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TRUNKING TELEPHONE SYSTEM.

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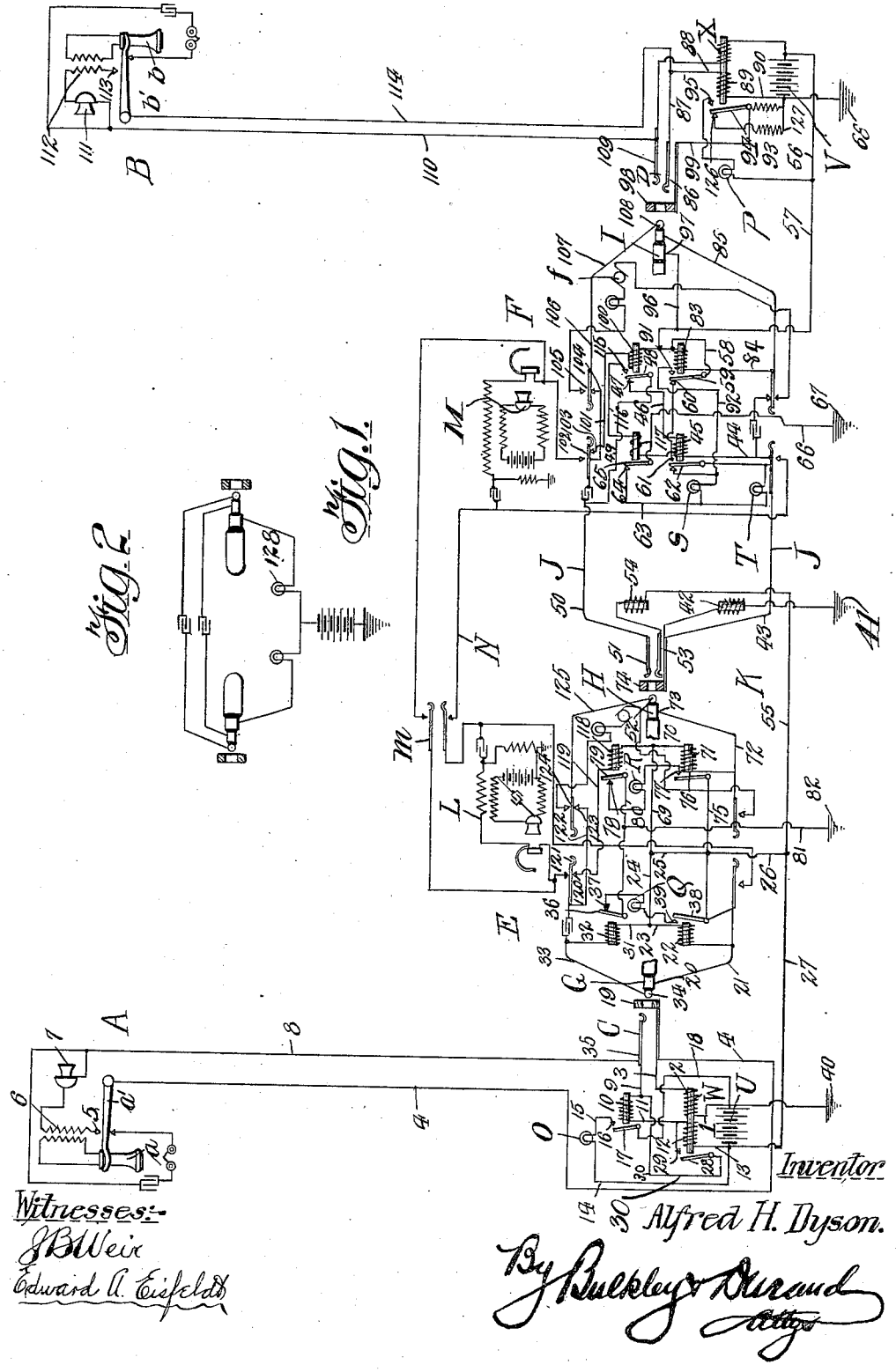

Fig. 1.

Fig. 2.

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TRUNKING TELEPHONE SYSTEM.

1,043,306. Specification of Letters Patent. Patented Nov. 5, 1912.

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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 Trunking Telephone Systems, of which the following is a specification.

