

H. P. CLAUSEN.
TELEPHONE SYSTEM.
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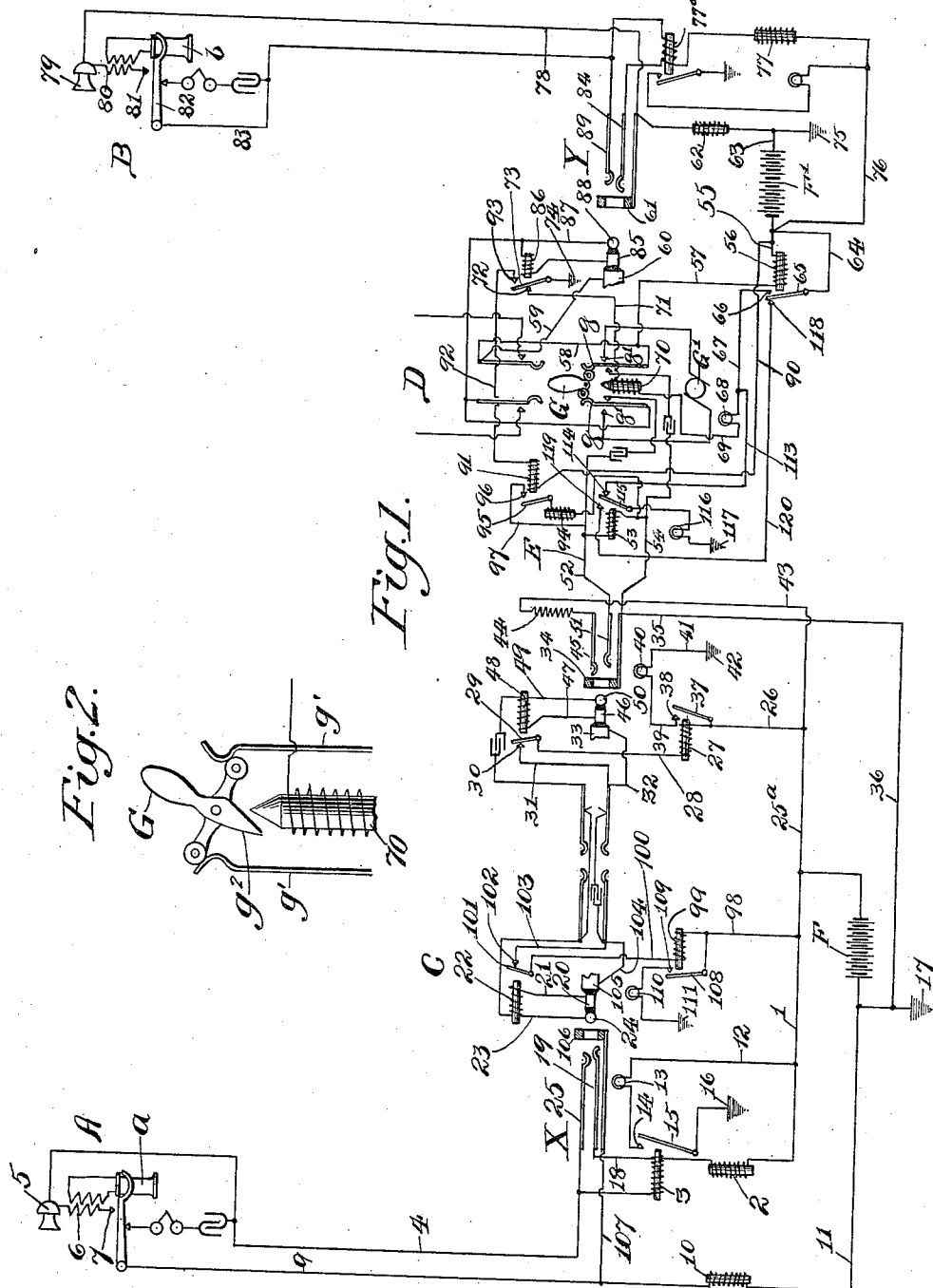
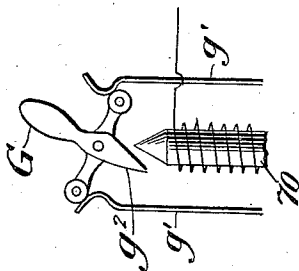


Fig. 2.



