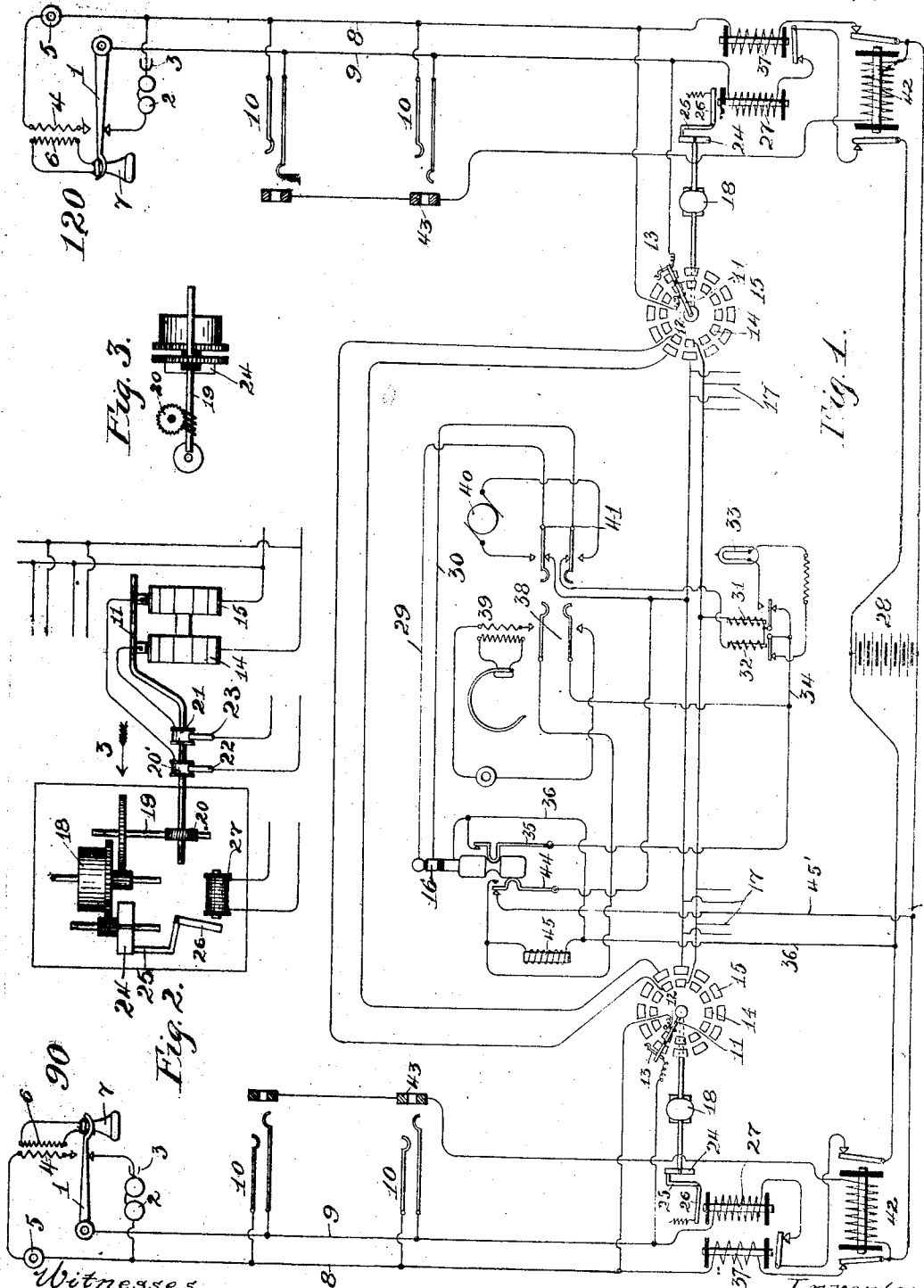


H. D. STROUD.
 TELEPHONE EXCHANGE SYSTEM.
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Patented Dec. 17, 1918.



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TELEPHONE-EXCHANGE SYSTEM.

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To all whom it may concern:

Be it known that I, HAROLD D. STROUD, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Telephone-Exchange Systems, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to telephone exchange systems, and has for its object the provision of automatic means for connecting subscribers' telephone lines with cord circuits, which cord circuits are also provided with manually operated means for uniting the same with telephone lines for completing connection between subscribers.

By means of my invention, I am enabled to have the calling subscriber's line automatically connected with the answering end of the cord circuit, the connecting end of the cord circuit being preferably provided with a connecting plug adapted for insertion within any of the ordinary line jacks. To this end, I preferably equip each subscriber's line with a traveling springjack adapted to be operated through the agency of apparatus actuated when a call is initiated, which springjack in its movement is brought into connection with the terminals of an idle cord circuit at the answering end thereof, whereupon an electromagnetic device has its operative condition changed to check the further movement of the traveling springjack to maintain the same in engagement with the said cord circuit terminals, whereby the cord circuit constitutes a continuation of the calling subscriber's line, the springjack being provided with springs connected with the sides of the said telephone line. The telephone lines are preferably unprovided with an individual line signal for each line, as I am able, by means of my invention, to have signals associated with the cord circuits act to indicate to the operator that a connection is desired. To this end, each cord circuit is provided with a signal actuating electromagnet or relay, which is operated when an idle cord circuit has been selected by the calling subscriber's selecting apparatus to actuate the signal controlled thereby, the signal being preferably in the form of a small incandescent

electric lamp, though I do not wish to be limited to this character of signal. The operator, after having communicated with the calling subscriber, through the agency of her telephonic outfit, inserts the connecting plug connected with the cord circuit to which the said signal corresponds, whereupon signaling current may be directed over the called subscriber's telephone line to actuate its signal. The clearing-out signal is preferably manifested by the same indicator. In order to effect a disconnection between the cord circuit and the calling subscriber's telephone line, I preferably employ an instrumentality governed in its operation by means of the connecting plug, which plug, upon being withdrawn from the called subscriber's springjack, serves to actuate the said instrumentality to effect a travel of the calling subscriber's moving springjack out of connection with the terminals at the answering end of the cord circuit, whereupon an electromagnet, preferably forming a part of the said instrumentality, is brought into play to stop the moving springjack, whereupon the cord circuit is restored to its normal condition, so that it may be automatically connected with another calling subscriber.

The advantages I gain by the apparatus of my invention are numerous.

In the first place, the operator's attention is confined to but one plug of each cord circuit. When the system is employed in connection with multiple switchboards, the especially provided answering jacks of the form now so well known may be dispensed with. Individual line signals for each telephone line are also rendered unnecessary, as they are preferably replaced by the reduced number of indicators employed only in connection with the cord circuits. This elimination of line jacks and individual line indicators for each telephone line lessens the attention the operator has to bestow upon the various signals and switches of the system. The capacity of switchboards by means of the invention may be increased, and the time for completing and breaking connections is greatly reduced, enabling the operator to increase her capacity.

I will explain the preferred embodiment of my invention in connection with the accompanying drawing, in which—

Figure 1 illustrates a multiple switch-

board telephone exchange system, having a semi-automatically controlled cord circuit constructed in accordance with the invention;

5 Fig. 2 is a detailed plan view of a motor and associated parts for actuating the moving springjack;

Fig. 3 is a side elevation looking in the direction of arrow 3 in Fig. 2.

10 At substations 90 and 120 I have illustrated one type of telephone substation apparatus, which is well understood by those skilled in the art, there being illustrated at each substation a gravity switchhook 1, provided with a normal contact constituting a terminal of a branch including a signal bell 2 and a condenser 3, and an alternate contact constituting a terminal of a branch including the primary 4 of an induction coil and the transmitter 5, the secondary 6 of the induction coil being included in the local circuit with a receiver 7. When the receiver is upon its switch hook the limbs 8 and 9 of the telephone line are united by means of the branch including the signal bell and condenser. When the receiver is removed from its hook, the said limbs are united by the branch including the transmitter and the primary of the induction coil. The limbs 8 and 9 extend to the exchange, and, in the case of multiple switchboards, are united with any usual form of line jacks 10, 10 upon the different sections of the particular board. The invention, however, is not to be limited to multiple switchboard systems. In the case of all switchboards each subscriber's telephone line is preferably provided with an additional springjack acting as a selector which is adapted to travel so as to seek the answering end of a cord circuit or connector rather than be manually sought by the answering end of the cord circuit, as hitherto. I do not wish to be limited, however, to this particular association of the automatic selector. This traveling springjack is preferably mounted upon a rotatable arm 11, the springs 12 and 13 constituting the springjack and connected with the limbs 8 and 9 respectively being mounted upon the arm but insulated from each other. The traveling springjack and the mechanism for operating the same are diagrammatically indicated in Fig. 1, their preferred structural form being illustrated in Figs. 2 and 3. Two peripheral rows of contacts, 14 and 15, are provided, with which the springs 12 and 13 are adapted for successive engagement. The radially alined contacts 14 and 15 of the switching appliance illustrated in Fig. 1 and the axially alined contacts 14 and 15 of the preferred form of the switching appliance illustrated in Figs. 2 and 3, are adapted for simultaneous engagement with the jack springs 12 and 13 respectively. Each of these pairs of alined contacts constitute the

terminals of the answering end of a corresponding cord circuit. I have illustrated but one cord circuit completely, but I have indicated the connection of two pairs of answering contacts to another cord circuit.

