

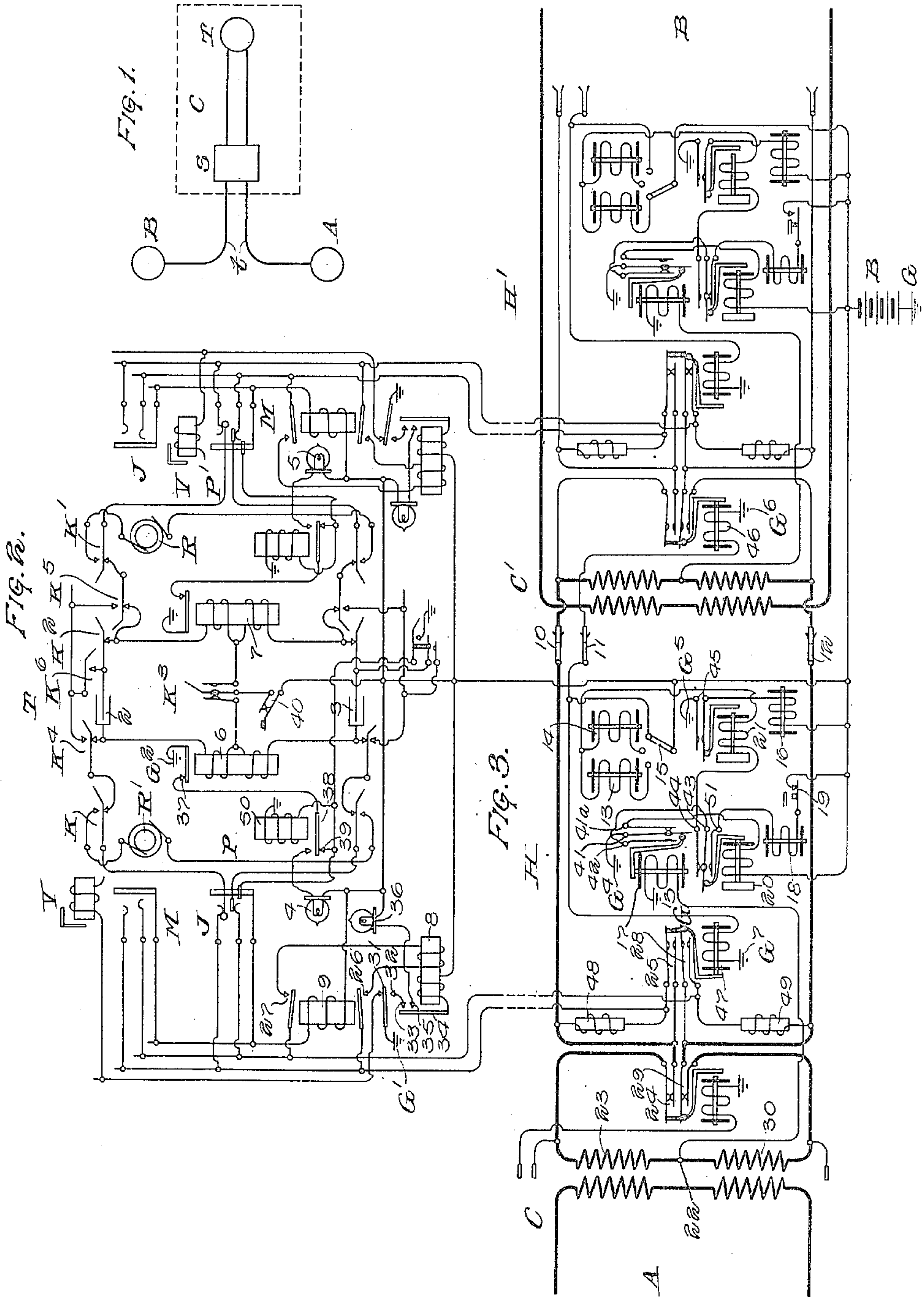
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TELEPHONE TRUNKING SYSTEM.