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UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

1,043,301.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, HENRY P. CLAUSEN, 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 of that character in which the connections are such that the subscriber of one exchange may be connected up for conversation with a subscriber of another exchange. Telephone systems operating on this principle are commonly known as trunking systems, the connections between the two exchanges consisting of trunk lines. With this arrangement, the originating operator, or operator receiving the call, can instruct the trunking operator as to the character of the connection desired, and if the line of the subscriber called for is not busy the trunking operator then establishes connection between this line and one of the trunk lines. It is the practice, however, for the trunking operator, upon receiving the order for connection, to first assign a certain idle trunk line for use between the two exchanges. After this, the originating operator then establishes connection between the trunk line and the calling subscriber's line. The circuit connections and signaling devices are usually of such character that the originating operator has complete control or supervision of the connecting and disconnecting. In other words, the trunking operator acts entirely on the instructions of the originating operator. There is a type of telephone system in which the current, both for talking and signaling purposes, is supplied from a common battery located at the central exchange. In other words, current is supplied from this battery to the various lines for operating the microphone transmitters at the substations, and also for operating the signal apparatus at the central station. A central station thus equipped is known as a common battery exchange.

One of the principal objects of my invention is to provide a simple and efficient arrangement whereby trunking may be successfully carried on between two common battery exchanges.

Another object is to provide an improved circuit arrangement whereby trunking may

be satisfactorily and economically carried on between two exchanges having a particular kind of switchboard apparatus.

A further object is to provide an improved arrangement for enabling the trunking operator to project ringing current onto the line of the called subscriber until the latter responds to the call.

Another object is to provide an improved arrangement whereby the originating operator may have complete control or supervision of the connections and disconnections.

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 satisfactory and serviceable in use.

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

In the accompanying drawings, Figure 1 is a diagram illustrating a trunking system embodying the principles of my invention, and Fig. 2 is a detail.

In the diagram two common battery exchanges are shown connected by a trunk line, and a subscriber's substation is shown connected with each exchange. It will be understood that only such instruments, devices, and circuit connections are illustrated as are necessary to a full understanding of the invention.

Briefly stated, the system comprises any suitable number of subscribers' stations such, for example, as the subscribers' telephone sets located at the stations A and B. These subscribers' stations are connected in the usual manner with a switchboard apparatus at the exchange or central station; and in the present case, the said switchboard apparatus may be located at two different exchanges or central stations, or at the same central station, as may be desired. For example, the switchboard apparatus C with which the line running from station A is connected may be located at one exchange, while the switchboard apparatus D with which the line running from the subscriber's station B is connected may be located at another station or exchange. As shown, the line running from station A terminates in a spring-jack X, while the line extending from station B terminates in a spring-jack Y. It will be readily understood that the

operator's cord-connecting apparatus, as hereinafter more fully described, is employed by the operators at each exchange, or each division of the switchboard apparatus, for establishing connection between the spring-jacks of any two subscribers' lines. As illustrated, the switchboard apparatus C is connected with the switchboard apparatus D by means of one or more trunk lines, such, for example, as the trunk line E. The battery F associated with the switchboard apparatus C furnishes current to the subscribers' lines at this exchange for both talking and signaling purposes. In a similar manner, the battery F¹, associated with the switchboard apparatus D, furnishes current to the subscribers' lines of this exchange for both talking and signaling purposes.