Each cord circuit is provided with a single connecting terminal plug 16 and a plurality of pairs of answering terminals 14 and 15 in multiple relation, for the purpose of providing a set of answering cord circuit contacts for each traveling springjack. In Fig. 1 two pairs of answering terminal contacts are illustrated in multiple relation, and branches 17, 17 for connection with other pairs of answering contacts are indicated. There are illustrated in Fig. 1 several disconnected pairs of contacts 14 and 15, but it is to be understood that these pairs are connected in a manner similar to the connected pairs shown.

I will now more particularly describe the instrumentalities for connecting the calling subscriber's line with the answering end of a cord circuit, and thereafter the operation of the additional instrumentalities entering into the service of connecting and disconnecting subscribers' lines.

To effect the travel of the arm 11 carrying the moving springjack, I preferably employ a motor 18, which may be a self-winding spring motor or motor of other type. This motor actuates a worm shaft 19, having engagement with a worm wheel 20, from which projects the arm 11, carrying the springs of the corresponding answering springjacks. These springs are connected with a pair of collector rings 20' and 21, with which contact brushes 22 and 23 are engaged, which contact brushes are directly connected with the line. The motor actuates a number of fan blades 24, across whose plane the nose 25, carried upon the armature 26, projects when the electromagnet 27, controlling the said armature, is deenergized, whereby the said worm shaft is held from rotation to secure the springs of the springjack in a stationary position, the said springs being normally disconnected from answering contacts of the cord circuit when the cord circuit is idle, as will be hereinafter explained. When a subscriber initiates a call, the electromagnet 27 is energized by being included in circuit with the common battery 28, occurring when the calling subscriber removes his telephone from its switch hook, this battery being excluded from circuit with the electromagnet when the telephone is upon its switch hook by the condenser included in the bell branch. The magnet, upon being thus energized, attracts its armature and removes the nose 25 from engagement with the fan blades 24, whereupon the motor 18 is permitted to operate to rotate the springjack upon the arm 11 into engagement with a pair of answering contacts 14, 15, the traveling springjack se-

lecting a pair of answering contacts of the line cord circuit in the manner to be presently set forth.

The cord circuit is, in this instance, provided with a tip strand 29, connected with one of the contacts 15 and a sleeve strand 30, connected with one of the contacts 14. The sleeve strand includes windings of two relays or electromagnets 31 and 32. The armature of the relay or magnet 31 controls the operation of a signal 33, preferably in the form of a small incandescent electric lamp. The armature 31, by resting on its normal contact, excludes the lamp 33 from circuit; by engaging its alternate contact, it includes the lamp 33 in circuit. The armature of the magnet 32 and its contact anvil are in series in the branch conductor including the signal 33. When a cord circuit is idle, the corresponding contact 14 is connected with one terminal of the common battery by way of the winding of relay 31, its armature, the normal contact anvil for the armature, the branch conductor 34, the spring 35 of a plug seat switch, and a branch conductor 36. If the cord circuit were busy, that is, were in use in connecting other subscribers' lines for conversation, the armatures of both electromagnets 31 and 32 would be attracted, thereby disconnecting the conductor 34 and the terminal of the battery connected with the said conductor from the particular sleeve strand connected with a contact 14. If, therefore, the moving spring-jack spring 12 comes into engagement with the contact 14 that is not thus connected with a terminal of the battery 28, it will continue in its travel until it does strike a contact that is connected with this battery terminal, whereupon circuit may be traced from the engaging contact 14, the winding 31, the lamp 33, the armature of magnet 32, the conductor 34, switch spring 35, conductor 36, to one terminal of the battery 28, thence from this battery through the winding of the electromagnet 37, back to the said jack spring 12. The circuit just traced through the "winding 31" and the "lamp 33" is a maintaining circuit for relay 37 and immediately replaces the initial energizing circuit, which is "by way of the winding of relay 31, its armature and the normal contact anvil for the armature." The magnet or relay 37 is thus energized, when an idle cord circuit has been thus automatically selected, to attract its armature from its contact anvil to open circuit through the magnet 27, thereby permitting the nose 25 to be thrust into the path of the fan blades 24.

It will be observed that the magnet 37 is of very low winding, so that owing to the resistance of the line, transmitter at the subscriber's station, and the other instrumentalities in the circuit, this magnet 37 is

not energized when a subscriber initiates a call, whereby the selector magnet 27 may be permitted to perform its function. When, however, a local circuit of low resistance is established by the connection of the spring 12 with a contact 14 of an idle cord circuit, sufficient current will be passed through this magnet 37 to permit it to open the circuit including the magnet 27 to arrest the further operation of the motor 18 and permit the arm 11 to rest. The lamp 33 is, simultaneously with the energization of the magnet 37, caused to glow, warning the operator that the cord circuit corresponding to the lamp has been automatically selected by a calling subscriber. The operator thereupon listens to the want of the calling subscriber. For this purpose, I have illustrated a manually operated listening key 38. Supposing, for example, that subscriber No. 90 is the calling subscriber, and that he wishes connection with subscriber No. 120; the operator, after operating key 38 removes the plug 16 from its seat, and inserts the connecting plug 16 into a stationary jack 10 of the called subscriber's line, and at the same time includes a signaling generator 40 in bridge of the cord circuit. I have illustrated a manually operated ringing key 41 for this latter purpose. I do not wish to be limited, however, to the manual operation of either or both keys 38 and 41. When the called subscriber responds by removing his telephone from its switch hook, circuit is also closed through the magnet 32, thereby opening the circuit including the lamp 33. A line relay 42 is provided in connection with each telephone line, this relay being provided with two armatures which normally preserve the connection of the electromagnets 27, 37 to the common battery 28. The connecting plug, however, is provided with a third contact adapted for engagement with the thimble 43 of a line jack, whereby a local circuit including the conductor 36, the said battery and the relay 42, is established, the armatures of the said relay being attracted to disconnect the magnets 27 and 37 from the common battery, whereby the operation of the selector magnet 27 of the called subscriber's line is prevented when the called subscriber removes his telephone from its switch hook. The connecting plug, having been withdrawn from engagement with its plug seat switch, releases the plug switch spring 44 to permit it to engage its alternate contact anvil and include impedance 45 in circuit with the battery 28.

After the subscribers have finished conversation, their receivers being restored, current through the magnet 32 ceases to flow but continues to flow through the magnet 31, the circuit through the latter magnet being traced from one pole of the battery 28 to

magnet 37 of the calling subscriber, the spring 12, the engaging contact 14, the magnet winding 31, electric lamp 33, the armature of the electromagnet 32, the conductor 34, the spring 35, conductor 36, to the other pole of the battery 28. The operator thereupon restores the plug 16 to its seat, and in so doing momentarily disengages the spring 35 from the terminal connected with the conductor 36. The connection, however, is immediately reeffected between the spring 35 and its anvil to place the signaling apparatus in condition to indicate a new call, the plug for this purpose being provided with a peripheral groove adapted for engagement with a bend in the spring 35.

To reset the moving springjack of the calling subscriber, the spring 44 through the agency of the restored plug connects a conductor 45' across the cord circuit, and, as the corresponding magnet 37 is deenergized, completes circuit through the selector magnet 27, whose armature is attracted to permit the motor 18 to operate. Current from battery 28 flows by way of 45', 44, tip strand of the cord to contact 15, spring 13, magnet 27 and back to battery 28 to reset the moving jack. The arm 11 is thereupon moved until the brushes 12 and 13 are removed from engagement with the engaging contacts 14 and 15, whereupon circuit through the electromagnet 27 is opened to release its armature and prevent the further operation of the said motor.

It will be seen that I have provided a telephone exchange system wherein the selecting mechanism includes traveling contacts that automatically connect calling lines with the answering ends of cord or link circuits, which link circuits have manually controlled terminals, preferably in the form of plugs. It will also be seen that the call signals are automatically controlled and are adapted for interchangeable association with different telephone lines. The manually controlled terminals of the link circuits operate upon the signal devices (which are preferably self restoring) and cause the same to change their indications, this result being preferably accomplished by having these manually controlled terminals operate upon circuits of said signal devices.

Where in the claims I use terms like "progressively traveling switch" or "automatic progressively selective" or "mechanism including a traveling member" or "traveling contact maker," I refer to selector mechanism having a traveling member capable of assuming a plurality of selective positions as distinguished from simple mechanism, like a relay for example, having only a simple forward and backward movement.

While I have herein shown and particularly described the preferred embodiment of my invention, I do not wish to be limited

to the precise disclosure herein set forth; but having thus described my invention, I claim as new and desire to secure by Letters Patent:—

1. The combination with telephone lines extending from subscribers' stations to an exchange, of a plurality of cord circuits at the exchange, each including a manually operated terminal connecting plug, a plurality of sets of answering switch contacts connected to the said cord circuits, the answering contacts of the different cord circuits being arranged in multiply related groups, a moving springjack for each telephone line adapted for successive connection with the cord circuits by engagement with the answering contacts, motor mechanism for effecting the travel of the moving springjack, and means associated with each telephone line whereby the calling subscriber may control the operation of the motor mechanism to effect the connection of the moving springjack with the answering end of the cord circuit, substantially as described.