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TELEPHONE TRUNKING SYSTEM.

1,293,415.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, BERNARD C. GROH, a citizen of the United States of America, and a resident of Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Telephone Trunking Systems, of which the following is a specification.

My invention relates in general to telephone trunking systems and more particularly to methods of trunking or, "through switching," as it is usually termed, between long distance lines terminating at an intermediate or switching station. The switching of toll lines for the establishment of through connections has been done manually in the past, through the medium of operators at the switching station, and the principal object of my invention is the production of an automatic toll switching system whereby through connections may be established by automatic switches under control of an operator at a distant toll board and without the assistance of operators at the switching station.

Further objects of the invention relate to circuit improvements whereby well known types of automatic switches are used in conjunction with well known manual equipment to form a complete and efficient automatic toll switching system.

The invention relates also to the provision of means for setting up an automatic connection between the calling and called lines after the called line has been signaled and for disconnecting the called line from its normal connection to the operator's board and for retaining supervision over the automatically established connection between the calling and called lines. My invention also relates to details of improvement tending to increase the efficiency and serviceability of apparatus of the above character.

The means for accomplishing the foregoing and other useful ends are hereinafter set forth and claimed.

In the drawings Figure 1 represents a diagrammatic layout of a telephone system in which I have chosen to illustrate my invention.

Fig. 2 shows an operators cord circuit,

together with the toll board equipment of two lines.

Fig. 3 shows the switching station equipment of two toll lines.

Referring to Fig. 1, A and B represent outlying towns which are connected with the city C by means of toll lines *t*. It will be seen that these toll lines *t* loop through the switching station S before entering the toll board T in the city C. Heretofore, the method of operation has been as follows: Supposing that the operator at A desires connection with B, the operator at A by ringing on her toll line causes a signal to be displayed at the toll board T in the city C. The operator at T goes in on the line and upon finding that a connection is desired with B she depresses an order wire key leading to an operator at the switching station S and orders toll line A switched through to toll line B. As the switching station is placed in the outskirts of the city at the point where the open wire toll lines are connected to the underground cable system, it will be seen that this through switching eliminates several miles of cable circuit when a through connection is put up. It is the object of this invention to disclose means by which the operations at the switching station S may be controlled wholly by the operators at the toll board T, thus eliminating the operators at the switching station.

The cord circuit T (Fig. 1) is a well known type of cord circuit comprising the usual answering and calling plugs P and P', respectively, inductively connected through the medium of the condensers 2 and 3. The lamps 4 and 5 are the usual supervisory lamps and are controlled by the supervisory relays 6 and 7, respectively. The keys K and K' are the usual ringing keys, keys K⁴, K⁵ and K⁶ are the usual listening keys, the key K² when operated, disconnects the answering and calling ends of the cord circuit. The key K³ is a calling device key, the purpose of which is to connect a calling device with the cord circuit, through the medium of which the operator may control the automatic switches to set up the proper connection. This calling device may be any desired type, such for instance, as

that shown in British Patent to S. G. S. Dicker No. 29,654 of 1910, through the medium of which calling device the operator may interrupt the simplex circuit a desired number of times for each of the digits of the number of the called subscriber.

The toll line A terminates at the toll switchboard in an answering jack J, line relay 8 and cut-off relay 9. In addition, there is shown the multiple jack M with its visual busy signal V. The equipment for the toll line B is similar to that of toll line A.

The connector switch H associated with the toll line A, is of the same general type of connector switch as disclosed in United States Letters Patent No. 815,176, granted March 13, 1906, to Keith, Erickson and Erickson, the circuits, however, being notified to adapt the switch to operate in a system embodying the principles of my invention. Among other details, the connector H comprises a bank of contacts arranged in horizontal rows or levels, which contacts are adapted to be engaged by a set of wipers, 10, 11 and 12 carried upon a shaft (not shown) which has a vertical movement controlled by the vertical magnet 13 and a rotary movement controlled by the rotary magnet 14. The usual side switch comprising the wiper 15 is controlled by the private magnet 16 in the usual and well-known manner. The operations of various parts of the switch are controlled through the medium of the line relay 17. Means for permitting the switch to be restored to normal position, are provided in the release magnet 18, which, upon energizing, withdraws the retaining double-dog from the shaft, thereby causing the shaft and wipers to be returned to their normal position. The springs 19 close only when the switch shaft has been raised one or more steps from its lowest position. The relays 20 and 21 are slow acting, that is, slow to release their armatures upon deenergizing. The connector switch H' associated with the toll line B is similar to the connector switch H.