My invention relates to telephone systems of that type in which complete metallic line connection is provided between the substations and the exchange or central station, and in which all of the current, both for talking and signaling purposes, is supplied from a common battery or centralized source of current at the central exchange.

It also relates more particularly to systems of this character in which provision is made for connecting subscribers of one exchange with those of another, or for connecting subscribers of one division of an exchange with those of another division of the same exchange. Systems of this character are ordinarily known as trunking telephone systems, it being necessary to employ what are known as trunk lines in establishing connection between subscribers of one exchange with subscribers of another exchange, or between two subscribers of different divisions of the same exchange. It is customary to provide a system of signaling apparatus whereby the subscribers may call up the operators by simply removing the receivers from the usual switch-hooks. Supervisory or clearing out signals are also provided and employed for enabling the subscribers to indicate when they have finished talking.

The connections between subscribers' lines, in systems of the foregoing character, are usually made through the medium of what are known as cord-circuits. Each operator is provided with a number of pairs of plugs, the plugs of each pair being connected by a couple of insulated flexible conductors, and each plug being adapted for insertion in any one of the spring jacks which are connected with the subscribers' lines. Means are also provided for enabling the operators to converse with the subscribers, and for enabling the operators to ring the bells at the substations. And, as previously stated, all of the current, both for talking and signaling purposes, is supplied from a battery located at the exchange.

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

A special object is to operatively combine switchboard apparatus of one type with switchboard apparatus of another type, and to organize the same into an efficient and operative trunking telephone system.

Another object is to provide an improved construction of trunking operator's cord-circuit apparatus, whereby subscribers' lines of one type may be connected with the subscribers' lines of another type without interfering with the proper mode of operation of any of the lines, and without departing from approved methods of practice with respect to the operation of the line and calling signals, and with respect to the manner of establishing connection between the lines.

A further object is to provide an improved arrangement of relays and circuit connections, whereby the originating operator may have complete and satisfactory supervision over the trunking connections.

It is also an object to provide certain details and features of improvement tending to increase the general efficiency and serviceability of a telephone system of this particular character.

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

In the accompanying drawing, Figure 1 is a diagram illustrating a telephone system embodying the principles of my invention, only two substations being shown, as well as only one originating operator's cord-circuit, and one trunking operator's cord-circuit, it being understood, however, that the system may include as many substations as the size and growth of the system may demand, and that as many cord-circuits may be employed for establishing the connections between subscribers' lines as may be found necessary or convenient. Fig. 2 is a diagram of the cord-circuit adapted for connecting subscribers' lines of the type shown at the right of Fig. 1.

As thus illustrated, my improved common battery or central energy trunking telephone system comprises substations A and B, connected, respectively, with spring-

jacks C and D. It will be observed that complete metallic line connection is employed between the said sub-stations and the said jacks. For convenience of illustration, it may be assumed that the jack C is located at one exchange and that the jack D is located at another exchange, the two exchanges being located, for instance, in different parts of the city. Such being the case, the cord-circuit E will be associated with the jack C, at one exchange, while the cord-circuit F will be associated with the jack D at the other exchange. The cord-circuit E, more properly known as the originating operator's cord-circuit, is preferably provided at its opposite ends with answering and calling plugs, G and H. The cord-circuit F, however, which is known as the trunking operator's cord-circuit, is provided at one end with a calling plug I, but is connected permanently at its other end with the trunk line J. This trunk line extends between the two exchanges and terminates at its other end in what is known as a trunk-jack K. The cord-circuit is provided with an operator's talking set L, while the trunking operator's cord-circuit F is provided with a similar talking set M. These two talking sets are adapted to be connected by what is known as an operator's private order line N, whereby the two operators may converse for the purpose of determining which trunk line shall be used for establishing connection between the two exchanges, it being understood that, in order to facilitate traffic and give good service, it is usual and preferable to provide a number of trunk lines between the two exchanges, or between two divisions of the same exchange. These talking sets with which the operators are provided are also employed by them in conversing with the subscribers and in receiving orders for connection.

