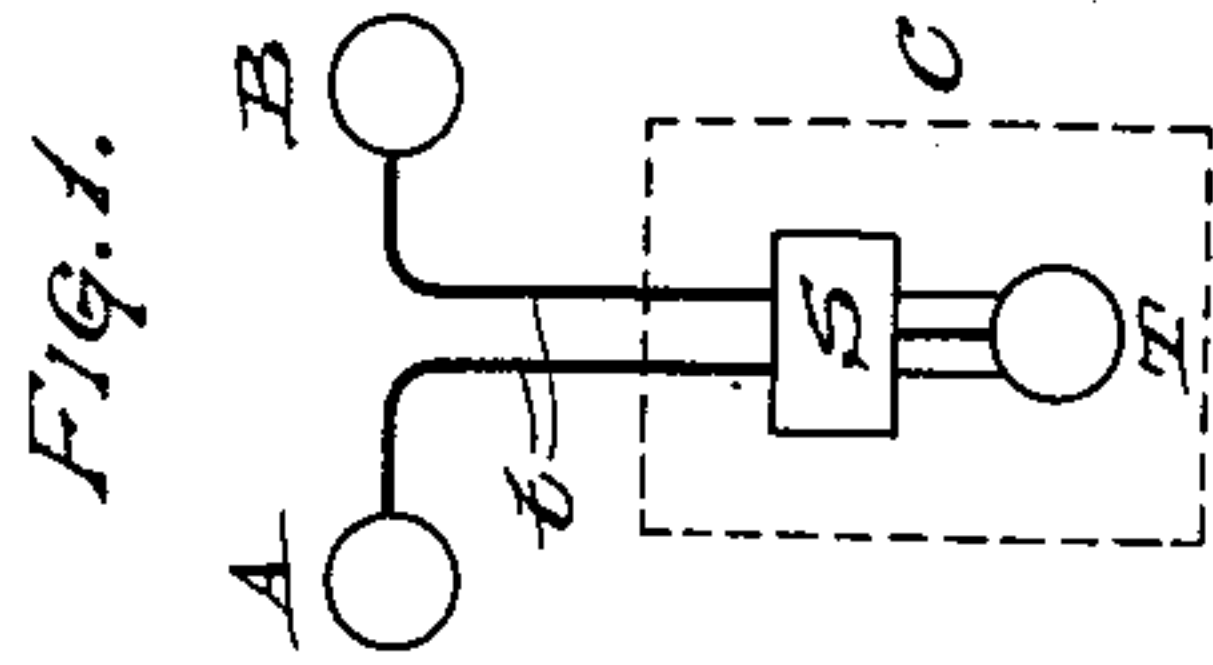


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TELEPHONE SYSTEM.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that we, EARL R. NEIR and BERNARD C. GROH, both citizens of the United States of America, and residents, respectively, of Chicago, Cook county, Illinois, and St. Paul, Ramsey county, Minnesota, have invented certain new and useful Improvements in Telephone Systems, of which the following is a specification.

Our invention relates to telephone systems and has particular reference to such systems as comprise a plurality of widely separated exchanges interconnected by toll lines.

In the system of the above general character certain exchanges may be interconnected through the medium of toll lines which terminate in a third intermediate exchange. It is customary where the intermediate exchange is of considerable size to terminate the toll lines in a toll board centrally located as regards the local subscribers; and, in compliance with the dictates of modern practice, that portion of the toll lines which lies within the city proper is usually composed of cable.

To avoid the inclusion of the cable in through connections a so called switching station may be provided, located at the outskirts of the city at the point where the open wire lines are joined to the cable conductors extending to the toll board. Operators at the switching station are provided with means for directly connecting any two open wire toll lines in response to orders transmitted from the toll board.

The principal object of our invention is to provide, at the toll switching station of an intermediate exchange, means comprising automatic switches and controlling circuits therefor whereby the operators stationed at the toll board may control the interconnection of toll lines without the intervention of other operators.

Further objects of our invention relate to details of circuit arrangement whereby well known types of automatic switches may be used in conjunction with well known manual apparatus to form a complete and efficient automatic toll switching system.

Having given a general statement of the object and scope of our invention, we will now proceed to a description of the operation of the same, reference being had to the accompanying drawings, in which Figure 1 represents diagrammatically the layout of

the telephone system disclosed herein, and Fig. 2 represents a complete circuit connection between a toll line indicated by reference characters 52 and 53 and a second toll line indicated similarly by reference characters 50 and 51; together with certain manual equipment to be described hereinafter. The aforesaid connection has been established through the medium of the automatic switches H' and H and the cut-off relays 4 and 24, as will appear more clearly hereafter.

Referring now to Fig. 1, A and B represent exchanges at outlying towns which are connected with the intermediate exchange in the city C through the medium of toll lines *t*. It will be seen that these toll lines pass through the switching station S before entering the toll board T in the intermediate exchange. In general our improved system contemplates the provision of automatic switches at the switching station S connected in pairs and controllable by operators stationed at the toll board T. An operator at the exchange A who desires to obtain connection with the exchange B will signal the operator at the intermediate exchange in the city C in the regular manner, the signal appearing on the toll board T. The operator at exchange C, upon learning the connection desired, will signal the operator at exchange B, and will then proceed to connect the toll lines to the respective exchanges A and B directly, through the medium of a pair of automatic switches at the switching station S. Circuits are provided whereby the toll operator at exchange C can supervise the connection and terminate it at will by disconnecting the automatic switches.