The character of the different devices in the construction of the circuits, and the functions of the different instruments, will, however, be better understood by considering the various steps or operations necessary in connecting one subscriber's line of one exchange with a subscriber's line of the other exchange; and it will, of course, be understood that the different relays, impedance coils, switches, and other switching devices can be constructed in any suitable known or desired manner consistent with the mode of operation hereinafter explained.

As thus illustrated, and assuming that the subscriber at substation A desires to be connected up with substation B, the operations and circuit connections are as follows: The removal of the receiver *a* from the hook-switch at substation A serves to complete a line circuit from the battery F at the exchange indicated by C, through the conductor 1, through the impedance coil 2, through the coil of the line relay 3, thence through the line conductor 4, through the subscriber's transmitter 5, through the primary of the induction coil 6, through the contact-point 7 and the subscriber's hook-switch, thence through the other line conductor 9, through the impedance coil 10, and thence through the conductor 11 to said battery. The current flowing through this closed line circuit energizes the relay 3, causing it to attract its armature. The said armature, when attracted, completes a local circuit from the battery F through conductors 1 and 12, through the line lamp 13, which is the calling signal, through the contact-point 14, and the armature 15, and thence through the ground or common connections 16 and 17 to said battery. The current flowing through this local circuit causes the lamp 13 to glow, indicating that the subscriber at substation A desires to give an order for connection. The central operator at exchange C observing this signal, then inserts the answering plug of the cord circuit in the spring-jack corresponding to the line of substation A.

This completes a line circuit including the coil of the supervisory relay, rather than the coil of the line relay. In other words, when a plug is inserted, the current flows from the battery through the conductor 18, through the spring-jack 19, through the ring contact 20 of the plug, through the conductor 21, through the coil of said supervisory relay 22, through the cord-strand 23, thence through the plug tip 24, and through the jack-spring 25, to the line conductor 4, rather than through the coil of the line relay 3. This, it will be understood, is for the reason that the coil of the supervisory relay 22 is of less resistance than the coil of the line relay 3. In this way, the originating operator in answering a call automatically shunts out or short-circuits the line relay, so as to automatically restore or extinguish the line signal. The coil of the supervisory relay practically constitutes a shunt adapted to be placed in the line to short-circuit the line relay. The originating operator, after receiving the order for connection from the calling subscriber, then communicates with the trunking operator at exchange D. It will be readily understood that any suitable circuit arrangement can be employed for enabling the originating operator to talk to the calling subscriber, and also for enabling the two operators—that is, the originating operator and the trunking operator—to exchange instructions in regard to the desired connection.

The trunking operator, upon learning the character of the connection desired, then immediately assigns a certain idle trunk line between the two exchanges, which in this case is assumed to be the trunk line E. The originating operator, complying with the instructions given by the trunking operator, then inserts the calling-plug of the cord circuit in the trunk-jack connected with the trunk line assigned for use by the trunking operator. The calling plug, when inserted in this manner, operates to complete a local circuit from the battery F, through the conductors 25^a and 26, through the coil of the supervisory relay 27, through the conductor 28 and the armature 29, through the contact-point 30 and the conductor 31, thence through the conductor 32 and the sleeve 33 of the calling plug, thence through the ringing thimble 34 of the trunk-jack, and through the conductors 35 and 36 to said battery. This energizes the relay 27, causing it to attract its armature. The said armature, when attracted, completes another local circuit from the battery, through the conductors 25^a and 26, through the armature 37 and the contact point 38, thence through the conductor 39 and the supervisory lamp 40, through the conductor 41, and thence through the ground or common connections 42 and 17 to said battery.