2. The combination with telephone lines extending from subscribers' stations to an exchange, of a plurality of cord circuits at the exchange, each including a terminal connecting plug, a plurality of sets of answering switch contacts connected to the said cord circuits, the answering contacts of the different cord circuits being arranged in multiply related groups, a moving springjack for each telephone line adapted for connection with the cord circuits by engagement with the answering contacts, motor mechanism for effecting the travel of the moving springjack, means associated with each telephone line whereby the calling subscriber may control the operation of the motor mechanism to effect the connection of the moving springjack with the answering end of the cord circuit, an electromagnet associated with each moving springjack for arresting the travel of the springjack when it is brought into engagement with an idle cord circuit, and switching means controlled by the connecting plug of each cord circuit for governing the circuit of the said electromagnet to permit the passage of the said moving springjack past the answering contacts of busy cord circuits and to arrest the travel of the springjack when brought into engagement with the answering contacts of an idle cord circuit, substantially as described.

3. The combination with telephone lines extending from subscribers' stations to an exchange, of a plurality of cord circuits at the exchange, each including a terminal connecting plug, a plurality of sets of answering switch contacts connected to the said cord circuits, the answering contacts of the different cord circuits being arranged

in multiply related groups, a moving springjack for each telephone line adapted for connection with the cord circuits by engagement with the answering contacts, motor mechanism for effecting the travel of the moving springjack, means associated with each telephone line whereby the calling subscriber may control the operation of the motor mechanism to effect the connection of the moving springjack with the answering end of the cord circuit, an electromagnet associated with each moving springjack for arresting the travel of the springjack when it is brought into engagement with an idle cord circuit, and a plug seat switch for each cord circuit engaged by the corresponding connecting plug when idle for governing the circuit of the said electromagnet to permit the passage of the said moving springjack past the answering contacts of busy cord circuits and to arrest the travel of the springjack when brought into engagement with the answering contacts of an idle cord circuit, substantially as described.

4. The combination with telephone lines extending from subscribers' stations to an exchange, of a plurality of cord circuits at the exchange, each including a terminal connecting plug, a plurality of sets of answering switch contacts connected to the said cord circuits, the answering contacts of the different cord circuits being arranged in multiply related groups, a moving springjack for each telephone line adapted for connection with the cord circuits by engagement with the answering contacts, motor mechanism for effecting the travel of the moving springjack, means associated with each telephone line whereby the calling subscriber may control the operation of the motor mechanism to effect the connection of the moving springjack with the answering end of the cord circuit, an electromagnet associated with each moving springjack for arresting the travel of the springjack when it is brought into engagement with an idle cord circuit, means controlled by the connecting plug of each cord circuit for governing the circuit of the said electromagnet to permit the passage of the said moving springjack past the answering contacts of busy cord circuits and to arrest the travel of the springjack when brought into engagement with the answering contacts of an idle cord circuit, and means governed by the said terminal plug for effecting the restoration of the moving springjack when the said connecting plug is disconnected from the telephone line, substantially as described.

5. The combination with telephone lines extending from subscribers' stations to an exchange, of a plurality of cord circuits at the exchange each including a terminal con-

necting plug, a plurality of sets of answering switch contacts connected to the said cord circuits, the answering contacts of the different cord circuits being arranged in multiply related groups, a moving springjack for each telephone line adapted for connection with the cord circuits by engagement with the answering contacts, motor mechanism for effecting the travel of the moving springjack, means associated with each telephone line whereby the calling subscriber may control the operation of the motor mechanism to effect the connection of the moving springjack with the answering end of the cord circuit, an electromagnet associated with each moving springjack for arresting the travel of the springjack when it is brought into engagement with an idle cord circuit, means controlled by the connecting plug of each cord circuit for governing the circuit of the said electromagnet to permit the passage of the said moving springjack past the answering contacts of busy cord circuits and to arrest the travel of the springjack when brought into engagement with the answering contacts of an idle cord circuit, and means governed by the said terminal plug for effecting the restoration of the moving springjack when the said connecting plug is disconnected from a telephone line, the latter means including an electromagnet and a circuit-closing switch operated by the connecting plug when restored to permit the travel of the moving springjack, the said electromagnet being included in circuit with the springjack, whereby when the springjack is brought out of connection with the answering end of the cord circuit the electromagnet is deenergized, checking the further progress of the traveling springjack, substantially as described.

6. The combination with telephone lines extending from subscribers' stations to an exchange, of a plurality of cord circuits at the exchange, each including a terminal connecting plug, a plurality of sets of answering switch contacts connected to the said cord circuits, the answering contacts of the different cord circuits being arranged in multiply related groups, a moving springjack for each telephone line adapted for connection with various cord circuits by engagement with the answering contacts, motor mechanism for effecting the travel of the moving springjack, means associated with each telephone line whereby the calling subscriber may control the operation of the motor mechanism to effect the connection of the moving springjack with the answering end of the cord circuit, and an indicator in association with each cord circuit and operated upon connection of a moving springjack with the answering end of the selected cord circuit, substantially as described.

7. The combination with telephone lines extending from subscribers' stations to an exchange, of a plurality of cord circuits at the exchange, each including a terminal connecting plug, a plurality of sets of answering switch contacts connected to the said cord circuits, the answering contacts of the different cord circuits being arranged in multiply related groups, a moving springjack for each telephone line adapted for connection with the cord circuits by engagement with the answering contacts, motor mechanism for effecting the travel of the moving springjack, means associated with each telephone line whereby the calling subscriber may control the operation of the motor mechanism to effect the connection of the moving springjack with the answering end of the cord circuit, an electromagnet associated with each moving springjack for arresting the travel of the springjack when it is brought into engagement with an idle cord circuit, means controlled by the connecting plug of each cord circuit for governing the circuit of the said electromagnet to permit the passage of the said moving springjack past the answering contacts of busy cord circuits and to arrest the travel of the springjack when brought into engagement with the answering contacts of an idle cord circuit, and an indicator in association with each cord circuit and operated upon connection of a moving springjack with the answering end of the selected cord circuit, substantially as described.

8. The combination with telephone lines extending from subscribers' stations to an exchange, of a plurality of cord circuits at the exchange, each including a terminal connecting plug, a plurality of sets of answering switch contacts connected to the said cord circuits, the answering contacts of the different cord circuits being arranged in multiply related groups, a moving springjack for each telephone line adapted for connection with the cord circuits by engagement with the answering contacts, motor mechanism for effecting the travel of the moving springjack, means associated with each telephone line whereby the calling subscriber may control the operation of the motor mechanism to effect the connection of the moving springjack with the answering end of the cord circuit, and a clearing-out indicator included in each cord circuit, substantially as described.

9. The combination with telephone lines extending from subscribers' stations to an exchange, of a plurality of cord circuits at the exchange, each including a terminal connecting plug, a plurality of sets of answering switch contacts connected to the said cord circuits, the answering contacts of the different cord circuits being arranged in multiply related groups, a moving spring-

jack for each telephone line adapted for connection with the cord circuits by engagement with the answering contacts, motor mechanism for effecting the travel of the moving springjack, means associated with each telephone line whereby the calling subscriber may control the operation of the motor mechanism to effect the connection of the moving springjack with the answering end of the cord circuit, an electromagnet associated with each moving springjack for arresting the travel of the springjack when it is brought into engagement with an idle cord circuit, means controlled by the connecting plug of each cord circuit for governing the circuit of the said electromagnet to permit the passage of the said moving springjack past the answering contacts of busy cord circuits and to arrest the travel of the springjack when brought into engagement with the answering contacts of an idle cord circuit, and a clearing out indicator included in each cord circuit, substantially as described.

10. In a telephone exchange system, the combination with telephone lines extending from substations to an exchange, of cord-connecting apparatus at the exchange including a manually operated terminal plug at one end of the cord circuit, a switching appliance at the other end of the cord circuit, means controlled by a subscriber for effecting the operation of the said switching appliance to connect the cord circuit with his telephone line, and means controlled by the terminal plug and operated thereby when being restored to its idle condition to effect the restoration of the switching appliance and its disconnection from the said cord circuit, substantially as described.

11. In a telephone exchange system, the combination with a group of telephone lines extending from sub-stations to an exchange, of a plurality of cord connectors at the exchange, each including a manually operated terminal plug at one end of the cord circuit and having a traveling switch at the other end of the cord circuit and means to propel the traveling switch past undesirable positions, and means serving to arrest the operation of a traveling switch and cause it to connect an idle cord circuit with the telephone line of a calling subscriber, substantially as described.

12. In a telephone exchange system, the combination with telephone lines extending from sub-stations to an exchange, of a plurality of cord connectors at the exchange, each including a manually operated terminal plug at one end of the cord circuit, a traveling switching appliance at the other end of the cord circuit and constituting a line terminal, a plurality of contacts for the plurality of cord circuits, with any of which the traveling terminal may make contact,

and means controlled by a subscriber for governing the traveling switching appliance to connect his line with a cord circuit, substantially as described.

5 13. In a telephone exchange system, the combination with a group of telephone lines extending from substations to an exchange, of a plurality of cord connectors at the exchange, each including a manually operated
10 terminal plug at one end of the cord circuit and having a traveling switch at the other end of the cord circuit, means for propelling said traveling contact past undesirable positions, means serving to arrest the operation
15 of a traveling switch and cause it to connect an idle cord circuit with the telephone line of a calling subscriber, and a signal at the exchange controlled by said subscriber's apparatus to indicate the fact of his connection with a cord circuit, substantially as
20 described.