Referring now to Fig. 2, the toll lines 52—53 and 50—51, which may be assumed to extend, respectively, to the exchanges A and B (Fig. 1), are provided at the toll board in the intermediate exchange with the regular multiple jacks and drops shown at M and M', to which they are normally connected through back contacts of relays 4 and 24, respectively. Cord circuits are provided, one of which is shown at L, which may be used to connect two toll lines by means of their multiple jacks, but which are ordinarily used only for answering, signaling and supervising.

The cord circuit L may be of any well known or suitable type. As herein represented

sented it consists essentially of the plugs P and P' connected by the two strands of the cord with a signal 2 in bridge thereof. A listening key K is provided by means of which the operator is enabled to connect her head set with the cord circuit at the proper time, and a ringing key K' affords means for projecting ringing current from the generator R out over a called toll line.

10 The automatic switches H and H' are, of the general type of connector switch disclosed in U. S. Letters Patent #815,176, granted March 12, 1906, to Keith, Erickson, and Erickson; the circuits being modified, 15 however, to enable the switches to operate in accordance with the principles of our invention. Considering first the connector H, it comprises among other details a bank of contacts arranged in horizontal rows or 20 levels, which contacts are adapted to be engaged by a set of wipers 5, 6, and 7 carried upon a shaft (not shown) which has a vertical movement controlled by the vertical magnet 8 and a rotary movement controlled 25 by the rotary magnet 9. The usual side switch comprising the wipers 10 and 11 is controlled by the private magnet 12 in the well known manner. Means for permitting the switch to be restored to normal position is provided in the release magnet 14 30 which, upon energizing, withdraws the retaining pawls from the shaft and returns the side switch wipers to their first position. The contact 15 makes against its spring only 35 when the shaft has been raised one or more steps from its normal position. The relays 16 and 17 are slow acting. The operation of the various parts of the switch is controlled through the medium of the line relay 13.

40 The connector H' is almost identical with connector H in construction except that it has no line relay, being controlled by the line relay 13 after the connector H has been operated.

45 It will be observed that the wipers 105 and 107 of the connector H' are normally connected directly with the wipers 5 and 7 of the connector H, the combination of the two sets of wipers and their connecting conductors forming a link circuit. The bank con- 50 tacts to which these sets of wipers have access form terminals of the toll lines entering the switching station, each toll line having a set of multiple bank contacts accessible to 55 each connector. These bank contacts of course are also multiplied in the banks of as many other connector pairs as are necessary to handle the traffic.

Each toll line is provided, as before mentioned, with a cut-off relay, one of which is 60 indicated by reference character 4, which serves to disconnect its associated toll line from the apparatus at the toll board and to connect it with its multiple contacts in the 65 banks of the connector switches. The cut-

off relays are controlled over the private wipers of the connector switches.

The upper conductor of the link circuit shown in Fig. 2 is connected by way of impedance coil 36, condenser 56, cable conductor 73, and condenser 70 with one strand of the cord circuit L. The lower conductor is connected by way of impedance coil 35, condenser 57, cable conductor 72, and condenser 71 with the other strand of the cord circuit L. The drop signal 2 and the impedance coil 48 are bridged across the conductors 72 and 73, the former at the toll board and the latter at the switching station. Through the medium of the double windings of the drop 2 and the impedance coil 48 a simplex circuit is superimposed on the conductors 72 and 73 to form a controlling circuit for the automatic switches H and H'. The keys K² and K³ are individual to the cord circuit L 75 and its associated link circuit, and there are as many sets of keys similar to keys K² and K³ as there are cord circuits. Any key K², when operated, serves to complete the simplex controlling circuit for the automatic 80 switches of its associated link circuit at the switching station, while the corresponding key K³, when operated serves to insert a calling device D in the aforesaid controlling circuit. 85

The calling device D, represented herein 95 by a pair of impulse springs 18, may be of any well known or suitable type, such, for example, as is shown in British Patent to S. G. S. Dicker, #29,654 of 1910. A calling 100 device of the above type consists essentially of a pair of impulse springs which may be separated a variable number of times through the medium of an impulse wheel controlled by a finger hole dial. 105

For supplying current for operating purposes we have shown two batteries, indicated by reference characters B and B', each having one terminal grounded. For supplying ringing current we have shown a ringing 110 current generator, indicated by reference character R.

Having given a general description of the apparatus employed in our invention, we will now proceed to an explanation of the 115 operation of the same. Inasmuch as a great deal of the apparatus shown herein is old and well known in the art, having been fully described in the publications hereinbefore referred to, the operation will be described in 120 a more or less general manner, the details being given only where they have to do in some respect with the application of the principles of our invention. For the purposes of this explanation it will be assumed that an 125 operator at exchange A (Fig. 1) wishes to connect with an operator at exchange B. To establish such a connection the services of an operator at intermediate exchange C are required. Accordingly, the operator at ex- 130

change A inserts a plug in the multiple jack of a toll line extending to the intermediate exchange C, assumed in this case to be the toll line 52—53 (Fig. 2), and then projects
 5 ringing current over the toll line by means of her ringing key, all in the well known manner.

In response to the operation of the ringing key by the operator at exchange A, the
 10 drop 3 on the toll board at the exchange C is actuated, thereby notifying the operator stationed at the toll board of the call. Upon perceiving the actuated drop, the operator may insert the plug P of her cord circuit L
 15 in the multiple jack J, thereby disconnecting the drop 3 and energizing the magnets V which may be used to operate suitable visual busy signals (not shown). The operator at exchange C may now operate her listening
 20 key K and converse with the operator at exchange A. Being informed that connection is desired with exchange B, the operator at exchange C may now insert plug P' of her cord circuit L in the multiple jack J²
 25 of a toll line extending to exchange B, assumed in this case to be toll line 50—51. As a result of the insertion of the plug in jack J², the drop 103 is disconnected and the associated visual busy signals (not shown)
 30 controlled by the magnets V' are actuated. The ringing key K' may now be operated to project ringing current over toll line 50—51 to signal the operator at exchange B.