The current flowing through this last local circuit causes the lamp 40 to glow. As will hereinafter appear, this lamp continues to glow until the called subscriber answers the call. In addition to these local circuits, the insertion of the calling plug operates to complete a line circuit from the battery F, through conductors 25^a and 43, through the resistance 44 of the spring 45 of the trunk-jack, through the ring contact 46 of the calling plug, thence through the conductor 47 and the coil of supervisory relay 48, through the cord strands 49, and the plug-tip 50, thence through the spring 51 of the trunk-jack, through the conductor 52 of the trunk-line, through the coil of the supervisory relay 53, thence through the other line conductor 54, and through the conductors 35 and 36 to said battery. The relative resistance of the relays 48 and 53 is such that the latter is energized, while the former is not. Consequently the relay 53 attracts its armature, while the relay 48 allows its armature 29 to remain resting against the back contact 30. Simultaneously with the assigning of the trunk line between the two exchanges, and providing the line of the called-for subscriber is not busy, the trunking operator inserts the plug of the trunking cord circuit in the jack corresponding to the called-for subscriber's line. This completes a circuit from the battery F¹, through the conductor 55 and the coil of the supervisory relay 56, thence through the conductors 57 and 58, through the strand 59 of the cord circuit, through the sleeve contact 60 of the plug, thence through the ring or thimble 61 of the jack, through the impedance coil 62, thence through the conductor 63, to said battery. The current passing through this circuit energizes the relay 56 causing it to attract its armature. The said armature, when attracted, completes a local circuit from the battery F¹, through the conductor 64 and the armature 65, through the contact point 66 and conductor 67, thence through the supervisory lamp 68 and the conductor 69, through the coil of the electro-magnet 70, of the trunking operator's ringing key, thence through the conductor 71, through the contact point 72, and the armature 73, and thence through the ground or common connections 74 and 75 to said battery. The current flowing through this circuit not only causes the supervisory lamp 68 to glow, but also energizes the electro-magnet 70. The trunking operator now presses the ringing key G, so as to put the generator G¹ on the called subscriber's line. It will be seen that this key, when pressed, remains in its shifted position by reason of its being brought into contact with the electro-magnet 70. Consequently, the generator continues to project ringing current onto the called subscriber's line until the receiver at substation B is re-

moved from the hook. The connection between the generator and the cord circuit is made, it will be seen, by pressing the springs *g* of the ringing key into contact with the contact points *g*¹.

When the called subscriber answers the call by removing the receiver from the hook-switch, a line circuit is completed from the battery F¹ through the conductor 76, through the line impedance 77, through the coil of line relay 77^a, thence through the line conductor 83, switch-hook 82, contact 81, primary 80 of the subscriber's induction coil, transmitter 79, line conductor 78, and through the impedance coil 62 and the conductor 63 to said battery. It will also be seen that a short-circuit is formed from the battery through the jack spring 84, through the ring contact 85 of the plug, through the coil of the supervisory relay 86, through the strand 87 of the cord circuit, thence through the plug-tip 88, through the tip-spring 89 of the jack, and thence to the line conductor, that is, when the plug is inserted by the trunking operator. In this way, the relay 77^a is shunted out or short-circuited, the coil of the supervisory relay 86 being of relatively low resistance. Consequently, the called subscriber, in answering a call, does not cause the line relay 77^a to be energized, and does not cause the line signal allotted to this line to be displayed. It will be seen, however, that the current passing through the relay 86 is sufficient to energize it and cause it to attract its armature. The said armature, when attracted, completes a local circuit from the battery F¹, through the conductor 90, and through the coil of the supervisory relay 91, thence through the conductor 92, and the contact point 93, through the armature 73, thence through the ground or common connections 74 and 75 to said battery. The current flowing through this said local circuit energizes the relay 91, and in attracting its armature it closes a shunt around the supervisory relay 53. This normally open shunt connection consists of the impedance coil 94, the armature 95, contact point 96, and the conductor 97. When closed, this shunt reduces the resistance of the circuit of the supervisory relay 53, without causing the latter to release its armature.