14. In a telephone exchange system, the combination with telephone lines extending from sub-stations to an exchange, of a plurality of cord connectors at the exchange,
25 each including a manually operated terminal plug at one end of the cord circuit, a traveling switching appliance at the other end of the cord circuit and constituting a line terminal, a plurality of contacts for the plurality of cord circuits, with any of which
30 the traveling terminal may make contact, means controlled by a subscriber for governing the traveling switching appliance to connect his line with a cord circuit, and a signal at the exchange controlled by said subscriber's apparatus, to indicate the fact of his connection with a cord circuit, substantially
35 as described.

40 15. In a telephone exchange system, the combination with a group of telephone lines extending from sub-stations to an exchange, of a plurality of cord connectors at the exchange, each including a manually operated
45 terminal plug at one end of the cord circuit and having a traveling switch at the other end of the cord circuit and means serving to arrest the operation of a traveling switch and cause it to connect a cord circuit
50 with the telephone line of a calling subscriber, and a signal controlled by current in the cord circuit and operated by said subscriber's apparatus to indicate the fact of his connection with a cord circuit, substantially
55 as described.

16. In a telephone exchange system, the combination with telephone lines extending from sub-stations to an exchange, of a plurality of cord connectors at the exchange,
60 each including a manually operated terminal plug at one end of the cord circuit, a traveling switching appliance at the other end of the cord circuit and constituting a line terminal, a plurality of contacts for the
65 plurality of cord circuits, with any of which

the traveling terminal may make contact, and means controlled by a subscriber governing the traveling switching appliance to connect his line with a cord circuit, and a signal controlled by current in the cord circuit and operated by said subscriber's apparatus to indicate the fact of his connection with a cord circuit, substantially as described.

17. The combination with telephone lines extending from subscribers' stations to an exchange, of a plurality of link circuits at the exchange, each including a manually operated terminal, a plurality of sets of answering switch contacts connected to the said link circuits, the answering contacts of the different link circuits being arranged in multiply related groups, a moving jack for each telephone line adapted for connection with the link circuits by engagement with the answering contacts, motor mechanism for effecting the travel of the moving jack past busy link circuit answering contacts, and means associated with each telephone line whereby the calling subscriber may control the operation of the motor mechanism to effect the connection of the moving jack with the answering end of an idle link circuit.

18. The combination with telephone lines extending from subscribers' stations to an exchange, of a plurality of link circuits at the exchange, each including a terminal, a plurality of sets of answering switch contacts connected to the said link circuits, the answering contacts of the different link circuits being arranged in multiply related groups, a moving jack for each telephone line adapted for successive connection with the link circuits by engagement with the answering contacts, motor mechanism for effecting the travel of the moving jack, means associated with each telephone line whereby the calling subscriber may control the operation of the motor mechanism to effect the connection of the moving jack with the answering end of the link circuit, and an indicator in association with each link circuit and operated upon connection of a moving jack with the answering end of the selected link circuit.

19. The combination with telephone lines extending from subscribers' stations to an exchange, of a plurality of link circuits at the exchange, each including a terminal, a plurality of sets of answering switch contacts connected to the said link circuits, the answering contacts of the different link circuits being arranged in multiply related groups, a moving jack for each telephone line adapted for connection with the link circuits by successive engagement with the busy answering contacts, motor mechanism for effecting the travel of the moving jack, means associated with each telephone line

whereby the calling subscriber may control the operation of the motor mechanism to effect the connection of the moving jack with the answering end of an idle link circuit, and a clearing-out indicator included in each link circuit.

20. In a telephone exchange system, the combination with a group of telephone lines extending from sub-stations to an exchange, of a plurality of link connectors at the exchange, each including a manually operated terminal at one end of the link circuit and having a traveling switch at the other end of the link circuit, and means serving to arrest the operation of a traveling switch and cause it to connect a link circuit with the telephone line of a calling subscriber.

21. In a telephone exchange system, the combination with telephone lines extending from sub-stations to an exchange, of a plurality of link connectors at the exchange, each including a manually operated terminal at one end of the link circuit, a traveling switching appliance at the other end of the link circuit and constituting a line terminal, a plurality of contacts for the plurality of link circuits, with any of which the same contact surface of the traveling terminal may make contact, and means controlled by a subscriber for governing the traveling switching appliance to connect his line with a link circuit.

22. In a telephone exchange system, the combination with a group of telephone lines extending from sub-stations to an exchange, of a plurality of link connectors at the exchange, each including a manually operated terminal at one end of the link circuit and having a traveling switch at the other end of the link circuit, means serving to arrest the operation of a traveling switch and cause it to connect a link circuit with the telephone line of a calling subscriber, and a signal at the exchange controlled by said subscriber's apparatus to indicate the fact of his connection with a link circuit.

23. In a telephone exchange system, the combination with telephone lines extending from sub-stations to an exchange, of a plurality of link connectors at the exchange, each including a manually operated terminal at one end of the link circuit, a traveling switching appliance at the other end of the link circuit and constituting a line terminal, a plurality of contacts for the plurality of link circuits, with any of which the same contact surface of the traveling terminal may make contact, and means controlled by a subscriber for governing the traveling switching appliance to connect his line with a link circuit, and a signal at the exchange controlled by said subscriber's apparatus, to indicate the fact of his connection with a link circuit.

24. In a telephone system, a switch-board,

a subscriber's telephone line, a selective switch for said line, selecting contacts for said switch, waiting contacts for said selecting switch, links leading from said waiting contacts to said switch-board, means outside of said switch for rendering some of said links busy, means for automatically moving said selecting contacts over past the waiting contacts of busy links, other telephone lines, multiple jacks in said switch-board pertaining to said telephone line, multiple jacks in said switch-board pertaining to said other telephone lines, and connecting means in said switch-board whereby any link may be connected to a multiple jack of a selected line.

25. In a telephone system, a switch-board, a subscriber's telephone line, a selective switch for said line, selecting contacts for said switch, waiting contacts for said selecting switch, links leading from said waiting contacts to said switch-board, means outside of said switch for rendering some of said links busy, means for automatically moving said selecting contacts over the waiting contacts of the busy links, means for stopping said selecting contacts on the waiting contacts of the first idle link, other telephone lines, multiple jacks for said telephone line in said switch-board, multiple jacks for said other telephone lines in said switch-board, and plugs forming terminals for said links and adapted to connect with a multiple jack of a selected one of said telephone lines.

26. In a subscriber's telephone line, a selective switch associated therewith, a multiple switch-board, selecting contacts for said selective switch, stationary contacts for said selective switch, a series of links leading from said stationary contacts to said multiple switch-board, and means for causing said selective switch to automatically move said selecting contacts into engagement with the stationary contacts of the first idle link of said series.

27. In a telephone system, a subscriber's line, a multiple switch-board in which said subscriber's line terminates, a selecting switch for said line, movable trunk hunting contacts upon said switch, stationary contacts for said selecting switch, means under the control of the subscriber's line for causing said movable contacts to engage certain of said stationary contacts, other subscribers' lines terminating in said multiple switch-board, links extending from said stationary contacts to said multiple switch-board, and switching means in said switch-board whereby any link may be connected with any line.

28. In a telephone system, a switch-board, a subscriber's telephone line, a selective switch for said line, selecting contacts for said switch, waiting contacts for said selecting switch, links leading from said waiting contacts to said switch-board, means for

automatically moving said selecting contacts past the waiting contacts of busy links, other telephone lines, multiple jacks in said switch-board pertaining to said telephone line, multiple jacks in said switch-board pertaining to said other telephone lines, and connecting means in said switch-board whereby any link may be connected to a multiple jack of a selected line.

ing signal devices associated with said link circuits and operable by apparatus at said stations, automatic selecting mechanism, including traveling contacts, for connecting the answering ends of certain of said link circuits interchangeably with different telephone lines, and operator-controlled terminals for certain of said link circuits for use in connecting the link circuits with called lines, said terminals controlling the restoration of said signals.

29. A telephone exchange system, including telephone lines extending from stations to an exchange, link circuits for uniting telephone lines in conversation, signal devices associated with said link circuits and operable by apparatus at said stations, automatic selecting mechanism for connecting the answering ends of said link circuits interchangeably with different telephone lines, and manually manipulated terminals for said link circuits serving to act upon circuits of said signal devices to alter the indications thereof.

34. A telephone exchange system, including telephone lines extending from stations to an exchange, link circuits for uniting telephone lines in conversation, self-restoring call signal devices associated with said link circuits, automatic selector mechanism including a traveling contact maker for connecting the answering ends of certain of said link circuits and said call signal devices interchangeably with different telephone lines, and operator-controlled terminals for certain of said link circuits for use in connecting said link circuits with called lines and for restoring said signals.

30. A telephone exchange system, including telephone lines extending from stations to an exchange, link circuits for uniting telephone lines in conversation, signal devices associated with said link circuits and operable by apparatus at said stations, automatic selecting mechanism, including traveling contacts, for connecting the answering ends of said link circuits interchangeably with different telephone lines, and manually manipulated terminals for said link circuits serving to act upon circuits of said signal devices to alter the indications thereof.