The operator at exchange C may now proceed to connect the two toll lines 52—53 and
 35 50—51 directly, by means of the connector switches H and H' at the switching station. It is understood that each toll line terminating at the toll board at exchange C is assigned a two digit number corresponding to
 40 the position of the contacts of that line in the banks of the connectors at the switching station. Also since all connectors have access to all toll lines it is immaterial which
 45 number is called first.

To proceed with the operation, by throwing key K² a circuit is completed for the line relay 13 which may be traced as follows: ground at G', winding of relay 13,
 50 windings of retardation coil 48 in parallel, conductors 72 and 73 in parallel, windings of drop 2 in parallel, contact springs 81 and 82 of key K³, and contact springs 84 and 85 of key K² to battery B'. Upon energizing, relay 13 completes a circuit for slow acting
 55 relay 16 of connector H over the following path: ground at G², contact springs 19 and 47, and winding of relay 16 to battery B. Relay 16, upon attracting its armature,
 60 opens a contact in the circuit of the release magnets 38 and 14 and prepares a circuit for the vertical magnet 8 of connector H.

The operator may now throw her key K³, thereby inserting the calling device D in the
 65 previously described circuit of relay 13 in an

obvious manner. The apparatus is now in readiness for the operation of the calling device D. By manipulating the finger hole dial in accordance with the first digit of the number of toll line 50—51, the impulse
 70 springs 18 are separated momentarily a number of times, resulting in a corresponding number of deenergizations of relay 13. At each deenergization relay 13 sends an impulse to the vertical magnet 8 over the fol-
 75 lowing path: ground at G², contact springs 19 and 20, contact springs 21 and 22, winding of slow acting relay 17, winding of vertical magnet 8, and side switch wiper 10 in its first position to battery B. In response
 80 to these impulses the vertical magnet 8 operates to raise the shaft until the wipers 5, 6 and 7 stand opposite the level in which are located contacts which are terminals of toll
 85 line 50—51. Relay 17 is energized in series with the vertical magnet and being slow acting retains its armature attracted during the series of impulses. In its operated position relay 17 disconnects the wipers 5 and 7
 90 and also completes an energizing circuit for the private magnet 12. At the end of the series of impulses relay 17 retracts its armature thereby breaking the private magnet circuit. The consequent energization and
 95 deenergization of the private magnet operates to advance the side switch wipers 10 and 11 to their second positions in the well known manner. It should be mentioned at this point that relay 16, being slow acting,
 100 does not respond to momentary deenergizations of relay 13 but retains its armature in an operated position.

The calling device D may now be operated in accordance with the second and final
 105 digit of the number of toll line 50—51, resulting as before in deenergizations of relay 13. At this time, however, side switch wiper 10 being in its second position, relay 13 sends impulses to the rotary magnet 9,
 110 thereby rotating the wipers 5, 6, and 7 until they reach the bank contacts 91, 92, and 93 which are terminals of toll line 50—51. Relay 17 is also in series with the rotary magnet and responds to the series of impulses
 115 therethrough to control the private magnet in the manner already described, whereby the side switch wipers 10 and 11 are advanced to their third position.

An energizing circuit may now be traced for relay 24 over the following path:
 120 ground at G⁴, winding of relay 24, bank contact 92, wiper 6, and side switch wiper 10 in its third position to battery B. Upon attracting its armature, relay 24 disconnects the toll line 50—51 from the cable con-
 125 ductors 87—88 extending to the toll board and connects it to its multiple contacts in the connector banks, one set of these contacts being the set 91—93 upon which the wipers of connector H are now resting.
 130

As side switch wiper 11 comes onto its third position contact point a circuit is completed for slow acting relay 25 of the connector H' which may be traced as follows:
 5 ground at G², contact springs 19 and 47, side switch wiper 11 in its third position, and winding of relay 25 to battery B. Relay 25, upon energizing, prepares a circuit for the vertical magnet 28.

10 The operator may now operate her calling device D in accordance with the first digit of the number of the toll line 52—53. There follows as before a corresponding number of deenergizations of the relay 13
 15 which now sends impulses to the vertical magnet 28 of the connector H' over the following path: ground at G², contact springs 19 and 20, contact springs 26, winding of relay 27, winding of vertical magnet 28,
 20 and side switch wiper 30 in its first position to battery B. In response to these impulses the vertical magnet 28 operates to raise the shaft of connector H' until the wipers 105, 106, and 107 stand opposite the level in
 25 which are located contacts which are terminals of the toll line 52—53. Relay 25, being slow acting, remains energized during the interruptions of its circuit by relay 13. Relay 27, energized in series with the vertical magnet 28, performs the same function
 30 for connector H' as relay 17 did in the case of connector H. In other words, relay 27 controls the private magnet 33 whereby the side switch wiper 30 is advanced to its second position at the end of the first series of
 35 impulses directed to connector H'. The calling device D may now be operated in accordance with the second and final digit of the number of toll line 52—53, resulting
 40 again in deenergizations of relay 13. Side switch wiper 30 being in its second position, impulses are now sent through the rotary magnet 29 which operates in response thereto to rotate the wipers 105, 106, 107 until
 45 they arrive at bank contacts 94, 95, and 96 which contacts are terminals of toll line 52—53. Relay 27 again controls the private magnet 33 to advance the side switch wiper 30 to its third position.