The relay 86 in attracting its armature operates to break the previously described local circuit, including the lamp 68. In this way, the subscriber in answering a call automatically extinguishes the supervisory lamp 68. Furthermore, the relay 53 when short circuited or shunted by the coil 94 permits sufficient current to pass through the trunk line to energize the relay 48. This relay 48, when energized, attracts its armature, and in this way breaks or opens the local circuit including the relay 27. This

relay 27 then in turn releases its armature and opens the circuit including the supervisory lamp 40. In this way, therefore, the called subscriber in answering a call not only automatically restores or extinguishes the supervisory lamp 68, which is associated with the trunking operator's cord circuit, but also automatically extinguishes or restores the supervisory lamp 40, which latter is associated with the originating operator's cord circuit. In this way, each operator is advised as soon as the called subscriber responds to the call.

The disconnections are made as follows:
 15 When the subscriber at substation A hangs up the receiver *a*, the line circuit including the supervisory relay 22 is opened up or broken, thereby allowing the said relay to release its armature. This in turn closes a
 20 local circuit from the battery F, through the conductor 98, the supervisory relay 99, the conductor 100, the armature 101, and the contact-point 102, through the conductors 103 and 104, through the plug sleeve 105,
 25 and the jack ring 106, thence through the conductor 107 and the impedance coil 10, and through the conductor 11 to said battery. The current flowing through this local circuit causes the relay 99 to attract its armature and the said armature when attracted
 30 closes another local circuit from the battery F, through the conductor 98 and the armature 108, through the contact point 109 and the supervisory lamp 110, through the
 35 ground or common connections 111 and 17 to said battery. Thus the subscriber at substation A in hanging up the receiver causes the automatic display of the supervisory signal consisting of the lamp 110, thereby advising the originating operator that the calling subscriber is through talking.

Now when the subscriber at substation B hangs up the receiver *b*, the line circuit is broken, and the supervisory relay 86 thereby deenergized. This relay when deenergized releases its armature causing the latter to complete a local circuit from the battery F¹ through the conductor 64 and the armature 65, through the contact-point 66 and
 45 the conductor 67, through the lamp 68 and the conductor 69, through the locking magnet 70, through the conductor 71, through the contact-point 72 and the armature 73, and thence through the ground or common
 50 connections 74 and 75 to said battery. This advises the trunking operator that the called subscriber is through talking, but the said operator does not pay any attention to this signal until a clearing out or disconnecting
 60 signal is received from the originating operator. When the originating operator withdraws the plug from the trunk jack, the trunk line circuit is broken and the bridge relay 53 is deenergized. This relay in releasing its armature causes a local circuit to

be completed from the battery F¹ through the conductors 67 and 113, through the contact-point 114 and the armature 115, through the supervisory lamp 116 and thence through the ground or common connections 117 and 75 to said battery. Acting on this signal, the trunking operator then withdraws the plug of the trunking cord-circuit from the jack of the called subscriber's line.

It will be observed that the called subscriber in hanging up the receiver B not only causes the lamp 68 to glow, but also causes the lamp 40 to glow at the originating operator's switchboard. This is for the reason that when the relay 86 releases its armature, it breaks the circuit of the supervisory relay 91, thereby opening the shunt connection around the relay 53. The flow of current through the trunking line circuit being thus reduced, the supervisory relay 48 is deenergized and causes its armature to close the
 80 aforescribed circuit through the supervisory relay 27. This latter relay in attracting its armature completes a local circuit through the lamp 40. Thus the called subscriber in hanging up the receiver causes the display of clearing-out signals at both the trunking and originating operator's switchboard. With this arrangement the originating operator has complete control of the connections and disconnections, and the trunking operator acts entirely on the instructions given by the originating operator.