The line of substation A is provided with a line signal O, whereby the subscriber at the substation may call up the operator at the board at which his line terminates. A similar line signal P is provided at the other exchange and arranged to enable the subscriber at substation B to call-in and attract the attention of the operator who has charge of the board at which his line terminates. Supervisory signals Q and R are associated with the originating operator's cord-circuit, the circuit arrangement being such that the signal Q responds when the subscriber A, having finished his conversation, hangs up his receiver. The signal R responds when the subscriber at substation B hangs up his receiver. Thus the originating operator, or operator at whose board the call originates, has complete supervision over the connection established through her cord-circuit, through the trunk line and the trunking operator's cord-circuit. In addition, the trunking operator's cord-circuit is provided with a supervisory signal S adapted to also respond when the subscriber at substation B hangs up his receiver. What is sometimes known as an O-K lamp or check, T, is also preferably associated with the trunking operator's cord-circuit and adapted to respond when the originating operator plugs into a trunk-jack. In this way, the trunking operator may be certain that the originating operator has understood the instructions given over the private order line, and has established connection with the proper trunk line. It will be observed that all of said signals are controlled by line and supervisory relays. Current for operating all of said signals and relays, and also for operating the various transmitters and receivers employed in the system, is supplied from the two common batteries or centralized sources of energy U and V. The functions of these relays, signals, and other devices, will, however, be more clearly understood by considering the various operations which take place in connecting one subscriber's line with another.

Suppose, for example, that subscriber A desires to converse with subscriber B. Subscriber A, in removing his receiver a from the switch-hook a^1, thereby closes a line circuit from the battery U, through the conductor 1, through the coil 2 of the differentially wound cut-off relay W, through the conductor 3, thence through the limb or line conductor 4, through the switch-hook a^1, and the contact 5, through the winding 6 of the inductive connection between the receiver a and the line circuit, through the transmitter 7, through the other limb or line conductor 8, thence through the conductor 9 and the coil of the line relay 10, through the conductor 11, through the other winding 12 of the differentially wound cut-off relay W, thence through the conductor 13 to said battery. The flow of current through this closed line circuit is sufficient to energize the line relay 10, but owing to the differential winding, relay W is not energized. The armature of the line relay 10, when attracted, closes a local circuit through the battery U, through the conductor 14, through the line lamp signal O, thence through the conductor 15, through the contact 16, through the armature 17 of said line relay, thence through the conductor 18 to said battery. The flow of current through this closed local circuit is sufficient to cause the line lamp signal O to glow, and to, in this way, attract the attention of the operator. Observing the signal, the operator in charge of the board upon which the line lamp signal O is located, then inserts the answering plug G of her cord-circuit in the spring-jack C. This act on the part of the operator estab-