50 An energizing circuit for relay 4 may now be traced as follows: ground at G⁶, winding of relay 4, bank contact 95, wiper 106, and side switch wiper 30 to battery B. Upon attracting its armature, relay 4 dis-
 55 connects the toll line 52—53 from the cable conductors 62—63 extending to the toll board and connects it to its multiple contacts in the connector banks, one set of these contacts being the set 94—96, upon
 60 which the wipers of connector H' are now resting.

The required direct connection between the two toll lines has now been completed over the path shown in the heavy lines.

65 Having finished dialing the numbers re-

quired to set up the connection just described the operator may restore her key K³ thereby making the calling device D accessible for use in establishing other connections. By throwing her listening key 70 K the operator is enabled to observe the progress of the conversation over the through connection, if necessary, by reason of the connection between the strands of her cord circuit and the link circuit. The 75 impedance coils 35 and 36, however, reduce the efficiency of this connection as regards the shunting of voice currents from the connected toll lines, thereby preventing the operator at exchange C from seriously 80 interfering with the through connection, although she can hear well enough to satisfy herself that it is progressing satisfactorily.

When the conversation has been com- 85 pleted the operator at exchange A will operate her ringing key again to project ringing current over the toll line, thereby actuating the drop 2 in bridge of the two conductors of the link circuit. Upon per- 90 ceiving the actuated drop the operator at exchange C is informed that disconnection is desired, whereupon she will remove plugs P and P' from the jacks and restore key K² to its normal position. Upon re- 95 storing key K² the circuit of relay 13 is broken. Relay 13, upon deenergizing, breaks the circuit of slow acting relays 16 and 25. Relay 16, upon deenergizing, completes a circuit for the release magnet 14 100 of connector H and also for release magnet 38 of connector H', whereupon the connectors are restored to normal position in the well known manner. The release magnets 14 and 38 have their circuits broken at off 105 normal contacts 15 and 31, respectively, when the connectors reach their normal position. When the side switch wipers 30 and 10 are restored to first position by the release of the connectors the previously 110 described energizing circuits for relays 4 and 24 are broken, whereby these relays are deenergized and the toll lines are again connected to their respective apparatus at the toll board. 115

It will be seen from the foregoing that we have provided a simple and efficient automatic toll switching apparatus through the medium of which operators stationed at a toll board are enabled to accomplish 120 the through switching of toll lines at a distant switching station, thereby dispensing with the operators at the switching station.

While we have found it convenient in explaining our invention to illustrate and 125 describe a certain specific embodiment thereof, we do not wish to be held strictly to the exact form shown herein, for various adaptations will no doubt suggest themselves to persons skilled in the art. 130

We desire therefore to include and have protected by Letters Patent all forms and modifications of our invention which may come within the scope of the appended claims.

What we claim as our invention is:

1. In a trunking system, a pair of lines, an operator's position, fixed terminals for said lines normally disconnected therefrom, a link circuit, movable terminals at each end of said link, means operable for advancing one of said movable terminals into engagement with the fixed terminal of either of said lines, and means operable for advancing the other of said movable terminals into engagement with the fixed terminal of the other of said lines, and means controlled solely by said operator for disengaging said movable terminals from said fixed terminals.
2. In a trunking system, a pair of lines, an operator's position, fixed terminals for said lines normally disconnected therefrom, a link circuit, movable terminals at each end of said link, means operable for advancing one of said movable terminals into engagement with the fixed terminal of either of said lines, means operable for advancing the other of said movable terminals into engagement with the fixed terminal of the other of said lines and a relay for each of said lines for connecting its associated fixed terminals, and means controlled solely by said operator for disengaging said movable terminals from said fixed terminals.
3. In a trunking system, a pair of lines, an operator's position, fixed terminals for said lines normally disconnected therefrom, a link circuit, movable terminals at each end of said link, means operable for advancing one of said movable terminals into engagement with the fixed terminal of either of said lines, and means operable for advancing the other of said movable terminals into engagement with the fixed terminal of the other of said lines, each of said means comprising an automatic switch, and means controlled solely by said operator for releasing said switches.
4. In a trunking system, a pair of lines, an operator's position, fixed terminals for said lines normally disconnected therefrom, a link circuit, movable terminals at each end of said link, means operable for advancing one of said movable terminals into engagement with the fixed terminal of either of said lines, means operable for advancing the other of said movable terminals into engagement with the fixed terminal of the other of said lines, each of said means comprising an automatic switch, and a relay for each of said lines for connecting its associated fixed terminals, and means controlled solely by said operator for releasing said switches.
5. In a trunking system, a pair of lines, fixed terminals for said lines normally dis-

connected therefrom, a link circuit, movable terminals at each end of said link, means operable for advancing one of said movable terminals into engagement with the fixed terminal of either of said lines, and means operable for advancing the other of said movable terminals into engagement with the fixed terminal of the other of said lines, each of said means comprising an automatic switch, and a common controlling circuit for said switches.

6. In a trunking system, a pair of lines, fixed terminals for said lines normally disconnected therefrom, a link circuit, movable terminals at each end of said link, means operable for advancing one of said movable terminals into engagement with the fixed terminal of either of said lines, means operable for advancing the other of said movable terminals into engagement with the fixed terminal of the other of said lines, each of said means comprising an automatic switch, a relay for each of said lines for connecting its associated fixed terminals, and a common controlling circuit for said switches.