With the provision of the back contact 118, the front contact 119, and the conductor 120, it will be seen that the lamp 116 will glow or light up in case the originating operator plugs into the jack of the trunk line before the trunking operator establishes connection between the trunking cord-circuit and the line of the called subscriber. In this way, the lamp 116 is adapted to serve as a sort of calling signal, as it is arranged to light up or glow as soon as the connection is made with the trunk line. It also serves as
 110 a means of indicating to the trunking operator that the originating operator has correctly understood the instructions and has established connection with the correct trunk line. In other words, the trunking operator can instruct the originating operator which trunk line to use, and if after doing so and before establishing connection with the called subscriber's line, the lamp 116 glows or lights up, the trunking operator then knows that the instructions given to the originating operator have been followed. As previously described, however, if the trunking operator plugs into the called-for subscriber's jack before the originating operator establishes connection with the trunk line, then the lamp 116 remains dark, inasmuch as the armature 65 is against the contact-point 66, and the energizing of the relay 53 cannot complete a local circuit through
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the lamp 116. But, as explained, when the originating operator disconnects from the trunk line, then the armature 115 falls back into contact with the contact point 114, and in this way the circuit is completed through the lamp 116 and the latter acts as a supervisory or clearing-out signal. If the subscriber at substation B is first to signal for a disconnection, then the lamps 68 and 40 are caused to glow, the called subscriber in this way signaling both the trunking and originating operators. Then when the subscriber at substation A signals for a disconnection, causing the lamp 110 to glow, the originating operator withdraws the plug from the jack of the trunk-line, causing the lamp 116 to glow. The trunking operator acting on this signal from the originating operator withdraws the plug of the trunking cord-circuit from the jack of the called subscriber.

It will be readily understood that the electromagnet 70, when energized, attracts the armature g^2 , thereby holding the switch-lever G and the switch-springs g in the previously described manner, and for the purpose set forth.

The electro-magnet 70 is responsive to the called subscriber to close the trunk or talking connection between the subscriber and take ringing current off the line of the called subscriber.

I claim as my invention:—

1. In a telephone system, the combination of a subscriber's line, a subscriber's circuit-changing device for opening and closing the line circuit, an operator's cord-circuit, a supervisory lamp associated with the cord-circuit, a generator associated with the cord-circuit, a ringing key for connecting the generator with the line, so as to project ringing current on to the line, an electro-magnet in the circuit of said supervisory lamp arranged to hold the said key in position to cause a continuous projection of ringing current on to the line until the subscriber answers the call, and a supervisory relay connected and arranged to break the circuit of the supervisory lamp and thereby release the ringing key as soon as the subscriber answers the call.

2. In a telephone system, the combination of a subscriber's line, a supervisory or clearing-out signal at the exchange connected and arranged to be displayed until the subscriber answers a call, means for projecting ringing current on the line, so as to call the said subscriber, an electromagnet in the circuit of the said clearing-out or supervisory signal, a ringing key arranged to be attracted by said magnet and held in position to cause a projection of ringing current on to the line, a supervisory relay controlling the circuit of said supervisory or clearing-out signal, and means at the subscriber's station for causing

said relay to open the circuit of the supervisory signal and thereby automatically discontinue the ringing current.

3. In a telephone system, the combination of a subscriber's line, a clearing-out signal connected and arranged to be displayed until the subscriber answers a call, means for projecting ringing current on to the line, so as to call a subscriber, a supervisory relay for controlling the circuit of said supervisory signal, a pair of springs for connecting the source of ringing current with the line, a key-lever arranged between and operating to spread said springs, an electro-magnet in the circuit of said supervisory signal adapted to attract and hold said key-lever in position and keep the source of ringing current connected with the line until the subscriber answers the call, and means at the subscriber's station for causing said relay to open the circuit of the supervisory signal when the subscriber answers the call.

4. In a telephone system, the combination of a calling subscriber's line, an originating operator's cord-circuit, a trunking operator's cord-circuit, a trunk line between the two cord-circuits, a called subscriber's line, a line relay for each line, a line signal associated with each line relay, supervisory relays in each cord-circuit adapted to be placed in the lines to short-circuit said line relays, a ringing key and a source of current connected for projecting ringing current on to the called subscriber's line, and a locking magnet arranged in the circuit of one of said supervisory signals and adapted to hold the ringing key in position to cause a continuous projection of ringing current on to the called subscriber's line until the call is answered.

