, for the purpose of connecting the generator *n*<sup>1</sup> with the line of the called subscriber. The projection of ringing current on to the called subscriber's line in this manner rings the bell *b*<sup>1</sup> at substation B, and hearing this signal subscriber B then removes his receiver *b*<sup>2</sup> from the switch hook *b*. The insertion of the plug *g* in the jack E completes a circuit from the battery V through the conductors 41 and 42, through the conductor 43, through the coil of the supervisory relay 55, through the conductor 56 and the contact 57, through the key *n*, through the talking strand 58, through the plug ring 59, through the spring 60 of the jack, and thence through the coil 61 of relay Q to the other pole of said battery. This energizes the relay Q, causing it to attract its armature, and the said armature when attracted closes a circuit from the battery V through conductors 41, 42 and lamp K, through the contact 62 and the armature 63, and through the resistance coil 64 to the other pole of the said battery. Ordinarily this would cause the lamp K to glow, but at this time it does not do so, owing to the fact that the insertion of the plug *g* in the jack E also serves to close a shunt or short circuit around the lamp K. This shunt or short circuit consists of the conductor 42, the plug sleeve 65, the thimble or testing ring 66 of the spring jack E, and the conductor 67. Consequently the energizing of the relay Q, when caused by the insertion of the plug *g*, does not cause the lamp K to glow. The completion of this circuit through the relay Q also energizes the relay 55, causing it to attract its arma-



ture, and in so doing it of course opens the circuit of the lamp O. Furthermore, the relay 55, when energized, causes its armature to close a circuit from the battery V through the conductors 41, 42 and 43, through the conductor 44 and the armature 45, through the contact 68, through the lamp N, through the contact 51 and the armature 52, thence through the conductor 53, and through the ground or common connections 54 and 55 to the other pole of the battery. The current flowing through this closed local circuit causes the lamp N to glow. At this juncture it may be stated that this lamp N, and also the lamp M, continue to glow until the called subscriber answers the call.

When subscriber B answers the call by removing his receiver  $b^2$  from the switch hook  $b$ , he thereby closes a line circuit from the battery V through the conductors 41 and 42, through the supervisory relay 35, through the contact 69, through the listening key 70, through the conductor 71, through the contact 72 and the key  $n$ , through the talking strand 73 and the plug tip 74, through the tip spring 75 of the jack E, through the limb or line conductor 76, through the transmitter 77, through the winding 78 of the inductive connection between the receiver  $b^2$  and the line circuit, through the contact 78 and the switch hook  $b$ , through the other limb or line conductor 79, thence through the coil 61 to the other pole of the battery. This energizes the relay 35, causing it to attract its armature and thereby effect an opening of the circuit of the lamp N. The energizing of this relay 35 also operates to close a circuit from the battery U, through the conductors 11 and 16, through the lamp M, through the plug sleeve 20 and the jack contact 21, through the relay 80, through the contact 81 and the armature 26, and through the conductors 27 and the connections 28 and 29 to said battery. This is for the reason that the energizing of the relay 35 and the consequent energizing of the relay 82 not only opens the circuit of the lamp N, but also closes a circuit from the battery U through the conductors 11 and 30, through the armature 31 and the contact 32, through the relay 25 and the conductor 33, through the armature 34 and the contact 33, thence through the conductor 84 and the relay 82, through the conductor 85, through the impedance coil 39, and thence through the connections 40 and 29 to said battery. As the relay 82 is of comparatively low resistance—say about 100 ohms resistance—its connection in series with the relay 25 in this manner, operates to energize the latter. This relay 25 when energized closes the aforesaid circuit from the contact 81 through the armature 26, etc., and at the same time opens the previously

described circuit of the relay 22. The circuit closed by the relay 25 serves to energize the relay 80, causing it to attract its armature, and thereby maintain an energizing circuit for the relay 25 through the armature 28 and the contact 87. Thus in order to keep relays 25 and 82 energized, it is necessary that the armature of relay 25 complete a battery circuit through the lamp M and the relay 80. This relay 80 is, however, of a much higher resistance and hence does not permit a passage of sufficient current to cause the lamp M to glow. But as the relay 80 is energized, current is thereby maintained in the circuit through the relay 25, relay 82 and impedance coil 39. Thus the called subscriber in answering the call automatically opens the circuits of the two supervisory lamps M and N, and thereby causes the same to cease glowing. The originating operator, and also the trunking operator, is thus advised that the called subscriber has answered the call.