7. In a trunking system, a pair of lines, fixed terminals for said lines, a link circuit, movable terminals at each end of said link, means operable for advancing one of said movable terminals into engagement with the fixed terminal of either of said lines, means operable for advancing the other of said movable terminals into engagement with the fixed terminal of the other of said lines, each of said means comprising an automatic switch, a common controlling circuit for said switches normally adapted to control a first one of said switches, and means included in said first switch for shifting the control to the other of said switches.

8. In a trunking system, a pair of lines, fixed terminals for said lines normally disconnected therefrom, a link circuit, movable terminals at each end of said link, means operable for advancing one of said movable terminals into engagement with the fixed terminal of either of said lines, means operable for advancing the other of said movable terminals into engagement with the fixed terminal of the other of said lines, each of said means comprising an automatic switch, a common controlling circuit for said switches normally adapted to control a first one of said switches, and means included in said first switch for shifting the control to the other of said switches.

9. In a trunking system, a pair of lines, fixed terminals for said lines normally disconnected therefrom, a link circuit, movable terminals at each end of said link, means operable for advancing one of said movable terminals into engagement with the fixed terminal of either of said lines, means operable for advancing the other of said movable

- terminals into engagement with the fixed terminal of the other of said lines, each of said means comprising an automatic switch, a relay for each of said lines for connecting its associated fixed terminals, a common controlling circuit for said switches normally adapted to control a first one of said switches, and means included in said first switch for shifting the control to the other of said switches.
10. In a trunking system, a pair of lines, fixed terminals for said lines normally disconnected therefrom, a link circuit, movable terminals at each end of said link, means operable for advancing one of said movable terminals into engagement with the fixed terminal of either of said lines, means operable for advancing the other of said movable terminals into engagement with the fixed terminal of the other of said lines, each of said means comprising an automatic switch, a relay for each of said lines for connecting its associated fixed terminals, a common controlling circuit for said switches normally adapted to control a first one of said switches, means included in said first switch for shifting the control to the other of said switches, and means in said switches for controlling said relays.
11. In a trunking system, a plurality of lines, an operator's position, fixed terminals for each of said lines normally disconnected therefrom, a link circuit having movable terminals at each end, means operable for advancing one of said movable terminals into engagement with a fixed terminal of any one of said lines, and means operable for also advancing the other of said movable terminals into engagement with a fixed terminal of any one of said lines, and means controlled solely by said operator for disengaging said movable terminals from said fixed terminals.
12. In a trunking system, a plurality of lines, an operator's position, fixed terminals for each of said lines normally disconnected therefrom, a link circuit having movable terminals at each end, means operable for advancing one of said movable terminals into engagement with a fixed terminal of any one of said lines, means operable for also advancing the other of said movable terminals into engagement with a fixed terminal of any one of said lines, and a relay for each of said lines for connecting its associated fixed terminals, and means controlled solely by said operator for disengaging said movable terminals from said fixed terminals.
13. In a trunking system, a plurality of lines, an operator's position, fixed terminals for each of said lines normally disconnected therefrom, a link circuit having movable terminals at each end, means operable for advancing one of said movable terminals into engagement with a fixed terminal of any one of said lines, and means operable for also advancing the other of said movable terminals into engagement with a fixed terminal of any one of said lines, each of said means comprising an automatic switch, and means controlled solely by said operator for releasing said switches.
14. In a trunking system, a plurality of lines, an operator's position, fixed terminals for each of said lines normally disconnected therefrom, a link circuit having movable terminals at each end, means operable for advancing one of said movable terminals into engagement with a fixed terminal of any one of said lines, means operable for also advancing the other of said movable terminals into engagement with a fixed terminal of any one of said lines, each of said means comprising an automatic switch, and a relay for each of said lines for connecting its associated fixed terminals, and means controlled solely by said operator for releasing said switches.
15. In a trunking system, a plurality of lines, fixed terminals for each of said lines normally disconnected therefrom, a link circuit having movable terminals at each end, means operable for advancing one of said movable terminals into engagement with a fixed terminal of any one of said lines, means operable for also advancing the other of said movable terminals into engagement with a fixed terminal of any one of said lines, each of said means comprising an automatic switch and a common controlling circuit for said switches.
16. In a trunking system, a plurality of lines, fixed terminals for each of said lines normally disconnected therefrom, a link circuit having movable terminals at each end, means operable for advancing one of said movable terminals into engagement with a fixed terminal of any one of said lines, means operable for also advancing the other of said movable terminals into engagement with a fixed terminal of any one of said lines, each of said means comprising an automatic switch, a relay for each of said lines for connecting its associated fixed terminals, and a common controlling circuit for said switches.
17. In a trunking system, a plurality of lines, fixed terminals for each of said lines, a link circuit having movable terminals at each end, means operable for advancing one of said movable terminals into engagement with a fixed terminal of any one of said lines, means operable for also advancing the other of said movable terminals into engagement with a fixed terminal of any one of said lines, each of said means comprising an automatic switch, a common controlling circuit for said switches normally adapted to control a first one of said switches, and

means included in said first switch for shifting the control to the other of said switches:

18. In a trunking system, a plurality of lines, fixed terminals for each of said lines
5 normally disconnected therefrom, a link circuit having movable terminals at each end, means operable for advancing one of said movable terminals into engagement with a fixed terminal of any one of said lines, means
10 operable for also advancing the other of said movable terminals into engagement with a fixed terminal of any one of said lines, a common controlling circuit for said switches normally adapted to control a first one of
15 said switches, and means included in said first switch for shifting the control to the other of said switches.