5. In a telephone system, the combination of a calling subscriber's line, an originating operator's cord-circuit, a trunking operator's cord-circuit, a trunk line extending between the two cord-circuits, a called subscriber's line, line relays, line signals controlled by said line relays, supervisory relays in the cord-circuits adapted to be placed in the lines to short-circuit the line relays and restore the line signals, two supplemental relays associated with the originating operator's cord-circuit, two supervisory signals associated with the originating operator's cord-circuit and controlled conjointly by the supplemental relays and supervisory relays, two supervisory signals associated with the trunking operator's cord-circuit, two other relays both associated with the trunking operator's cord-circuit and one bridged across the trunk line, the supervisory lamps associated with the trunking operator's cord-circuit being conjointly controlled by the two last mentioned relays and one of said supervisory relays, and sources of current permanently connected with the said line.

6. In a trunking telephone system, the

combination of a trunk line, a trunking operator's cord circuit having two talking strands, a condenser in each strand to thereby prevent the passage of direct current through said strands, a relay associated with said cord circuit and bridged across said trunk line, and a supervisory signal controlled by said relay.

7. In a trunking telephone system, the combination of a trunk line, an originating operator's cord circuit adapted to be connected with one end thereof, a trunking operator's cord circuit connected to the other end thereof, comprising two talking strands and a condenser in each strand to thereby prevent the passage of direct current through said strands, a supervisory signal associated with said trunking operator's cord circuit, means for displaying said signal when the originating operator makes connection with the trunk line before the trunking operator has established connection with the called subscriber's line, and means for displaying said signal when the originating operator disconnects from said trunk line.

8. In a trunking telephone system, the combination of a trunk line, an originating operator's cord circuit adapted to be connected with one end thereof, a trunking operator's cord circuit connected to the other end comprising two talking strands and a condenser in each strand to thereby prevent the passage of direct current through said strands, a supervisory signal for said trunking operator's cord circuit, a relay bridged across said trunk and controlling parallel circuits for said signal, to thereby display said signal when the originating operator's cord circuit is connected with said trunk line, means for extinguishing said signal when the trunk is connected with the called line, and means controlled by said relay for again displaying said signal when the originating operator disconnects from the trunk line.

9. In a trunking telephone system, the combination of a trunk line, an originating operator's cord circuit adapted to be connected with one end thereof, a trunking operator's cord circuit connected to the other end, comprising two talking strands and a condenser in each strand to thereby prevent the passage of direct current through said strands, a supervisory relay bridged across said trunk line, a normally open shunt around said relay, a second supervisory relay for controlling the opening and closing of said shunt, and a third supervisory relay associated with the originating operator's cord circuit and adapted to be energized when said shunt is closed.

10. A trunking telephone system, comprising a trunk line terminating in a trunk cord having two talking conductors, a con-

denser in each conductor thereof, a supervisory relay bridged across said trunk line, means for shunting said relay by a low resistance shunt, and a supervisory device operated by the reduction of resistance in the trunk line circuit caused by the shunting of said relay.

11. In a trunking telephone system, the combination of subscribers' lines, originating and trunking operators' cord-circuits, a trunk line extending between the cord-circuits, a supervisory relay bridged across the trunk line, a normally open shunt around said supervisory relay, a second supervisory relay for controlling the opening and closing of said shunt, a supervisory lamp controlled in part by said first mentioned supervisory relay, a third supervisory relay arranged to control the circuit of said second supervisory relay, a second supervisory lamp controlled in part by said third supervisory relay, and a fourth supervisory relay arranged to control a normally open switchpoint in the circuit of both lamps.

12. In a telephone system, the combination of a line circuit, means for projecting a signaling current upon said line circuit, a supervisory signal to indicate when the line circuit is open, an electro-magnet in the circuit of said supervisory signal, normally open and normally closed switch-points in the circuit of said signal and magnet, said magnet being adapted to lock the said means for projecting signaling current in position to cause constant signaling until the line circuit is closed, and means controlled by the called subscriber in answering for de-energizing said magnet to discontinue the signaling.