The through talking circuit over which the subscribers may converse includes, it will be seen, the line conductors of the two lines, the tip and sleeve contacts of the jacks and plugs, the talking strands of the cord circuits, which latter are preferably provided with condensers 88 and 89, and 90 and 91. The talking circuit also, of course, includes the two limbs or line conductors 33 and 92 of the trunk line. The condensers stop the flow of battery current, but at the same time provide an inductive connection through which voice currents may pass.

When the subscribers have finished talking and hang up their receivers, the lamps L, N, M again flow. Suppose subscriber A hangs up his receiver first. By so doing, the line circuit, including the relay P, is opened, and this relay is thereby deenergized. At this juncture it will be seen that relays P and Q remained energized during conversation between the two subscribers. The relay P when deenergized releases its armature, thereby opening the circuit of the lamp J, and at the same time closing a normally open shunt around the resistance 14. This shunt or short circuit connection includes the resistance coil 93, the back contact 94 and the armature 10. The resistance of the coil 14 being thus shunted, and the total resistance of the circuit of the lamp L being thus reduced, sufficient current then flows through this derived circuit to cause the lamp L to glow. When subscriber B hangs up his receiver, thereby opening his line circuit, the relay 35 is deenergized, and a battery circuit is closed from the battery V through the conductors 41, 42 and 43, through the conductor 44 and the armature 45, through the contact 68, through the lamp end, through the conductor



50 and the contact 51, thence through the armature 52 and the conductor 53, and through the connections 54 and 55 to said battery. This causes the lamp N to glow.

5 The called subscriber in hanging up his receiver also causes the lamp M to glow. This is due to the fact that the deenergizing of relay 35 opens the circuit of relay 82, and also that of relay 25, and in addition that

10 of relay 80. The armature 26 when released again completes circuit of relay 22, and of the lamp M in series. As the relay 80 is of a relatively high resistance while the relay 22 is of relatively low resistance,

15 the lamp M when thus switched into series with the relay 22 then glows as the result of the proper flowing of current in its circuit. The trunking operator pays no attention to the glowing of lamp N, the originating operator being the one who controls the connecting and disconnecting. But

20 as soon as the originating operator observes the glowing of lamp M, she then withdraws the plug  $f^1$  from the trunk jack I, and also withdraws the plug  $f$ , providing she has not previously done so. In withdrawing these two plugs the originating operator restores the lamps L and M to their normal condition. The act of withdrawing

30 the plug  $f^1$  from the jack I is also accompanied by the glowing of the lamp O. This is due to the fact that the withdrawal of the plug  $f^1$  opens the previously described circuit of the relay 38, and the latter when

35 deenergized permits its armature to complete a circuit from the battery V through the conductors 41 and 42, through the conductor 44 and the armature 45, through the contact 68 and the conductor 93<sup>a</sup>, thence

40 through the contact 94 and the armature 48, through the lamp O, through the contact 51 and the armature 52, thence through the conductor 53 and the connections 54 and 55 to said battery. In this way the lamp O

45 serves as a signal by which the originating operator can signal the trunking operator to make the disconnection. Observing this signal, the trunking operator then withdraws the plug  $g$  from the jack E.

50 It will be readily understood that the cord circuit F can be employed for making a connection between subscribers whose lines terminate at the switchboard in charge of the originating operator. In other words,

55 the subscribers' line circuits are all of the same type, and those terminating at the same switchboard, or the same division of the switchboard, can be connected directly by the cord circuit F, or by any one of the

60 many cord circuits of this type with which the exchange may be provided.