For the purpose of supplying battery current for operating the apparatus there is shown the battery B having one terminal grounded at G. Although there is shown only one battery in the drawings, a plurality of batteries may be provided, that is, a battery at the switching station S and one at the toll board T. For the purpose of supplying ringing current there is shown the ringing current generators R and R'.

A general description of the apparatus having been given it will now be explained how a connection may be completed from toll line A to toll line B. It will be assumed that the circuit number of toll line B is 22

When an operator upon the toll line A desires connection with the toll line B, she impresses ringing current upon the toll line A which induces an alternating current in the following circuit, from point 22 through winding 23 of repeating coil C, springs 24, springs 25, springs 26, right hand winding of relay 8, springs 27, springs 28, springs 29, and the winding 30 of repeating coil C to point 22. This alternating current energizes relay 8, which, upon energizing, forms a locking circuit for itself from ground G¹ through springs 31 and 32, springs 33 and 34, and the left hand winding of relay 8 to battery B. In addition the relay 8, upon energizing, closes a circuit from ground G¹ through springs 31 and 32, springs 33, 34 and 35, and lamp 36 to battery B. The operator at T upon seeing the lamp 36 glowing, inserts the plug P into the jack J, whereupon a circuit is formed from ground G² through springs 37, springs 38 and 39, sleeve of plug P and sleeve of jack J, relay 9 to battery B. The relay 9, upon energizing, removes the winding of relay 8 from across the line, extinguishes the lamp 36, and closes a circuit from ground G¹ through all the visual busy relays, associated with that line to battery B. The energization of the visual busy relays informs the operators at the multiple positions that the toll line A is busy. The operator at T then operates the key K⁴ to connect her talking set (not shown) across the calling line and converses with the operator at A. Upon learning that a connection is desired with toll line B, she inserts the plug P' into a multiple jack M of the toll line B. The insertion of the plug P' causes the line relay to be removed from the toll line B and the visual busy relays to be operated in a manner similar to that described in connection with the plug P. The operator at T then depresses the key K' to impress ringing current on the toll line B, and upon the response of the operator at B, the operator at T presses the key K³ to the left and operates the calling device 40 for the digits of the circuit number of the toll line B.

When the key K³ is pressed to the left, a circuit may be traced from ground G³ through line relay 17 to point 22, through the windings 23 and 30 in parallel, the two sides of the line and of the cord circuit in parallel, the two windings of relay 6 in parallel, key K³ and the calling device 40 to battery B. The relay 6 is differentially wound and will not operatively energize at this time, the relay 17, however, will energize and close a circuit through relay 20. This circuit extends from ground G⁴ through contacts of springs 41 and 41* and relay 20 to battery B. The operator at T now operates the calling device 40 for the first digit two of the number of toll line

B, whereby the calling device impulse springs are separated twice momentarily, each time breaking the circuit of the line relay 17 of the connector H.