lishes a derived circuit from the battery U, through the conductor 1, through the winding 2 of the differentially wound cut-off relay, through the conductor 3, through the testing ring 19 of the said jack, through the sleeve 20 of the answering plug, through the talking strand 21 of the cord-circuit, through the coil of the supervisory relay 22, thence through the conductors 23, 24, 25 and 26, and through the conductor 27 to said battery. The flow of current through this derived circuit is sufficient to unbalance the differential cut-off relay, thereby causing it to be energized; and the flow of current is also sufficient to energize the supervisory relay 22. The differentially wound cut-off relay W, when energized, attracts its armature 28, causing the same to engage the contact 29, and thereby close a normally open shunt 30 about the coil of the line relay 10. A path of low resistance being thus established around the line relay the same releases its armature, and thereby cuts battery off from the line lamp signal O, causing the lamp to cease glowing. The operator in thus establishing connection between the calling subscriber's line and her cord-circuit, also completes a line circuit from the battery U, through the conductors 27, 26, 25, 24, and 31, through the coil of the supervisory relay 32, through the talking strands 33 of the cord-circuit, through the tip contact 34 of the answering plug, thence through the spring 35 of the jack C, through the limb or line conductor 8, through the transmitter 7 and the coil 6, through the contact 5, and the switch-hook a^1, through the other limb or line conductor 4, and through the conductor 3 and the coil 2 to said battery. This additional path is provided through the coil 2 for unbalancing the cut-off relay, and causing it to extinguish the line lamp signal O. Furthermore, the closing of this line circuit energizes the supervisory relay 32, causing it to attract its armature 36, causing it to move away from the contact 37. The normally closed switch-point in the circuit of the lamp Q, being thus opened, the previously described energizing of the relay 22 and the consequent engagement of its armature 38 with the contact 39 cannot operate to cause the supervisory lamp signal Q to glow, notwithstanding the fact that the normally open switch-point of this lamp has been thus closed. In other words, the establishment of connection between the calling subscriber's line and the originating operator's cord-circuit operates to automatically restore the line lamp signal, and to also place the supervisory lamp signal Q in condition to be operated or caused to glow when the calling subscriber finishes his conversation and hangs up the receiver. Upon receiving the order for connection, the originating operator then presses the key *m*, so as to connect her talking set with the private order line N. The originating operator can then converse with the trunking operator, and the latter will then advise the originating operator as to which trunk line is idle and in condition for use. Assuming that the trunk line J is assigned by the trunking operator for use between the two exchanges, the originating operator then inserts the calling plug H of her cord-circuit in the spring-jack K. This completes a circuit from the battery U, through the ground or common connections 40 and 41, through the impedance coil 42, through the limb 43 of the trunk line, through conductor 44, thence through the coil of the supervisory relay 45, through conductor 46, and through contact 47 and the armature 48, thence through the conductor 49, through the limb 50 of the trunk line, through the spring 51, through the plug-tip 52, through the other spring 53 of the spring-jack, thence through the impedance coil 54 and through the conductors 55 and 27 to said battery. The current flowing through this circuit energizes the relay 45, causing its armature to close a local circuit from the battery V, through the conductors 56 and 57, through the conductor 58 and the armature 59, through the contact point 60, thence through the contact point 61 and armature 62, through the O-K lamp or check T, thence through the conductor 63, through the contact-point 64 and the armature 65, through the conductor 66, and thence through the ground or common connections 67 and 68 to said battery. The current flowing through this closed local circuit causes the lamp T to glow and thereby indicate that the originating operator has correctly understood the instructions and has established connection with the correct trunk-line. It will also be seen that the insertion of the plug H in the trunk-jack completes a local circuit from the battery U, through the conductor 27, through the conductors 26, 25, through the conductors 69 and 70, through the coil of the supervisory relay 71, thence through the talking strand 72 of the cord-circuit, through the sleeve 73 of the plug, through the testing ring 74 of the trunk-jack, thence through the impedance coil 42, and through the ground or common connections 41 and 40 to said battery. The current flowing in this circuit energizes the relay 71, and this relay, when energized, attracts its armature and closes a local circuit from the battery U, through the conductors 27 and 26, through the conductor 75, through the armature 76, through the contact-point 77, thence through the supervisory lamp R, through the contact 78, and armature 79, thence through the conductors 80 and 81, and through the ground or common connections

82 and 40 to said battery. Sufficient current flows through this local circuit to cause the supervisory lamp R to glow. This lamp continues to glow until the subscriber at substation B answers the call. In order to complete the connection between the two subscribers, the trunking operator then inserts the plug I of the trunking operator's cord-circuit into the jack D connected with the line of the called subscriber. A derived circuit is closed from the battery V, through the conductor 57, through the coil of the supervisory relay 83, through the conductor 84, through the talking strands 85, through the spring 86 of the jack D, through the conductors 87 and 88, through the winding 89 of the line relay X, which, while preferably having both coils in the line is not differentially wound, and through the conductor 90 to said battery. This energizes the relay 83, causing its armature to complete a circuit from the battery V, through the conductors 57 and 58, through the armature 59, through the contact 91, through the conductor 92, through the supervisory lamp signal S, through the conductor 63, through the contact 64 and the armature 65, and thence through the conductor 66 and the ground or common connections 67 and 68 to said battery. Sufficient current flows through this closed local circuit to cause the lamp S to glow, and, as will be seen, this lamp continues to glow until the subscriber at substation B answers the call. It will also be seen that the relay 83, when energized, opens the normally closed switch-point in the circuit of lamp T, thereby causing the latter to cease glowing. Furthermore, the current flowing through the coil 89, of the line relay X, energizes this relay and causes it to close a circuit through the battery V, through the resistance coil 93 and the armature 94, through the contact 95, and through the line lamp signal P and the conductor 56 to said battery. Ordinarily, the closure of this circuit would cause the lamp P to glow, but at this time it does not do so, owing to the fact that the insertion of the plug I in the jack D closes a shunt circuit from the battery V, through the conductors 56 and 57, through the conductor 96, through the sleeve 97 of the plug, through the testing ring 98 of the jack D, thence through the conductor 99 and the said resistance 93 to said battery. The path of low resistance thus established around the lamp P prevents the latter from glowing. The trunking operator can then signal the subscriber at substation B, by bridging her generator *f* across the cord-circuit and projecting ringing current on to the line leading to said substation. Subscriber B, in answering the call—that is to say, in taking down his receiver *b*, releases the switch-hook b^1, thereby closing a circuit from the battery V, through the conductors 56 and 57, through the coil of the supervisory relay 100, through the conductor 101, through the spring 103 of the listening key, through the contact 102, through the conductor 104, through the contact 105 and the spring 106 of the ringing key, thence through the talking strand 107, through the plug-tip 108, through the spring 109 of the jack D, thence through the line conductor 110, through the transmitter 111, through the winding 112 of the inductive connection between the receiver *b* and the line circuit, thence through the contact 113 and the switch-hook b^1, through the line conductor or limb 114, thence through the conductor 88 and the coil 89, to said battery. The current flowing through this closed line circuit energizes the relay 100, causing it to attract its armature, and in so doing the said relay opens the aforedescribed circuit of the relay 45, permitting the latter to release its armature.