13. A telephone system comprising a called telephone line, a source of ringing current and means including an operator's key for connecting it with the line, an electro-magnet and means including a local circuit for energizing it to hold the ringing current on the line until the called subscriber answers, and means excluded from the talking circuit and free from control by said magnet for deenergizing the latter when the subscriber answers.

14. A telephone system comprising a line, means including an operator's key for supplying ringing current to the line, an electro-magnet, means for energizing said magnet for holding the ringing current on the line until the called subscriber answers, and means including a supervisory relay excluded from the talking circuit and free from control by said magnet for deenergizing said magnet when the subscriber answers.

15. A telephone system comprising a line, means for supplying ringing current to the line, an electro-magnet for holding the current on the line until the called subscriber

answers, a supervisory signal device and means for operating it in series with said magnet, and means for deenergizing said magnet and retiring said signal when the subscriber answers.

16. A telephone system comprising means for trunking a calling line of one exchange into connection with a called line of another exchange, including a two-wire trunk-line between said exchanges, means for supplying ringing current to the called line until the subscriber answers, means for taking the current off when the called subscriber answers, and suitable means at both exchanges responsive to the answer of the called subscriber.

17. A telephone system comprising automatic ringing mechanism for ringing the called subscriber until he answers, means for opening both sides of the talking circuit and connecting said mechanism directly with the called subscriber's line, and means free from control by said mechanism and by which the called subscriber controls said mechanism to take the ringing current off the line and close talking connection with the calling line.

18. A telephone system comprising a trunk line for use between calling and called telephone lines, means for extending the calling line to the trunk line, means for extending the trunk line to the called line, suitable mechanism for keeping the trunk connection open and ringing the called subscriber until he answers, and means free from control by said mechanism and by which the called subscriber controls said mechanism to close the trunk connection and take the ringing current off the line.

19. A telephone system comprising a trunk line for use between calling and called telephone lines, means for extending the calling line to the trunk line, means for extending the trunk line to the called line, a source of ringing current, an electro-magnet controlling the continuity of the trunk connection and the supply of ringing current to the called subscriber's line, and means free from control by said mechanism and by which the called subscriber controls the said magnet to close the trunk connection for talking purpose and take ringing current off the line.

20. A telephone system comprising a talking circuit, a central source of ringing current,

means for putting the ringing current on the called line, and an electro-magnetic device responsive to the called subscriber and adapted to control both the continuity of said circuit and the supply of ringing current thereto, said device having only a single energizing circuit over which it has no control.

21. A telephone system comprising a talking circuit, an electro-magnet controlling the continuity of both sides of the talking circuit, and a device by which the called subscriber controls said magnet to close the said circuit, said device having an energizing circuit free from control by said magnet.

22. In a telephone system, subscribers' lines, a central source of talking current, a two-conductor trunk line, means for extending connection from the calling line to the trunk line, means for extending connection from the trunk line to the called line, means for applying ringing current to two sides of said trunk line, mechanism operated from said central source of current for holding the ringing current on the called subscriber's line until the latter answers, means for preventing the ringing current from passing back over the trunk line in the direction of the calling subscriber, and means having a circuit free from control by said mechanism for discontinuing the signaling current when the subscriber answers.

23. In a telephone system, a two-conductor trunk line, means for seizing one end of the trunk line to extend a calling connection thereto, means for extending connection from the other end of the trunk line in the direction of the called subscriber, means for applying ringing current to two sides of said trunk line, mechanism for keeping the ringing current on the called line until the subscriber answers, means for preventing the ringing current from passing back over the trunk line in the direction of the calling subscriber, and means having a circuit free from control by said mechanism for discontinuing the signaling current when the subscriber answers.

Signed by me at Chicago, Cook county, Illinois, this 29th day of December, 1903.

HENRY P. CLAUSEN.

Witnesses:

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