5 The relay 20 of the connector being slow acting does not deenergize during the momentary interruptions of its circuit by the relay 17 and consequently each time the latter relay deenergizes an impulse is transmitted over the circuit extending from ground G⁴ through springs 41 and 42, springs 43 and 44, relay 21, vertical magnet 13, side switch wiper 15 (in first position) to battery B. The vertical magnet receives 10 two impulses over this circuit and operates to raise the switch shaft and wipers two steps, to a position opposite the second row or level of bank contacts, and, at the same time the shaft controlled springs 19 are closed. The slow acting relay 21 is maintained in its energized position continuously while impulses are being transmitted to the vertical magnet through it, and in its energized position closes a circuit from ground 15 G⁵ through springs 45, private magnet 16 to battery B. This circuit is broken when the relay 21 deenergizes after the last impulse has been delivered to the vertical magnet, and the breaking of said circuit causes 20 the private magnet 16 to deenergize, thus permitting the sideswitch to pass to second position. In passing from first to second position the side switch wiper 15 transfers the battery connection from the vertical 25 magnet 13 to the rotary magnet 14.

The operator at T now operates the calling device 40 for the second digit, two, of the number of toll line B, in response to which the connector line relay operates to transmit 30 two impulses through the rotary magnet 14 whereby the shaft wipers are rotated onto the bank contacts associated with the toll line B. The circuit of the rotary magnet extends from ground G⁴ through springs 41 and 42, springs 43 and 44, relay 21, rotary magnet 14, side switch wiper 15 (in second position) to battery B. The relay 21 operates in response to this digit, in the same manner as for the previous digit, to cause 35 the private magnet 16 to advance the side switch to third position. By the engagement of the side switch wiper 15 with its third position contact point circuits are formed as follows: from ground G⁶ through 40 relay 46, private wiper 11, side switch wiper 15 (in third position) to battery B. The relay 46, upon energizing, disconnects that part of toll line B which extend from the switching station to the toll board. A second circuit is formed from G⁷ through the 45 relay 47, side switch wiper 15 (in third position) to battery B, and the relay 47, upon energizing, removes the shunts from around the impedance coils 48 and 49.

65 It will be seen that the toll lines A and B

are now directly connected at the switching station and that the relay 6 at the cord circuit T is bridged across the toll line A, but in series with the impedance coils 48 and 49. These coils are of so high an impedance that 70 the relay 6 will not effect the transmission, but after the conversation is completed and either of the operators ring off, the relay 6 will receive enough current to be operated. The relay 6, upon operating, removes the 75 shunt from around the relay 50, which relay immediately energizes and locks up through the cut-off relay 9 and closes a circuit through the lamp 4, this causes the said lamp to glow. The operator at T, upon seeing the lamp 4 glowing, operates the key K⁶ 80 and inquires if the connection has been terminated, and, if it has, she thereupon removes the plugs P and P' from their respective jacks at the same time restoring the key 85 K³ to normal. The removal of the plug P opens the circuit of the relay 17, which relay, upon deenergizing, opens the circuit of relay 20. The relay 20, upon deenergizing, closes a circuit from ground G⁴ through 90 springs 41 and 42, springs 43 and 51, release magnet 18, off normal springs 19 to battery B. The release magnet, upon energizing, operates to remove the retaining double dog from the shaft thereby causing 95 said shaft to drop to its normal position and its own circuit is opened at the springs 19 when the said shaft reaches its lowest position.

It will be seen from the foregoing that I 100 have designed a practical and efficient toll switching system whereby toll lines extending to a toll board via a switching station may be interconnected automatically at the 105 latter point under the control of an operator at the toll board, and entirely independent of manual assistance at the switching station.

While I have found it convenient in explaining my invention to show a certain specific embodiment thereof, I am aware that 110 changes may be made to adapt the invention to various operating methods and systems, and I do not, therefore, wish to limit myself to the exact embodiment shown and described, but desire rather to include and have protected by Letters Patent all forms 115 and modifications of my invention which may hereafter be devised, limited only by the scope of the appended claims. 120

What I claim as my invention is:

1. In a telephone system, a line, an automatic switch associated with said line, a second line, a terminal for said second line in said switch, a branch circuit for said second 125 line, a branch circuit for said first line, an auxiliary circuit associated with the branch circuit of the first line, means for connecting the auxiliary circuit and said last mentioned branch circuit, means indi- 130

vidual to said auxiliary circuit for operating said switch over said last mentioned branch circuit to extend a connection from the first to the second line, and means controlled by said switch for disconnecting the second line from its branch circuit.