The relay 100, in attracting its armature, also closes a circuit from the battery U, through the conductors 27 and 55, through the impedance coil 54, through the spring 53, and the plug-tip 52, through the spring 51, and the talking strand 50, thence through the conductor 49, through the armature 48 and the contact 115, through the conductor 116, through the coil of relay 117, thence through the conductor 44 and the other limb 43 of the trunk line, through the impedance coil 42, and thence through the ground or common connections 41 and 40 to said battery. This, it will be seen, energizes the relay 117, causing it to attract its armature 65, and to thereby open the normally closed switchpoint in the circuit of the supervisory lamp S. In this way, the subscriber at substation B, in answering the call, restores the lamp S to its normal condition. It also, as will be seen, completes a circuit from the battery U, through the conductors 27, 26, 25 and 69, through the coil of the supervisory relay 118, through the conductor 119, through the contact 120 and the spring 121 of the listening-key, thence through the conductor 122 and the contact 123, through the spring 124, through the talking strand 125, through the plug-tip 52 and the spring 51, through the trunk-line conductor 50, through the conductor 49, through the armature 48 and the contact 115, thence through the conductor 116 and the relay 117, through the conductors 44 and 43, and thence through the impedance coil 42 and the ground or common connections 41 and 40 to said battery. The current flowing in this grounded trunk-line circuit energizes the relay 118, causing it to open the normally closed switch-point in the circuit lamp R. In this way, the subscriber at substation B, in answering the call, also restores the lamp R to its normal condition. When the subscribers have finished