35. A telephone exchange system, including telephone lines extending from stations to an exchange, call signal devices at the exchange, automatic selecting mechanism for interchangeably associating said call signal devices with different telephone lines, and link circuits having manually manipulated terminals serving automatically to change the indications of said signal devices.

31. A telephone exchange system, including telephone lines extending from stations to an exchange, link circuits for uniting telephone lines in conversation, signal devices associated with said link circuits and operable by apparatus at said stations, automatic selecting mechanism for connecting the answering ends of said link circuits interchangeably with different telephone lines, and manually manipulated terminals for said link circuits serving automatically to change the indication of said signal devices.

36. A telephone exchange system, including telephone lines extending from stations to an exchange, call signal devices at the exchange, automatic selecting mechanism for interchangeably associating said call signal devices with different telephone lines, and link circuits having manually manipulated terminals serving to change the circuits of the signal devices to alter their indications.

32. A telephone exchange system, including telephone lines extending from stations to an exchange, link circuits for uniting telephone lines in conversation, signal devices associated with said link circuits and operable by apparatus at said stations, automatic selecting mechanism, including traveling contacts, for connecting the answering ends of said link circuits interchangeably with different telephone lines, and manually manipulated terminals for said link circuits serving automatically to change the indication of said signal devices.

37. A telephone exchange system, including telephone lines extending from stations to an exchange, link circuits for uniting telephone lines in conversation, call signal devices associated with said link circuits, automatic selecting mechanism for connecting the answering ends of said link circuits and said call signal devices interchangeably with different telephone lines, and manually manipulated terminals for said link circuits for connecting said link circuits with called lines and serving automatically to alter the indications of said call signal devices.

33. A telephone exchange system, including telephone lines extending from stations to an exchange, link circuits for uniting telephone lines in conversation, self-restor-

38. A telephone exchange system, including telephone lines extending from stations to an exchange, link circuits for uniting telephone lines in conversation, call signal devices associated with said link circuits, automatic selecting mechanism for connecting the answering ends of said link circuits and said call signal devices interchangeably

with different telephone lines, and manually manipulated terminals for said link circuits for connecting said link circuits with called lines and serving to change the circuits of said call signal devices to alter their indications.

39. A telephone exchange system, including telephone lines extending from stations to an exchange, link circuits for uniting telephone lines in conversation, signal devices associated with said link circuits, automatic selecting mechanism for connecting the answering ends of said link circuits and said signal devices interchangeably with different telephone lines, and manually manipulated terminals for said link circuits for connecting said link circuits with called lines and serving automatically to alter the indications of said signal devices.

40. A telephone exchange system, including telephone lines extending from stations to an exchange, link circuits for uniting telephone lines in conversation, signal devices associated with said link circuits, automatic selecting mechanism for connecting the answering ends of said link circuits and said signal devices interchangeably with different telephone lines, and manually manipulated terminals for said link circuits for connecting said link circuits with called lines and serving to change the circuits of said signal devices to alter their indications.

41. In a telephone system, the combination with a line electromagnet, of a cut-off relay, a plurality of trunks, an automatic selecting switch adapted to connect its wipers with said trunks successively, a source of current, circuit connections by which said line magnet is energized from said source of current to start said automatic selecting switch to connect its wipers with said trunks successively and by which said cut-off relay is energized from said same source of current to stop said automatic selecting switch with its wipers in connection with one of said trunks, and means for opening the circuit of said cut-off relay whereby the control of said automatic switch is again placed under the control of said line electromagnet.

42. In a telephone exchange system, the combination with a line electromagnet, a test relay, a plurality of trunks, an automatic selecting switch adapted to connect its wipers with said trunks successively, a source of current, circuit connections whereby said line magnet is energized from said source of current to start said automatic selecting switch and by which said test relay is energized from said same source of current to stop said automatic selecting switch with its wipers in connection with one of said trunks, a circuit by which said test relay is energized from said same source of current when the wipers of said automatic selecting switch are in contact with a non-

busy trunk, and means for opening said test relay circuit whereby the said relay deenergizes and places the said automatic selecting switch in condition for reoperation.

43. A telephone system including a metallic telephone line, a line electromagnet therefor, a central source of current for supplying talking current to said metallic line, circuit connections for energizing said electromagnet from said source of current, multiple contacts, automatic traveling trunk hunting switch wipers responsive to said electromagnet to connect said line with idle contacts, a cut-off electromagnet for said line, and a circuit extending from said source of current for operating said cut-off electromagnet to disconnect said line electromagnet from the line, said circuit becoming effective on connection of said line with said idle contacts.

44. A telephone system including a metallic telephone line, traveling testing switch mechanism at the exchange, a central source of current for furnishing all necessary operating current, an electromagnet temporarily connected with said line and source of current and operable from the substation to control the actuation of said mechanism, switching mechanism automatically energized from said same source of current by the operation of said mechanism to disconnect said magnet from the line, and means for deenergizing said switch mechanism to again connect the said electromagnet to the line.

45. A telephone system including substation telephone lines, automatic testing switches, link circuits multiply connected with contacts of said switches, a source of current, means controlled at the substations and energized from said source of current for effecting operation of said switches for interconnecting said lines and link circuits interchangeably, and an electromagnet for each switch adapted to be energized from said same source of current upon connection by an associated switch with an idle trunk circuit for preventing further operation of the switch.

46. A telephone system including telephone lines, a link-circuit at the exchange, means for uniting said lines for conversation over said circuit, said means including an automatic progressive idle link selector at one end of said circuit having a contact maker capable of assuming a plurality of selective positions and an operator-controlled switch at the other end thereof, and signaling means controllable from a connected substation.

47. A telephone system including telephone lines, a plurality of signals common thereto, and means including an automatic idle trunk hunting traveling switch having a contact maker capable of assuming a plu-

ality of selective positions for temporarily rendering any one of certain of said signals individual to one of said lines.

48. A telephone system including telephone lines, operator-controlled link-circuits and automatic idle trunk hunting traveling switches associated with said link-circuits and having a contact maker capable of assuming a plurality of selective positions for connecting with and extending said lines.

49. A pair of connected metallic circuit telephone lines, an automatic progressively traveling trunk hunting switch individually to and operable over the metallic circuit of the calling line, and having contacts capable of assuming a plurality of connecting positions included in the talking circuit, and a central source of talking current.

50. In a telephone system a telephone line, an automatic idle trunk hunting traveling switch at the exchange having a contact maker capable of assuming a plurality of selective positions, terminals for said line adapted to be included in the talking circuit, a link circuit, means for operating said contact maker so as to connect said terminals with said link circuit and operator controlled means for extending said line to a called line, said means including said link circuit.

51. A telephone system including a telephone circuit, a battery at the exchange for supplying talking current to said circuit, battery connections therefor, said connections including an electromagnet winding at the exchange directly connected with said circuit, link circuits associated with said telephone circuit, traveling switch mechanism having a contact maker capable of assuming a plurality of selective positions operable responsive to circuit changes produced in said telephone circuit to automatically cause said telephone circuit to be connected with an idle link circuit, and a second electromagnet and switch apparatus controlled thereby automatically effective on connection of said telephone circuit with an idle link circuit to alter said battery connections and disconnect said electromagnet winding from the circuit, said second electromagnet being energized from said battery.

52. A telephone system including a calling line and a called line, link circuits adapted for use in extending a conversational circuit from the calling line to the called line, a common battery at the exchange for supplying talking current to said lines, an automatic switching device at the exchange including traveling mechanism having a contact maker capable of assuming a plurality of selective positions, contacts individual to the calling line included in said device, contacts of link circuits included in said device, and apparatus at the calling substation for

closing the metallic circuit of the line through said common battery, said switching device being responsive thereto to automatically connect contacts of said line operatively with contacts of an idle link circuit.

53. A telephone system including a calling line and a called line, link circuits adapted for use in extending a conversational circuit from the calling line to the called line, a common battery at the exchange for supplying talking current to said lines, an automatic switching device at the exchange including traveling mechanism having a contact maker capable of assuming a plurality of selective positions, contacts individual to the calling line included in said device, contacts of link circuits included in said device, apparatus at the calling substation for closing the metallic circuit of the line through said common battery, said switching device being responsive thereto to automatically connect contacts of said line operatively with contacts of an idle link circuit, and an electromagnet for the calling line automatically effective on said connection to alter the calling line's normal circuit connections at the exchange.

54. In a telephone system, a telephone line, a manual terminal for said line, adapted to be included in the talking circuit, an automatic terminal for said line at the exchange, adapted to be included in the talking circuit, manual means for establishing connection to said manual terminal, and an automatic traveling switch having a contact maker capable of assuming a plurality of selective positions for establishing connection to said automatic terminal.

55. In a telephone exchange system, the combination with a group of telephone lines extending from substations to an exchange, of a plurality of trunk circuits at the exchange, each including an operator-controlled switch at one end of the trunk circuit, traveling idle trunk hunting switches associated with the other end of the trunk circuits and having a contact maker capable of assuming a plurality of selective positions and means serving to arrest the operation of a traveling switch and cause it to connect a trunk circuit with the telephone line of a calling subscriber.