It will be readily understood that the resistances of the various relays, lamps and coils, and the capacities of the different condensers, can be regulated or adjusted to suit

conditions, and can be varied or changed without departing from the spirit of my invention. The resistance of each relay coil can be varied within limits, and to an extent which will not be inconsistent with its function and its relation to the resistances of the other relays, coils, etc. Obviously, the transmitters, receivers, plug switches, etc., employed in the system, can be of any suitable known or approved construction.

What I claim as my invention is:

1. A trunking telephone system comprising a calling subscriber's line, a called subscriber's line, suitable circuit connections and means for supplying all necessary current, means for establishing connection between said lines including an originating operator's cord circuit and a trunk line and a trunking operator's cord circuit, a supervisory lamp associated with the originating operator's cord circuit, a relay of relatively low resistance, and a relay of relatively high resistance, said relays being adapted to be alternately connected in series with said lamp.

2. A trunking telephone system comprising a calling subscriber's line, a called subscriber's line, a subscriber's switch hook for each line, suitable circuit connections and means for supplying all necessary current, means for establishing connection between the lines including an originating operator's cord circuit and a trunk line and a trunking operator's cord circuit, a supervisory lamp associated with the originating operator's cord circuit, a relatively low resistance relay, and a relatively high resistance relay, the relatively low resistance relay being adapted to be placed in series with the said lamp when the originating operator establishes connection with the said trunk line, and the said high resistance relay being adapted to be substituted for said low resistance relay when the called subscriber closes the line circuit with his switch hook.

3. A trunking telephone system comprising a calling subscriber's line, a called subscriber's line, suitable circuit connections and means for supplying all necessary current, means for establishing connection between the lines including an originating operator's cord circuit and a trunk line and a trunking operator's cord circuit, a lamp signal associated with the originating operator's cord circuit, and a relatively low and a relatively high resistance relay associated with the said trunk line, said relays being adapted to be alternately connected in series with said lamp signal before the subscribers can converse.

4. A trunking telephone system comprising a calling subscriber's line, a called subscriber's line, suitable circuit connections and means for supplying all necessary current, means for establishing connection be-



tween the lines including an originating operator's cord circuit and a trunk line and a trunking operator's cord circuit, a supervisory lamp associated with the originating operator's cord circuit, a relatively low and a relatively high resistance relay, said connecting means also including a plug switch for first connecting said lamp and low resistance relay in series, and means whereby the said high resistance relay is substituted for the low resistance relay before the subscribers can converse.

5. A trunking telephone system comprising a calling subscriber's line, a called subscriber's line, suitable circuit connections and means for supplying all necessary current, means for establishing connection between said lines including an originating operator's cord circuit and a trunk line and a trunking operator's cord circuit, a lamp signal associated with the originating operator's cord circuit, a relatively low and a relatively high resistance relay, adapted to be alternately connected in series with said lamp, and a third relay for controlling said first mentioned relays.

6. A trunking telephone system comprising a calling subscriber's line, a called subscriber's line, suitable circuit connections and means for supplying all necessary current, means for establishing connection between said lines including an originating operator's cord circuit and a trunk line and a trunking operator's cord circuit, a supervisory relay connected with the trunk line, and a relatively high and a relatively low resistance relay associated with the trunking operator's cord circuit, said last mentioned relays being adapted to be alternately connected in series with said first mentioned relay.

7. A trunking telephone system comprising a calling subscriber's line, a called subscriber's line, line relays for said lines having back contacts for controlling supervisory signals, suitable means for supplying all necessary current, means for establishing connection between the said lines including an originating operator's cord circuit and a trunk line and a trunking operator's cord circuit, a supervisory lamp associated with the originating operator's cord circuit, means including a relay for controlling said lamp, a relatively high resistance relay and a relatively low resistance relay, circuits controlled by said high and low resistance relays, said high and low resistance relays being associated with and adapted to be connected alternately in series with said first mentioned relay.