their conversation, and have hung up their receivers, the supervisory signals are operated to indicate to the operators that the subscribers are through talking. Suppose, for example, that the subscriber A hangs up his receiver first. In such case, the opening of the line circuit will deënergize the relay 32, thereby permitting its armature 36 to engage the contact 37, and to, in this way, close a circuit from the battery U through the conductors 27, 26, through the armature 38 and the contact 39, and thence through the supervisory lamp signal Q, through the contact 37 and the armature 36, and thence through the conductor 81 and the ground or common connections 82 and 40, to said battery. Current flowing in this local circuit causes the lamp Q to glow, and observing this signal the operator understands that the subscriber A is ready to have his line disconnected. The subscriber at substation B then hangs up his receiver. In so doing, he opens the line circuit, and thereby closes the circuits of the lamps S and R. The lamp S is caused to glow by reason of the deënergizing of the relay 100, which, when deënergized, allows its armature 48 to close the normally closed switch-point in the circuit of the relay 45, thereby causing the latter to again attract its armature and open its contacts 61 and 62 thus preventing lamp T from being again displayed. It will be observed in this connection that the deënergization of the relay 100 is followed by the deënergization of the relay 117, and the consequent closing of the normally closed switch-point in the circuit of the lamp S. Inasmuch as the low resistance relay 117 constitutes part of the energizing circuit of the relay 118, it follows that when the relay 100 becomes deënergized and thereby substitutes the high resistance relay 45 for relay 117, the relay 118 becomes deënergized and allows its armature to close the circuit of the lamp R. The trunking operator pays no attention to the display of signal resistance for disconnection. But the originating operator, observing that both her supervisory lamps are glowing, then withdraws both plugs from the jacks. The withdrawal of the plug G of course operates to automatically restore the lamp Q, while the withdrawal of the plug H operates to, in like manner, restore the lamp R. A further action also results from the withdrawal of the plug H. It opens the previously described circuit of the relay 45, thereby allowing the latter to again close the circuit of the lamp T, which, in this way, it will be seen, has the further function of serving as a disconnecting signal. The trunking operator, observing the glowing of the lamp T, then understands that the proper time has arrived for withdrawing the plug I from the jack D. The withdrawal of this plug opens the circuit of the relay 83, allowing the latter to release its armature and thereby open the circuit of the lamp T. The withdrawal of the plug I also opens the circuit through the resistance 93, and at the same time opens the connection around the lamp P. The opening of the circuit of the relay 83, furthermore opens the circuit of the coil 89 of the relay X, thereby allowing the armature 94 to fall back and engage the back contact 126, thereby placing the resistance 127 in parallel with the resistance 93. These two resistance coils and back contact 126 are, however, of value only in connection with the cord-circuit, which is provided for connecting two subscribers' lines of this particular type.

The cord-circuit, as shown in Fig. 2 may, for example, be employed for connecting two subscribers' lines of the type shown at the right of Fig. 1. With a cord-circuit of this character, it will be seen that the insertion of the plug will place the supervisory lamp 128 in parallel with the lamp P, and that while the line circuit is closed, the resistance coil is common to both lamps. But as soon as the subscriber hangs up his receiver, thereby opening the line circuit, then the two coils 93 and 127 become connected in parallel and are then common to said lamps. The resistance of the coil 93 is such that when only this coil is in circuit, sufficient current cannot flow through the circuit to light the two lamps in parallel. But when the resistance of this circuit is lowered by placing the two coils in parallel, then sufficient current is permitted to pass to cause the lamp 128 to glow. It is with respect to a circuit of this particular character that the short-circuit connection composed of the conductors 57, 96, 99, and the plug and jack sleeves, is necessary. For without this shunt or short-circuit connection the lamp P would glow as soon as subscriber B answers the call, and would continue to glow during conversation, owing to the fact that the relay X must remain energized during conversation between the two subscribers.

It will be seen that the insertion of the plug H in the trunk jack places the relay 118 in series with the relay 45. But owing to the fact that this relay 45 is of high resistance, say 12000 ohms resistance, the relay 118 does not, at such time, become energized. This relay 118 only becomes energized when the called subscriber answers the call, and when the relay 117 thereby becomes connected in series with the said relay 118. The relay 117 being of comparatively low resistance, say 250 ohms resistance, the relay 118 can then become energized. In other words, the only circuit which can be closed, and which, when closed, energizes the relay 118, is the previously described circuit which includes this relay in

series with the relay 117. The impedance coils 42, 54 can be of 175 ohms resistance each. The relay 118, and, in fact, all of the relays in this cord-circuit, can be of say 500 ohms resistance each. The other relays shown can be of any suitable or desired resistance consistent with their function and mode of operation. The various resistances can be changed or adjusted to suit conditions; but those indicated have been tried and found to give good results.

It will be readily understood that the originating operator's cord-circuit E can be employed for connecting subscribers' lines of the type shown at the left of Fig. 1.

I claim as my invention:

1. A trunking telephone system, comprising a calling subscriber's line, a called subscriber's line, a central source of current for said lines, means for connecting said lines including an originating operator's cord-circuit and a trunking operator's cord-circuit, each cord circuit comprising only two strands, high and low resistance supervisory relays associated with the trunking operator's cord-circuit, a supervisory relay associated with the originating operator's cord-circuit, and suitable circuit connections whereby the said last mentioned supervisory relay is first connected in series with said high resistance supervisory relay when connection is established between the two cord-circuits to actuate the high resistance relay, and whereby the relay thus associated with the originating operator's cord circuit is then connected in series with said low resistance relay when the called subscriber answers the call to release the high resistance relay and actuate the other two relays.