19. In a trunking system, a plurality of lines, fixed terminals for each of said lines
20 normally disconnected therefrom, a link circuit having movable terminals at each end, means operable for advancing one of said movable terminals into engagement with a fixed terminal of any one of said lines,
25 means operable for also advancing the other of said movable terminals into engagement with a fixed terminal of any one of said lines, each of said means comprising an automatic switch, a relay for each of said lines
30 for connecting its associated fixed terminals, a common controlling circuit for said switches normally adapted to control a first one of said switches, and means included in said first switch for shifting the control to
35 the other of said switches.

20. In a trunking system, a plurality of lines, fixed terminals for each of said lines normally disconnected therefrom, a link circuit having movable terminals at each end,
40 means operable for advancing one of said movable terminals into engagement with a fixed terminal of any one of said lines, means operable for also advancing the other of said movable terminals into engagement
45 with a fixed terminal of any one of said lines, each of said means comprising an automatic switch, a relay for each of said lines for connecting its associated fixed terminals, a common controlling circuit for said
50 switches normally adapted to control a first one of said switches, means included in said first switch for shifting the control to the other of said switches, and means in said switches for controlling said relays.

55 21. In a trunking system, a pair of lines, each line terminating in a jack, a cord circuit for interconnecting said lines through the medium of their associated jacks, a link circuit having movable terminals at each
60 end, fixed terminals for each of said lines normally disconnected therefrom and accessible to said movable terminals, means for advancing one of said movable terminals into engagement with a fixed terminal of
65 one of said lines, means for advancing the

other of said movable terminals into engagement with a fixed terminal of the other of said lines, and a relay for each of said lines for connecting its associated fixed terminals. 70

22. In a trunking system, a pair of lines, each line terminating in a jack, a cord circuit for interconnecting said lines through the medium of their associated jacks, a link circuit having movable terminals at each
75 end, fixed terminals for each of said lines normally disconnected therefrom and accessible to said movable terminals, means for advancing one of said movable terminals into engagement with a fixed terminal of
80 one of said lines, means for advancing the other of said movable terminals into engagement with a fixed terminal of the other of said lines, and a relay for each of said lines for connecting its associated fixed ter- 85
minals and for disconnecting its associated jack.

23. In a trunking system, a pair of lines, each line terminating in a jack, a cord circuit for interconnecting said lines through
90 the medium of their associated jacks, a link circuit having movable terminals at each end, fixed terminals for each of said lines accessible to said movable terminals, means for advancing one of said movable termi- 95
nals into engagement with a fixed terminal of one of said lines, means for advancing the other of said movable terminals into engagement with a fixed terminal of the other of said lines, each of said means com- 100
prising an automatic switch, and a common controlling circuit for said switches.

24. In a trunking system, a pair of lines, each line terminating in a jack, a cord circuit for interconnecting said lines through
105 the medium of their associated jacks, a link circuit having movable terminals at each end, fixed terminals for each of said lines normally disconnected therefrom and accessible to said movable terminals, means for
110 advancing one of said movable terminals into engagement with a fixed terminal of one of said lines, means for advancing the other of said movable terminals into engagement with a fixed terminal of the other
115 of said lines, each of said means comprising an automatic switch, and a relay for each of said lines for connecting its associated fixed terminals.

25. In a trunking system, a pair of lines, 120 each line terminating in a jack, a cord circuit for interconnecting said lines through the medium of their associated jacks, a link circuit having movable terminals at each end, fixed terminals for each of said lines 125
normally disconnected therefrom and accessible to said movable terminals, means for advancing one of said movable terminals into engagement with a fixed terminal of one of said lines, means for advancing 130

the other of said movable terminals into engagement with a fixed terminal of the other of said lines, each of said means comprising an automatic switch, and a relay
5 for each of said lines for connecting its associated fixed terminals and for disconnecting its associated jack.

26. In a trunking system, a pair of lines, each line terminating in a jack, a cord circuit for interconnecting said lines through
10 the medium of their associated jacks, a link circuit having movable terminals at each end, fixed terminals for each of said lines normally disconnected therefrom and accessible to said movable terminals, means for
15 advancing one of said movable terminals into engagement with a fixed terminal of one of said lines, means for advancing the other of said movable terminals into engagement with a fixed terminal of the other of
20 said lines, each of said means comprising an automatic switch, a common controlling circuit for said switches, and a relay for each of said lines for connecting its associated fixed terminals.
25

27. In a trunking system, a pair of lines, each line terminating in a jack, a cord circuit for interconnecting said lines through
30 the medium of their associated jacks, a link circuit having movable terminals at each end, fixed terminals for each of said lines normally disconnected therefrom and accessible to said movable terminals, means for
35 advancing one of said movable terminals into engagement with a fixed terminal of one of said lines, means for advancing the other of said movable terminals into engagement with a fixed terminal of the other of
40 said lines, each of said means comprising an automatic switch, a common controlling circuit for said switches, and a relay for each of said lines for connecting its associated fixed terminals and for disconnecting its associated jack.

45 28. In a trunking system, a pair of lines, each line terminating in a jack, a cord circuit for interconnecting said lines through the medium of their associated jacks, a link
50 circuit having movable terminals at each end, fixed terminals for each of said lines accessible to said movable terminals, means for advancing one of said movable terminals into engagement with a fixed terminal of one of said lines, means for advancing the
55 other of said movable terminals into engagement with a fixed terminal of the other of said lines, each of said means comprising an automatic switch, a common controlling circuit for said switches normally adapted
60 to control a first one of said switches, and means included in said first switch for shifting the control to the other of said switches.