56. In a telephone exchange system, the combination with a group of telephone lines extending from substations to an exchange, of a plurality of trunk circuits at the exchange, each including an operator-controlled switch at one end of the trunk circuit, traveling trunk hunting switches associated with the other end of the trunk circuits, and having a contact maker capable of assuming a plurality of selective positions, and means serving to arrest the operation of a traveling switch and cause it to connect a trunk circuit with the telephone

line of a calling substation, and a signal at the exchange controlled by the calling substation apparatus to indicate the fact of its connection with a trunk circuit.

57. A pair of connected telephone lines, an individual selective switch having a contact maker capable of assuming a plurality of selective positions, and operated over the metallic line circuit upon the initiation of a call over the calling line and having contacts included in the talking circuit, and a central source of talking current.

58. In a signaling system, the combination with a subscriber's station, of an operator-controlled link-circuit at the central station for connecting subscribers' stations, a source of electricity connected to the said link-circuit and adapted to furnish transmitter currents to connected stations, means for connecting said subscriber's station with said link-circuit, driven means for actuating said connecting means and means adapted to be energized by said source of electricity for arresting the movement of said connecting means.

59. A telephone system comprising a substation, a metallic circuit connecting said substation with the central office, a central source of current for supplying talking current over said circuit, a selector switch at the exchange connected to said line including mechanism energized from said source of current and controlled over the metallic circuit for operating said switch, link circuits for extending the talking circuit of said line and connected to contacts of said switch whereby said switch when operated will successively test said link circuits to extend connection from said line to an idle one of them and means for supplying talking current from said source through the connected link-circuit to said line.

60. In a telephone exchange system, the combination with metallic telephone lines normally open at the substations of a central source of current for supplying talking current to said lines, a trunk circuit at the central office common to said telephone lines, and a rotary switch started upon the closure of a circuit from said source of current over the limbs of one of said telephone lines for completing the circuit between said line and said trunk circuit, substantially as described.

61. In a telephone exchange system, the combination with a metallic telephone line normally open at the substation, a central source of current for supplying talking current to said line, a plurality of trunk circuits for the exchange, and automatic rotary means operative upon the closure of a circuit from said source of current over the limbs of said telephone line at the substation for completing the circuit between said line

and an idle one of said trunk circuits, substantially as described.

62. In a telephone exchange system, the combination with a telephone line extending in two metallic limbs from the exchange to the substation of a source of current at the exchange for supplying talking current to the substation normally connected in a bridge between the limbs of said telephone line, automatic switching apparatus at the exchange including a rotary switch actuated by the completion of the circuit of said source over the limbs of the telephone line, and means responsive to the operation of said automatic switching apparatus to bring said source into circuit to supply talking current to said line, substantially as described.

63. In a telephone exchange system, the combination with telephone lines each extending in two metallic limbs from the exchange to a substation, a central source of current for supplying talking current to the substations, an idle trunk circuit at the exchange adapted to the use of any one of said telephone lines, and a rotary device having contacts for connecting said trunk circuit and a line together and adapted to be started in rotation upon the completion of the circuit from said source of current through the limbs of said line at the substation, and means for supplying talking current from said source through said trunk circuit to said line, substantially as described.

64. In an automatic telephone system, a central office, a substation, a telephone line extending from the exchange to the substation, a source of current for talking purposes normally connected in a bridge between the limbs of said line, a plurality of trunk circuits, automatic means including a rotary switch for connecting an idle one of said trunk circuits to said line upon completing the circuit of said source over the limbs of the telephone line in series, and means for supplying talking current to the connected line through the associated trunk circuit, substantially as described.

65. In a telephone system, the combination with a subscriber's station, of a pair of normally open contacts at the subscriber's station adapted to be closed during conversation, an automatic rotary selector switch at the central office, trunk circuits at the exchange, the closing of said contacts at the substation being adapted to cause said automatic rotary selector switch to complete a connection between said station and an idle trunking circuit, substantially as described.

66. In a telephone system, the combination with a subscriber's station and cooperating trunk circuits, of a pair of normally open contacts at the subscriber's station,

closed during conversation to form a path for voice currents, and an automatic rotary selector switch at the central office adapted to be operated to connect said station with an idle trunk circuit when said contacts are closed to initiate a call, substantially as described.

67. In an automatic telephone system, the combination with a plurality of telephone lines, of a plurality of trunk lines, a central source of current, a rotary switch adapted to move to and stop upon an idle trunk line, an electromagnetic means actuated from said source of current over the limbs of the telephone line in series, for controlling said switch, and means for supplying talking current from said source to connected telephone lines through the associated trunk lines, substantially as described.

68. A telephone system including telephone lines, extending from stations to an exchange, call signal devices at the exchange, automatic selecting mechanism for interchangeably associating said lines and signals to indicate calls, and exchange operator controlled link circuits effective when operated in extending calls, to change the signals to alter their indications.

69. A telephone system including telephone lines, a plurality of operator controlled link circuits, an operator's telephone, talking circuit connections from said operator's telephone to said link circuits, and selector switches having contact makers each adapted to be moved into a plurality of selective positions for interchangeably connecting said lines and link circuits, and means responsive to the closing of the two limbs of the telephone lines in series for operating said contact makers to effect connection between calling lines and link circuits.

70. In a telephone system, the combination of telephone lines, trunk circuits, operator-controlled switches at the calling end of certain of said trunk circuits, and automatic switch mechanisms associated with the answering ends of certain of said trunk circuits, said trunk circuits, operator-controlled switches and automatic switch mechanisms cooperating in establishing connections between telephone lines, and said automatic switch mechanisms including contact makers capable of assuming a plurality of selective positions.

71. In a telephone system, the combination of telephone lines, trunk circuits, operator-controlled switches at the calling end of certain of said trunk circuits, automatic switch mechanisms associated with the answering ends of certain of said trunk circuits, said trunk circuits, operator-controlled switches and automatic switch mechanisms cooperating in establishing connections be-

tween telephone lines, and said automatic switch mechanisms including contact makers capable of assuming a plurality of selective positions; and signals associated with said link circuits and operable thereover to indicate the fact of the selections by said contact makers.

72. A telephone exchange system comprising a plurality of subscribers' telephone lines, a plurality of associated link-circuits, automatic switch mechanism for establishing connection between a calling line and an idle link-circuit, a signal displayed upon the establishment of such connection, operator's means for extending the circuit of a selected link-circuit to a called line, and means operative upon the extension of said circuit to a called line to cause said signal to serve in a supervisory capacity.

73. A telephone system comprising telephone lines, operator controlled link circuits for extending the circuits of calling to called lines, a signal for each of said link circuits, automatic switch mechanism for connecting a calling line to an idle link circuit, means responsive to such connection for lighting the associated signal to indicate the call, a supervisory relay for each link, and circuit connections including conductors of the selected link and a connected called line whereby the associated relay is operable to control said signal in a supervisory capacity.

74. A telephone system comprising telephone lines, operators' cord circuits, a signal for each of said cord circuits, automatic switch mechanism for interconnecting calling lines and idle cord circuits, a relay for each cord circuit responsive to such a connection for operating the associated signal to indicate a call, calling plugs for the cord circuits adapted for connection with called line terminals of the lines, and a second relay for each cord circuit operable through contacts of a connected plug and called line terminal for effacing the signal.

75. A telephone system comprising telephone lines, operators' link circuits, a signal for each of said link circuits, automatic switch mechanism for interconnecting calling lines and idle link circuits, a relay for each link circuit and operable over the answering end thereof responsive to such a connection for operating the associated signal to indicate a call, means for extending the calling end of the cord circuit toward a called line, and a second relay for each cord circuit operable over the calling end for effacing the associated signal.

76. A telephone system comprising telephone lines, operators' link circuits, a signal for each of said link circuits, automatic switch mechanism for interconnecting calling lines and idle link circuits, a relay for

each link circuit having normally open contacts in circuit of the associated signal and responsive to such a connection for operating the associated signal to indicate a call, and a second relay for each link circuit under operator control and having normally closed contacts in circuit with the associated signal.

77. A telephone system comprising telephone lines, operator controlled link circuits, automatic switch mechanism for interconnecting calling lines and idle link circuits, signals displayed responsive to such connections to indicate the calls, means for continuing the display of a signal when a calling subscriber restores his telephone prior to the extension of the link circuit, and a circuit controlled by the operator for again effacing said signal.

78. A telephone system comprising a telephone line, a line switch therefor, sets of progressively positioned stationary contacts for said switch, link circuits connected to said contacts, other means for rendering certain of said contact sets busy, movable contact makers for said switch responsive to a call over said line to connect the line with the first idle contact set and connected link, and means for restoring said switch by disconnecting the line from the engaged contact set whereby the next call over said line operates said contact maker to always connect the line with the first succeeding idle contact set.

79. A telephone system comprising telephone lines, a selector switch for each line including sets of contacts and cooperating non-normal-position progressively movable contact makers, link circuits for extending the talking circuits of said lines multiply connected to said contact sets, means included in each switch responsive to a call over the corresponding line for operating the associated contact makers to connect the calling line with the contact set of an idle link circuit, and means for restoring operated contact makers for further connection by simply disconnecting the contact makers and contacts.

80. An automatic telephone system comprising subscribers' lines, an "individual-switch" for each line, each switch having a normally bridged magnet, trunks for talking leading from said switches, means controlled by said magnet for seizing said trunks, means for seizing said lines to extend connection thereto, and means for furnishing all necessary current, each switch, whether of the calling or the called line, being adapted to open up or cut off its bridged magnet while the line is in use.