2. The combination with a trunk line of a cord circuit adapted to be connected with one end thereof, and a telephone line with which the other end may be connected, a high resistance signal controlling relay in a bridge of the limbs of the line at the latter end, a signaling device for the cord circuit through which current is supplied sufficient for the operation of the high resistance relay, the resistance of the circuit being too great for the actuation of the signaling device, and a low resistance relay adapted to be substituted for the high resistance relay, whereby the signaling device is actuated and the high resistance relay is released, and supervisory circuits controlled by the low resistance relay.

3. A trunking telephone system comprising a calling subscriber's line, a called subscriber's line, suitable means for supplying all necessary current, means for establishing connection between said lines including an originating operator's cord-circuit and a trunking operator's cord-circuit, each cord circuit comprising only two strands, an originating operator's relay, a trunking operator's low resistance relay, a trunking operator's high resistance relay, and suitable circuit connections whereby the originating operator's relay is connected in series with said high resistance relay when connection is established between the two cord-circuits, and whereby said originating operator's relay is then connected in series with said low resistance relay when the called subscriber answers the call, the trunking operator's high resistance relay being operated in series with the originating operator's relay, the originating operator's relay being operated in series with the trunking operator's low resistance relay.

4. A trunking telephone system comprising a calling subscriber's line, a line lamp signal associated with said calling subscriber's line, a line relay for controlling said signal, a normally open shunt around said line relay, a second relay for controlling said shunt, an originating operator's cord-circuit provided with plugs, a spring-jack connected with said calling subscriber's line, a pair of relays bridged across the end of the cord-circuit which is adapted to be connected with said jack, a supervisory lamp adapted to be conjointly controlled by said pair of relays, a second pair of relays bridged across the other end of said cord-circuit, a second supervisory lamp adapted to be conjointly controlled by said second pair of relays, a trunk jack, a trunking operator's cord-circuit provided with a single plug, a trunk line connecting the said trunk jack with said trunking operator's cord-circuit, a called subscriber's line, a jack connected with said called subscriber's line, two supervisory relays associated with the trunking operator's cord-circuit, two lamp signals associated with the trunking operator's cord-circuit and adapted to be controlled by the said two relays, a third relay coöperating with the other two relays, a fourth relay associated with the trunking operator's cord-circuit and adapted to control the operation of the said two relays, a line lamp signal associated with the subscriber's line, a line relay for controlling said last mentioned line lamp signal, a resistance coil, a normally closed shunt or short circuit controlled by said last mentioned line relay and extending around said resistance coil, a normally open circuit including said resistance coil and shunt or short circuit in parallel, and including also a portion of the trunking operator's cord-circuit, said resistance coil being common to said last mentioned line lamp signal and said portion of the trunking operator's cord-circuit when the called subscriber's line circuit is closed, but the said shunt or short circuit around the said resistance coil being closed and the circuit of the last mentioned line lamp signal opened when the called subscriber's line circuit is open, and suitable

circuit connections and means for supplying all necessary current.

5. A trunking telephone system comprising a calling subscriber's line, a line lamp signal associated with said line, a line relay for controlling said line lamp signal, a normally open shunt or short circuit extending around said line relay, a second relay for controlling said shunt, a called subscriber's line, a second line lamp signal associated with said called subscriber's line, a second line relay for controlling said second line lamp signal, a resistance adapted to be connected in series with said second line lamp signal, a normally closed shunt or short circuit controlled by said second line relay and extending around said resistance coil, means for connecting said lines including an originating operator's cord-circuit and a trunk line and a trunking operator's cord-circuit, supervisory signal devices associated with each cord-circuit and suitable circuit connections and means for supplying all necessary current, the two line signal controlling arrangements thus provided being coöperatively connected together by the said trunk line and cord circuits.

6. The improved trunking telephone system, comprising high and low resistance trunking operators' supervisory relays, connected in bridge of the talking circuit, an originating operator's supervisory relay provided with normally closed switch contacts and having a winding adapted to be connected in series with first one and then the other of high and low resistance trunking operators' supervisory relays.