29. In a trunking system, a pair of lines, each line terminating in a jack, a cord circuit for interconnecting said lines through

the medium of their associated jacks, a link circuit having movable terminals at each end, fixed terminals for each of said lines normally disconnected therefrom and accessible to said movable terminals, means for
70 advancing one of said movable terminals into engagement with a fixed terminal of one of said lines, means for advancing the other of said movable terminals into engagement with a fixed terminal of the other of
75 said lines, each of said means comprising an automatic switch, a common controlling circuit for said switches normally adapted to control a first one of said switches, means included in said first switch for shifting the
80 control to the other of said switches, and a relay for each of said lines for connecting its associated fixed terminals.

30. In a trunking system, a pair of lines, each line terminating in a jack, a cord circuit for interconnecting said lines through
85 the medium of their associated jacks, a link circuit having movable terminals at each end, fixed terminals for each of said lines normally disconnected therefrom and accessible to said movable terminals, means for
90 advancing one of said movable terminals into engagement with a fixed terminal of one of said lines, means for advancing the other of said movable terminals into engagement with a fixed terminal of the other
95 of said lines, each of said means comprising an automatic switch, a common controlling circuit for said switches normally adapted to control a first one of said
100 switches, means included in said first switch for shifting the control to the other of said switches, and a relay for each of said lines for connecting its associated fixed terminals and for disconnecting its associated jack.
105

31. In a trunking system, a pair of lines, each line terminating in a jack, a cord circuit for interconnecting said lines through
110 the medium of their associated jacks, a link circuit having movable terminals at each end, fixed terminals for each of said lines normally disconnected therefrom and accessible to said movable terminals, means for
115 advancing one of said movable terminals into engagement with a fixed terminal of one of said lines, means for advancing the other of said movable terminals into engagement with a fixed terminal of the other
120 of said lines, each of said means comprising an automatic switch, a common controlling circuit for said switches normally adapted to control a first one of said switches, means included in said first switch for shifting the control to the other of said
125 switches, a relay for each of said lines for connecting its associated fixed terminals, and means in said switches for controlling said relays.

32. In a trunking system, a pair of lines, each line terminating in a jack, a cord circuit for interconnecting said lines through

cuit for interconnecting said lines through the medium of their associated jacks, a link circuit having movable terminals at each end, fixed terminals for each of said lines
 5 normally disconnected therefrom and accessible to said movable terminals, means for advancing one of said movable terminals into engagement with a fixed terminal of one of said lines, means for advancing the
 10 other of said movable terminals into engagement with a fixed terminal of the other of said lines, each of said means comprising an automatic switch, a common controlling circuit for said switches normally
 15 adapted to control a first one of said switches, means included in said first switch for shifting the control to the other of said switches, a relay for each of said lines for connecting its associated fixed terminals and
 20 for disconnecting its associated jack, and means in said switches for controlling said relays.

33. In a trunking system, a pair of lines, each line terminating in a jack, a cord circuit for interconnecting said lines through
 25 the medium of their associated jacks, a link circuit having movable terminals at each end, fixed terminals for each of said lines accessible to said movable terminals, means
 30 for advancing one of said movable terminals into engagement with a fixed terminal of one of said lines, and means for advancing the other of said movable terminals into engagement with a fixed terminal of the
 35 other of said lines, each of said means comprising an automatic switch, a supervisory circuit for said cord circuit and a second supervisory circuit for said link circuit.

34. In a trunking system, a pair of lines,
 40 each line terminating in a jack, a cord circuit for interconnecting said lines through the medium of their associated jacks, a link circuit having movable terminals at each end, fixed terminals for each of said lines
 45 accessible to said movable terminals, means for advancing one of said movable terminals into engagement with a fixed terminal of one of said lines, means for advancing the other of said movable terminals into engagement
 50 ment with a fixed terminal of the other of said lines, each of said means comprising an automatic switch, a supervisory circuit for said cord circuit, a second supervisory circuit for said link circuit, and a signal common to both of said supervisory circuits.
 55

35. In a trunking system, a pair of lines, each line terminating in a jack, a cord circuit for interconnecting said lines through
 60 the medium of their associated jacks, a link circuit having movable terminals at each end, fixed terminals for each of said lines accessible to said movable terminals, means for advancing one of said movable terminals into engagement with a fixed terminal of
 65 one of said lines, means for advancing the

other of said movable terminals into engagement with a fixed terminal of the other of said lines, each of said means comprising an automatic switch, a supervisory circuit for said cord circuit, a second supervisory circuit for said link circuit, and a common controlling circuit for said switches, said controlling circuit superimposed on said second supervisory circuit.

36. In a trunking system, a pair of lines, 75 each line terminating in a jack, a cord circuit for interconnecting said lines through the medium of their associated jacks, a link circuit having movable terminals at each end, fixed terminals for each of said lines 80 accessible to said movable terminals, means for advancing one of said movable terminals into engagement with a fixed terminal of one of said lines, means for advancing the other of said movable terminals into engagement with a fixed terminal of the other 85 of said lines, each of said means comprising an automatic switch, a third line connecting the talking conductors of said cord circuit with the talking conductors of said link circuit, a signal in bridge of said third line, 90 and a common controlling circuit for said switches including the two conductors of said third line in parallel.

37. In a trunking system, a pair of lines, 95 each of which is provided with normally connected and normally disconnected terminals, a cord circuit adapted for interconnecting said lines through the medium of said normally connected terminals, a trunk 100 line terminating at each end in an automatic switch, which switches have access to said normally disconnected terminals, a relay for each of said lines for shifting the line from its normally connected to its normally disconnected terminals and means included in 105 said switches for operating said relays.