81. In an automatic telephone exchange system, a normally open telephone line, a selecting switch individual thereto, a plurality of trunk lines and automatic mechanism

controlled over the two sides of a line in series operated upon the closure of said telephone line to actuate said selecting switch to connect said telephone line with one of said trunk lines, a source of current, means inductively isolating the limbs of said line from said source after the connection of said line with said trunk.

82. In a telephone exchange system, the combination with a metallic telephone line normally open at the substation, a plurality of trunk circuits for the exchange, and automatic rotary means operative upon the closure of a circuit between the limbs of said telephone line at the substation for completing the circuit between said line and an idle one of said trunk circuits, substantially as described.

83. In an automatic telephone system, a central office, a substation, a telephone line extending from the exchange to the substation, a source of current normally connected in a bridge between the limbs of said line, a plurality of trunk circuits, an automatic means including a rotary switch for connecting an idle one of said trunk circuits to said line upon completing the circuit of said source over the limbs of the telephone line in series, and inductive means for separating the limbs of said line from said source of current after connection has been established with an idle one of said trunk circuits, substantially as described.

84. In a telephone system, the combination with a telephone line of a busy trunk circuit and an idle trunk circuit, and selector means controlled by current over the limbs of the telephone line in series, adapted to move over the contacts of said busy trunk and connect said line with said idle trunk circuit, other telephone lines, and means inductively separating each limb of said telephone line from each limb of another telephone line after connection with an idle trunk, substantially as described.

85. A non-numerical trunk-selecting switch mechanism comprising a pair of line wipers, a release mechanism, a release magnet for operating said release mechanism and controlling the connection to said wipers, trunk terminals to be seized by said wipers, and a source of electrical current and connections therefrom for operating purposes.

86. An automatic trunk-selecting switch comprising a pair of line wipers, a cut-off relay, a pair of line conductors connected between said wipers and the normally closed contacts in said relay, and a source of electrical current and connections therefrom for operating purposes.

87. In a telephone system comprising a subscriber's line and trunk lines, a subscriber's rotary individual non-numerical trunking switch for finding an idle trunk when the subscriber removes his receiver in initial

ating a call, a trunk release circuit for said individual switch, a central battery for furnishing all necessary operating and release current and means for interrupting the normal connections of said battery with said line when connection is made with said line as a called line.

88. In a telephone system comprising a subscriber's line, and trunk lines, a subscriber's rotary individual trunking switch for seizing an idle trunk line when the subscriber calls, an electromagnet included in said switch for releasing purposes, an energizing circuit for said electromagnet including one conductor of any trunk line seized by said switch, a central source of current for furnishing all necessary operating current and for supplying talking current to the subscriber's line, and a cut-off relay for interrupting the normal connections between said source and said line when connection is made with the line as a called line.

89. In a telephone system, a subscriber's line, a rotary non-numerical trunking switch for said line comprising trunk terminals, line terminals, means for releasing the line terminals from the trunk terminals including release trunk terminals corresponding to the trunk terminals, and a central source of current for furnishing all necessary operating current and for supplying talking battery to the subscriber's line.

90. In a telephone system, a subscriber's line, a non-numerical trunking switch for said line comprising only a single row or level of trunk terminals, a row of release trunk terminals corresponding thereto, a source of electrical current and connections therefrom for operating purposes and for supplying talking battery to said subscriber's line, and a cut-off relay for interrupting the normal connections of said battery with said line when connection is established with said line as a called line.

91. In a telephone system, the combination of trunk lines, means for distinguishing between idle and busy trunk lines, an operating magnet, a subscriber's line, and two energizing circuits for said magnet, one energizing circuit including the subscriber's line conductors in series, and the other energizing circuit being local.

92. A telephone exchange system comprising a plurality of telephone lines, a plurality of associated link-circuits, a plurality of automatic switches individually operative to establish connection between a calling line and an idle link-circuit, and means independent of the position of the contacts of the operated switch for rendering the selected link-circuit selectable by other switch mechanisms.

93. A telephone exchange system comprising a plurality of telephone lines, a plurality of associated link-circuits, a plurality of

switch mechanisms individually operative to establish connection between a calling telephone line and an idle link-circuit, and means for rendering the selected link-circuit selectable by other switch mechanisms independently of the return of the operated switch mechanism to normal.

94. A telephone system comprising a subscriber's individual trunk selecting switch provided with a contact maker capable of assuming a plurality of selective positions, a plurality of trunk lines leading from said switch, means at the end of each trunk line for extending a connection, subscriber means for operating said individual switch to select an idle one of said trunk lines, said individual switch being provided with relay means adapted to remain energized during the use of the switch for talking purposes, and means associated with each of said trunks for controlling the duration of energization of said relay means.

95. A telephone system including a calling subscriber's line and a called subscriber's line, a trunk selecting switch provided with a contact maker capable of assuming a plurality of selective positions, a plurality of trunk lines leading from said switch, connective apparatus at the end of each trunk line, subscriber means for operating said trunk selecting switch, said switch being provided with a relay that remains energized during the use of the switch for talking purposes, and means associated with each of said connective apparatuses for controlling the duration of energization of said relay.

96. A telephone system comprising subscribers' lines, rotatable progressively movable automatic switches provided with contact makers capable of assuming a plurality of selective positions, electromagnets normally bridged across said lines for controlling said switches, a talking circuit included in said lines, said talking circuit being at all times free from inductive resistance in the path of the talking currents at said automatic switches, means for cutting off or opening up the bridges in which said electromagnets are located when the two lines are connected up for conversational purposes, and a centralized source of current-supply for furnishing talking currents to the subscribers' lines and for also furnishing the current necessary for operating the said electromagnets before the bridges of the latter are cut off or opened up.

97. A telephone system including calling and called subscribers' lines connected up for conversation, a rotatable progressively movable automatic switch provided with a contact maker capable of assuming a plurality of selective positions included in said connection, one or more electromagnetic bridges located at the exchange and tem-

porarily cut off from the talking circuit during conversation, the talking circuit being free from inductive resistance at said automatic switch, and a centralized source of current-supply connected to furnish talking current to the subscribers' lines.

98. A telephone system including calling and called subscribers' lines connected up for conversation, a rotatable automatic switch provided with a contact maker capable of assuming a plurality of selective positions included in said connection, electromagnets normally bridged across the talking circuit but operatively disassociated therefrom during conversation, the talking circuit being free from inductive resistance in the path of the talking currents at the said automatic switch, and a centralized source of current-supply connected for-furnishing talking current to the subscribers' lines.

99. In a telephone system, a calling line, a called line, means for extending a call from a calling to a called line, said means including a line electromagnet, switching means controlled by said electromagnet, said switching means including a contact maker capable of assuming a plurality of selective positions, a cut-off relay, and means controlled over the calling line for operating said cut-off relay, responsive to the calling subscriber, to operatively disassociate by a single movement the line electromagnet before the call reaches the called line.

100. In a telephone system, a trunk-line, a called line, a calling line, means for extending a call from a calling to a called line, said means including a line electromagnet, switching means controlled by said electromagnet, said switching means being provided with a contact maker capable of assuming a plurality of selective positions, a cut-off relay, and means controlled over the trunk-line for operating said cut-off relay, responsive to the calling subscriber, to operatively disassociate by a single movement the line electromagnet before the call reaches the called line.

101. A telephone system comprising a calling line, a called line, means for extending a call from a calling line to a called line, said means including a trunk-line, a bridge including an electromagnetic switch operating element, a contact maker capable of assuming a plurality of selective positions controlled by said switch operating element, a bridge cut-off relay, and means controlled over the trunk-line for operating said relay, responsive to the calling subscriber, to open by a single movement said bridge before the call reaches the called line.

102. In a telephone system, means for establishing a talking circuit between a calling and a called subscriber's line, said means including an automatic trunk-selecting switch for selecting idle trunks and a single

wound relay for controlling said circuit, and means by which the calling subscriber energizes said relay before the call reaches the called line to maintain the continuity of the circuit during use of the same for talking purposes.

103. In a telephone system, a calling subscriber's line, a called subscriber's line, means for establishing a talking circuit between said lines, said means including an automatic switch provided with a contact maker capable of assuming a plurality of selective positions, a single wound relay for said switch for controlling said circuit, and means by which the calling subscriber causes said relay to be energized before the call reaches the called line to maintain the continuity of the circuit during use of the same for talking purposes.

104. In a telephone system, a calling subscriber's line, a called subscriber's line, means for establishing a talking circuit between said lines, said means including an automatic switch individual to the calling subscriber's line provided with a contact maker capable of assuming a plurality of selective positions, a single wound relay for said switch, and means by which the said relay is energized before the call reaches the called subscriber's line to maintain the continuity of the circuit during use of the same for talking purposes.

105. In a telephone system, a calling line, a called line, means including an automatic switch provided with a contact maker capable of assuming a plurality of selective positions for extending a call from the calling line in the direction of the called line, a line electromagnet and a cut-off relay for said automatic switch, and means controlled over the calling line for operating said cut-off relay responsive to the calling subscriber to disconnect by a single movement the line electromagnet before the call reaches the called line.