7. A telephone system comprising a supervisory relay, high and low resistance coils, said relay being provided with normally closed switch contacts and adapted to be connected in series with first one and then the other of the said high and low resistance coils, and suitable circuit connections controlled by said switch-contacts, said coils in bridge of the talking circuit.

8. In a telephone exchange system, the combination with a calling substation connected to a sub-central exchange by a telephone line, of a substation to be called connected with the main exchange through a telephone line, a trunk circuit at the main exchange for connection with the line leading to the substation to be called, a cord circuit at the sub-exchange for connection with the calling line and said trunk circuit, a supervisory relay for the cord circuit, a controlling relay associated with the trunk circuit and adapted upon connection of the cord circuit with the trunk circuit to be connected in circuit with the supervisory relay, the resistance of said controlling relay being sufficiently high to normally prevent operation of the supervisory relay, a second controlling relay of lower resistance, a main relay associated with the trunk circuit, and means adapted upon actuation of substation apparatus at the called substation for causing actuation of said main relay to disconnect the high resistance relay and to substitute the lower resistance relay, whereby sufficient current may flow to cause operation of the supervisory relay, said relays all in bridge of the talking circuit.

9. In combination with the limbs of a trunk line, a signal-controlling electromagnet and a source of current in a bridge thereof at one end, and a pair of signal-controlling electromagnets adapted to be alternately placed in a bridge thereof at the other end, each of the latter signal-controlling electromagnets being operated in series with the former, but the former being operated in series with only one of the latter, and the latter being operative only one at a time.

10. In combination with the limbs of a trunk line, a relay and a source of current in a bridge thereof at the calling subscriber's end of the trunk, a pair of signal-controlling electromagnets adapted to be alternately placed in a bridge of the trunk at the other end, each of said signal-controlling electromagnets being operated in series with said relay, but the relay being operated in series with only one of said signal-controlling electromagnets, said signal-controlling electromagnets being operative only one at a time.

11. In combination with a trunk line, a high resistance relay and a low resistance relay adapted to be alternately bridged between the limbs of the trunk line at one end, a relay and a source of current in a bridge between the limbs of the trunk line at the other end thereof, said relay being normal or operated, according to whether the high or low resistance relay is in circuit therewith, the high and low relays being alternately actuated and released when they are cut into and out of the circuit.

12. A trunking telephone system comprising a calling subscriber's line, a called subscriber's line, suitable means for supplying all necessary current, means for establishing connection between said lines, including an originating operator's cord circuit and a trunking operator's cord-circuit, an originating operator's relay, trunking operator's high and low resistance signal-controlling relays, and suitable circuit connections whereby the originating operator's relay is connected in series with said high resistance signal-controlling relay, when connection is established between the two cord-circuits to actuate the high resistance relay, and whereby said originating operator's relay is then connected in series with said low resistance signal-controlling relay when the called subscriber answers the call

to actuate the oroginating operator's relay and the low resistance relay, and to release the high resistance relay.

13. A trunking telephone system, comprising a calling subscriber's line, a called subscriber's line, a central source of current for said lines, means for connecting said lines including an originating operator's cord circuit, high and low resistance supervisory relays associated with the trunking operator's cord-circuit, in bridge of the talking circuit, a supervisory relay associated with the originating operator's cord-circuit, and suitable circuit connections whereby the said last mentioned supervisory relay is first connected in series with said high resistance supervisory relay when connection is established between the two cord circuits, and whereby said originating operator's relay is then connected in series with said low resistance relay when the called subscriber answers the call.

14. In combination with the limbs of a trunk line, a relay and a source of current in a bridge thereof at one end and a pair of signal-controlling relays adapted to be alternately placed in a bridge thereof at the other end, each of the latter relays being operated in series with the former but the former being operated in series with only one of the latter, and the latter relays being operative only one at a time.

15. In a telephone trunking system, a relay and a source of current in a bridge between the limbs thereof at one end, and a pair of signal-controlling relays adapted to be alternately included in series with the limbs of the line at the other end, the first relay being operative through only one of the latter relays, and the latter relays being operative one at a time.

Signed by me at Chicago, Cook county, Illinois, this 15th day of July, 1903.

ALFRED H. DYSON.

Witnesses:
A. F. DURAND,
WM. A. HARDERS.