38. In a trunking system, a pair of lines, each of which is provided with terminals of two kinds, a cord circuit adapted for inter- 110 connecting said lines through the medium of terminals of one kind, and a trunk line terminating at each end in an automatic switch, which switches have access to terminals of the other kind. 115

39. In a trunking system, a cord circuit and a trunk line inductively connected, and a plurality of lines adapted for interconnection by either.

40. In a trunking system, a plurality of 120 lines, a two conductor cord circuit for interconnecting said lines, a two conductor trunk line for interconnecting said lines, and condensers for inductively connecting the two conductors of the cord circuit, respectively, 125 with the two conductors of the trunk line.

41. In a trunking system, a pair of lines, each of which is provided with normally connected and normally disconnected terminals, a cord circuit adapted for intercon- 130

necting said lines through the medium of said normally connected terminals, a trunk line terminating at each end in an automatic switch, which switches have access to said normally disconnected terminals, a relay for each of said lines for shifting the line from its normally connected to its normally disconnected terminals, means included in said switches for operating said relays, and means whereby said cord circuit and said trunk line are connected in multiple.

42. In a trunking system, a pair of lines, each of which is provided with terminals of two kinds, a cord circuit adapted for interconnecting said lines through the medium of terminals of one kind, a trunk line terminating at each end in an automatic switch, which switches have access to terminals of the other kind, and means whereby said cord circuit and said trunk line are connected in multiple.

43. In a trunking system, a plurality of lines, a cord circuit for interconnecting said lines, a pair of automatic switches connected by a trunk line for interconnecting said lines, and means whereby said cord circuit and said trunk line are connected in multiple.

44. In a trunking system, a pair of lines, each of which is provided with normally connected and normally disconnected terminals, a cord circuit adapted for interconnecting said lines through the medium of said normally connected terminals, a trunk line terminating at each end in an automatic switch, which switches have access to said normally disconnected terminals, a relay for each of said lines for shifting the line from its normally connected to its normally disconnected terminals, means included in said switches for operating said relays, a supervisory circuit for said cord circuit, a second supervisory circuit for said trunk line, and a signal common to both of said supervisory circuits.

45. In a trunking system, a pair of lines, each of which is provided with terminals of two kinds, a cord circuit adapted for interconnecting said lines through the medium of terminals of one kind, a trunk line terminating at each end in an automatic switch, which switches have access to terminals of the other kind, a supervisory circuit for said cord circuit, a second supervisory circuit for said trunk line, and a signal common to both of said supervisory circuits.

46. In a trunking system, a plurality of lines, a cord circuit for interconnecting said lines, a pair of automatic switches connected by a trunk line for interconnecting said lines, a supervisory circuit for said cord circuit, a second supervisory circuit for said trunk line, and a signal common to both of said supervisory circuits.

47. In a trunking system, a pair of lines, each of which is provided with normally

connected and normally disconnected terminals, a cord circuit adapted for interconnecting said lines through the medium of said normally connected terminals, a trunk line terminating at each end in an automatic switch, which switches have access to said normally disconnected terminals, a relay for each of said lines for shifting the line from its normally connected to its normally disconnected terminals, means included in said switches for operating said relays, a third line inductively connected at one end with talking conductors of said cord circuit and inductively connected at the other end with talking conductors of said trunk line, and a common controlling circuit for said switches superimposed on said third line.

48. In a trunking system, a pair of lines, each of which is provided with terminals of two kinds, a cord circuit adapted for interconnecting said lines through the medium of terminals of one kind, a trunk line terminating at each end in an automatic switch, which switches have access to terminals of the other kind, a third line inductively connecting said cord circuit and said trunk line, and a controlling circuit for said switches superimposed on said third line.

49. In a trunking system, a plurality of lines, a cord circuit for interconnecting said lines, a pair of automatic switches connected by a trunk line for interconnecting said lines, conductors connecting the two strands of said cord circuit with said trunk line, a signal in bridge of said conductors, and a controlling circuit for said switches superimposed on said conductors.

50. In a trunking system, a pair of lines, each of which is provided with terminals of two kinds, a cord circuit adapted for interconnecting said lines through the medium of terminals of one kind, a trunk line terminating at each end in an automatic switch, which switches have access to terminals of the other kind, a third line interconnecting said cord circuit and trunk line, a controlling circuit for said switches superimposed on said third line, and a relay in said controlling circuit for controlling a first one of said switches.

51. In a trunking system, a plurality of lines, a cord circuit for interconnecting said lines, a pair of automatic switches connected by a trunk line for interconnecting said lines, conductors connecting the two strands of said cord circuit with said trunk line, a controlling circuit for said switches superimposed on said conductors, and a relay in said controlling circuit for controlling a first one of said switches.

52. In a trunking system, a pair of lines, each of which is provided with terminals of two kinds, a cord circuit adapted for interconnecting said lines through the medium of terminals of one kind, a trunk line termi-

nating at each end in an automatic switch, which switches have access to terminals of the other kind, a third line interconnecting said cord circuit and said trunk line, a controlling circuit for said switches superimposed on said third line, a relay in said controlling circuit for controlling a first one of said switches, and means included in said first switch for shifting the control of said relay to the other switch.

53. In a trunking system, a plurality of lines, a cord circuit for interconnecting said lines, a pair of automatic switches connected by a trunk line for interconnecting said lines.

conductors connecting the two strands of said cord circuit with said trunk line, a controlling circuit for said switches including said conductors, a relay in said controlling circuit for controlling a first one of said switches, and means included in said first switch for shifting the control of said relay to the other switch.

Signed by me at Chicago, Cook county, Illinois, this 11th day of March, 1916.

EARL R. NEIR.

Signed by me at St. Paul, Ramsey county, Minn., this 4th day of March, 1916.

BERNARD C. GROH.