106. In a telephone system, a trunk line, a called line, a calling line, means including an automatic switch provided with a contact maker capable of assuming a plurality of positions for extending a call from the calling line to the said trunk line, a line electromagnet and a cut-off relay for said automatic switch, and means controlled over the trunk line for operating said cut-off relay responsive to the calling subscriber to operatively disassociate by a single movement the line electromagnet before the call reaches the called line.

107. A telephone system including telephone lines, interconnecting link circuits, a selector switch for extending both limbs of the talking circuit of a calling line to an idle link circuit, said selector switch being controlled over the two sides of the calling line in series and provided with a test contact

for use in selecting the idle link circuit, and means for restoring said switch to normal including a circuit extending through said testing contact.

108. A telephone system including telephone lines, interconnecting link circuits, a selective switch mechanism controllable over the two sides of a calling line in series for use in uniting the calling and a called line by a link circuit into a talking circuit, a testing contact associated with said mechanism for selecting the link circuit to be included in said talking circuit, a circuit for releasing said switch mechanism including said testing contact, means for controlling said circuit, and a source of current for supplying current for operating and talking purposes.

109. A telephone system including telephone lines, interconnecting link circuits, a selector switch for extending both links of the talking circuit of a calling line to an idle link circuit, said selector switch being controlled over the two sides of the calling line in series and provided with a test contact for use in selecting the idle link circuit, means for restoring said switch to normal including a circuit extending through said testing contact, and a central source of current for furnishing all necessary operating and talking current.

110. In a telephone system, the combination of a subscriber's line comprising two metallic conductors, another subscriber's line, a plurality of trunk lines any one of which will serve to establish connection between said lines, a trunk selector provided with a contact maker capable of assuming a plurality of selective positions for automatically selecting an idle one of said trunk lines, a magnet for controlling said selector included in a bridge across the conductors of said first line and controllable over the sides of said line in series, and a source of current for supplying current for operating purposes and for talking purposes.

111. In a telephone system, a line, another line, each having two metallic limbs, a plurality of trunks any one of which will serve to build up a connection between said lines, a trunk selector, a magnet for controlling said selector included in a bridge across the metallic limbs of said first line and controllable over the said metallic limbs in series, means for causing said trunk selector to automatically connect said first line with an idle one of said trunks, said bridged magnet also being adapted to control the release of said selector.

112. In a telephone system, a line, another line, each having two metallic limbs, a plurality of trunks any one of which will serve to build up a connection between said lines, a trunk selector capable of assuming a plurality of selective positions, a magnet for

controlling said selector included in a bridge across the metallic limbs of said first line and energized over the two sides of the line in series, means for causing said trunk selector to automatically connect said first line with an idle one of said trunks, said bridged magnet also being adapted to control the release of said selector.

113. In an automatic telephone system, two lines each having two metallic limbs, a plurality of trunk lines any one of which will serve to establish connection between said lines, a trunk selecting switch provided with a contact maker capable of assuming a plurality of selective positions, a pair of controlling magnets in a bridge across the metallic conductors of said line, means for operating said magnets to cause said switch to select an idle one of said trunks, means for opening said bridge upon finding an idle trunk, the release of said switch being controlled by both of said bridged magnets, and a source of current for supplying current for operating and talking purposes.

114. A telephone system including telephone lines, an interconnecting link circuit, a switch mechanism provided with a contact maker capable of assuming a plurality of selective positions for uniting a calling and a called line by the link circuit into a talking circuit, an electromagnet in a bridge across the conductors of said talking circuit at said switch mechanism for controlling its operation, a testing contact associated with said switch mechanism for selecting the link circuit to be included in said talking circuit, a circuit for releasing said switch mechanism including said testing contact, means for controlling said circuit, and a central source of current for supplying current for operating and talking purposes.

115. In a telephone system, the combination with a substation telephone line, of trunk lines, an automatic progressively movable line switch for said line operative upon initiation of a call from said line to select an idle one of said trunks, a cut-off relay for said line energized after connection with said trunk, and means associated with the selected trunk to deenergize said relay, whereby said switch is released.

116. A telephone system comprising a substation telephone line, trunk lines, an automatic line switch for said line provided with a movable contact maker capable of assuming a plurality of selective positions and operated responsive to the removal of the telephone receiver in the initiation of a call over said line to select an idle one of said trunks, a cut-off relay for said line, means associated with said trunk for energizing said cut-off relay responsive to said selection, said means being also operable to deenergize said relay, and release means for said switch thereby rendered effective.

117. A telephone system comprising a substation telephone line, trunk lines, a control relay for said line, a non-numerical switch for said line operated responsive to
 5 said control relay to select an idle one of said trunks, a cut-off relay for said line, a circuit including a conductor of the selected trunk for energizing said cut-off relay, and means associated with said trunk control-
 10 lable to deenergize said cut-off relay to release said switch.

118. A line switch for a telephone system comprising contacts and cooperating wipers, restoring means for moving said wipers
 15 from engagement with a set of selected contacts, trunk lines, a motor magnet operating said wipers to select an idle one of said trunk lines, a cut-off relay maintained energized over a conductor of said selected
 20 trunk, and means controlled by said cut-off relay for operating said restoring means when said relay deenergizes.

119. In a telephone system, the combination with a substation telephone line, of
 25 trunk lines, an automatic switch for said line operated upon initiation of a call from said line to select an idle one of said trunks, means for maintaining said switch in a selective position, a cut-off relay for said line
 30 maintained energized over a conductor of said trunk after connection with said trunk, and means for deenergizing said relay whereby said maintaining means is operated to permit the said switch to move from its
 35 selective position.

120. In a telephone system, a combination with a substation telephone line, an automatic switch individual thereto, a control relay for said line energized upon initiation
 40 of a call at said substation, said switch being responsive to the energization of said control relay to extend the circuit of said line to an idle trunk, a cut-off relay for said line maintained energized over a conductor
 45 of said trunk upon an extension of said line, and means for deenergizing said cut-off relay whereby the said line is disconnected from said trunk line.

121. In a telephone system, a combination
 50 with a substation telephone line, an automatic switch individual thereto, a control relay for said line energized upon initiation of a call at said substation, said switch being responsive to the energization of said
 55 control relay to extend the circuit of said line to an idle trunk, a cut-off relay for said line maintained energized over a conductor of said trunk upon an extension of said line, and means for deenergizing said
 60 cut-off relay whereby the wipers of said switch are operated to disconnect the said telephone line from said trunk line.

122. A telephone system comprising a subscriber's line provided with a non-numerical trunk switch, a group of trunk lines

accessible to said switch, means controlled over said line for operating said switch to automatically select an idle one of said trunk lines, a cut-off relay for said switch main-
 70 tained energized upon the connection of said switch to an idle one of said trunk lines over a conductor of said trunk line, means for deenergizing said cut-off relay, and means controlled by the deenergization of
 75 said cut-off relay to operate said switch to disconnect said subscriber's line from said selected trunk line.

123. A non-restoring-wiper line switch for telephone systems comprising only con-
 80 tacts and cooperating wipers, motor mechanism for operating said wipers, simple relays each having individually controlled contacts, and circuit connections controlled by the contacts of said relays for operating
 85 said motor mechanism and wipers and restoring said switch.

124. A non-numerical non-restoring-wiper line switch comprising bank terminals and cooperating wipers, relays, con-
 90 tacts for said relays, said contacts being individually controlled by their respective relays, motor mechanism for operating said wipers, and circuit connections controlled by the contacts of said relays for operating
 95 said motor mechanism and wipers to select a set of said bank terminals and restoring said switch.

125. A group of lines and a group of trunks less in number than the number of
 100 lines, an individual moving element for each line, multiply connected stationary elements for each trunk, means to cause the movable element of a line to connect with one of the multiply connected stationary
 105 elements of a trunk, and means for causing the movable element of the line to assume a position until next used between the stationary element of the trunk last used and the stationary element of the next trunk when
 110 disconnection is made between the line and its last used trunk.

126. A telephone line extending in two limbs from a substation to a central office, a pair of line wipers connected with the limbs
 115 of said line, a plurality of pairs of trunk contacts with which said line wipers may connect, and means to disconnect the line wipers from their connected pair until again taken for use by advancing the said line
 120 wipers to a position between the pair of trunk contacts last used and the next pair of trunk contacts.

127. A telephone system comprising a telephone line and a rotary line switch for
 125 extending connection of said line to any one of a plurality of trunks, and means to advance the line switch to a position between the trunk last used and the next succeeding trunk when disconnection is desired, and
 130 until the line switch is again used.

128. In a telephone system the combination with trunk lines, of a plurality of switches at which said trunk lines are available, the number of switches being greater than the number of trunk lines, traveling contacts at each switch for connection with a trunk, and means for isolating the traveling contacts of switches which are not in use from the trunk contacts at said switches by retaining the contacts of said idle switches in positions between the contacts of the trunks last used and the next available set of trunk contacts.

129. A rotary switch for interconnecting

the different links of a circuit, comprising traveling contacts and multiply connected stationary contacts, and means to advance the traveling contacts to and stop them in a position between the stationary contacts last used and the next succeeding set of stationary contacts when disconnection is desired.

In witness whereof, I hereunto subscribe my name this 16th day of July A. D., 1901.

HAROLD D. STROUD.

Witnesses:

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