8. A trunking telephone system comprising a calling subscriber's line, a called subscriber's line, suitable circuit connections and means for supplying all necessary current,

line lamp signals and line relays for said lines, means for connecting said lines including an originating operator's cord circuit and a trunk line and a trunking operator's cord circuit, a supervisory lamp associated with the originating operator's cord circuit, means including the line relay of said calling subscriber's line for controlling said lamp, a second supervisory lamp associated with the originating operator's cord circuit, relatively low and relatively high resistance relays adapted to be alternately connected in series with said second supervisory lamp, a third relay for controlling said first mentioned relays, a relatively high and a relatively low resistance relay associated with the trunking operator's cord circuit and adapted to be alternately connected in series with said third relay, a supervisory relay for controlling said last mentioned relays, a supervisory lamp associated with said trunking operator's cord circuit, and a second supervisory relay associated with the trunking operator's cord circuit, the two supervisory relays associated with the trunking operator's cord circuit, and also the said low resistance relay which is associated with the trunking operator's cord circuit, being adapted to conjointly control the said last mentioned supervisory lamp.

9. A trunking telephone system comprising a calling subscriber's line, a line signal for said line, a line relay for controlling said signal, a resistance coil adapted to be connected in series with said line signal, a normally closed shunt or short circuit connection also controlled by said relay and extending around said resistance coil, a called subscriber's line, said called subscriber's line being equipped with a line relay and a line signal and a normally closed shunt or short circuit connection and a resistance coil of the same character and operating in the same manner as those allotted to the calling subscriber's line, suitable circuit connections and means for supplying all necessary current, and means for establishing connection between said lines, said connecting means including an originating operator's cord circuit and a trunk line and a trunking operator's cord circuit.

10. In a telephone exchange system, the combination of a trunk line, telephone lines, suitable means for connecting any calling telephone line with the trunk line, a pair of relays allotted to one end of said trunk line, a pair of relays allotted to the other end of said trunk line, grounded trunk-line circuits over which the relays at one end of the trunk line control the relays at the other end thereof, and suitable means controlled by the relays at the other end of the trunk line.

11. In a telephone exchange system, the combination of a trunk line, telephone lines,



suitable means for connecting any calling telephone line with the trunk line, a pair of relays allotted to one end of said trunk line, a pair of relays allotted to the other end of said trunk line, grounded trunk-line circuits over which the relays at one end of the trunk line control the relays at the other end thereof, signaling means controlled by the relays at the other end of the trunk line and means for causing the successive energizing of the relays in each pair.

12. In a telephone exchange system, the combination of a trunk line, a battery having one pole grounded, a pair of relays allotted to one end of said trunk line, means by which the energizing of either relay connects the trunk line with one and the same pole of the battery, a second pair of relays and signaling means controlled thereby at the other end of said trunk line, and grounded trunk-line circuits by which the first pair of relays controls the second pair of relays.

13. In a telephone exchange system, the combination of a trunk line, a pair of relays allotted to one end of the trunk-line, a second pair of relays allotted to the other end of said trunk line, means by which the originating operator controls the first relays to

control the second relays, and signaling means controlled by the second relays.

14. In a telephone exchange system, a trunk, a pair of relays at the calling end of the trunk, a pair of relays at the called end of said trunk, means for controlling said first relays, and signaling means controlled by the second relays, the second pair of relays controlled by the first pair.

15. In a telephone exchange system, the combination of a trunk line, two trunk-line relays and two other trunk-line relays controlled thereby over the trunk line, means for controlling the first relays and signal means controlled by the second relays.

16. In a telephone system, a trunk line relay, a pair of relays at the other end of the trunk line, and means for alternately including said first-mentioned relay in series with first one and then the other of said pair of relays, said pair of relays being connected to one pole of the source of current.

Signed by me at Chicago, Cook county, Illinois, this 21st day of July, 1903.

ALFRED H. DYSON.

Witnesses:

A. F. DURAND,

WM. A. HARDERS.