2. In a telephone system, a line, an automatic switch associated with said line, a second line, a terminal for said second line in said switch, a branch circuit for said second line, a branch circuit for said first line, a signal individual to the branch circuit of said first line, an auxiliary circuit associated with the branch circuit of the first line, means for operating said signal over circuits including the first line, means for connecting the auxiliary circuit and said last branch circuit in response to the operation of said signal, means associated with said branch circuit for operating said switch to extend a connection from the first to the second line, and means controlled by said switch for disconnecting the branch circuit of the second line from the second line.

3. In a telephone system, a line, an automatic switch associated with said line, a second line, a terminal for said second line in said switch, a branch circuit for said second line, a branch circuit for said first line, an auxiliary circuit associated with said branch circuits, means for connecting said auxiliary circuit with said second line, a signal on said second line, a source of signaling current, and means individual to said auxiliary circuit for applying said signaling current to the second line for operating said signal, means for connecting said auxiliary circuit with the branch circuit of the first line, means associated with said auxiliary circuit for operating said automatic switch to establish a connection between the first and the second lines.

4. In a telephone system, a line, an automatic switch associated with said line, a second line, a terminal for said second line in said switch, a branch circuit for said second line, a branch circuit for said first line, an auxiliary circuit associated with said branch circuits, means for connecting said auxiliary circuit with said second line, a signal on said second line, a source of signaling current, means individual to said auxiliary circuit for applying said signaling current to the second line for operating said signal, means for connecting said auxiliary circuit with the branch circuit of the first line, means associated with said auxiliary circuit for operating said automatic switch to establish a connection between the first and the second lines, and means controlled by said automatic switch for disconnecting the second line from its branch circuit.

5. In a telephone system, a line, an automatic switch associated with said line, a second line, a terminal for said second line in

said switch, a branch circuit for said second line, a branch circuit for said first line, a signal associated with the branch circuit of said first line, an auxiliary circuit associated with said branch circuits, means for connecting said auxiliary circuit with said second line, a signal on said second line, a source of signaling current, means individual to said auxiliary circuit for applying said signaling current to the second line for operating said signal, means for operating said first signal over circuits including the first line, means for connecting said auxiliary circuit with the branch circuit of the first line in response to the operation of said first signal, and means associated with said auxiliary circuit for operating said automatic switch to establish a connection between the first and the second lines.

6. In a telephone system, a line, an automatic switch associated with said line, a second line, a terminal for said second line in said switch, a branch circuit for said second line, a branch circuit for said first line, a signal associated with the branch circuit of said first line, an auxiliary circuit associated with said branch circuits, means for connecting said auxiliary circuit with said second line, a signal on said second line, a source of signaling current, means individual to said auxiliary circuit for applying said signaling current to the second line for operating said signal, means for operating said first signal over circuits including the first line, means for connecting said auxiliary circuit with the branch circuit of the first line in response to the operation of said first signal, means associated with said auxiliary circuit for operating said automatic switch to establish a connection between the first and the second lines, and means controlled by said automatic switch for disconnecting the second line from its branch circuit.

7. In a telephone system, a line, an automatic switch associated with said line, a second line, a terminal for said second line in said switch, a branch circuit for said second line, a branch circuit for said first line, an auxiliary circuit associated with the branch circuit of the first line, means for connecting the auxiliary circuit and said last branch circuit, means associated with said branch circuit for operating said switch to extend a connection from the first to the second line, means controlled by said switch for disconnecting the branch circuit of the second line from its branch circuit, supervisory equipment associated with said auxiliary circuit, and means for operating said supervisory equipment over the circuit connecting the two lines from either line.

8. In a telephone system, a line, an automatic switch associated with said line, a second line, a terminal for said second line in said switch, a branch circuit for said second

line, a branch circuit for said first line, a signal associated with the branch circuit of said first line, an auxiliary circuit associated with the branch circuit of the first line, means for operating said signal over circuits including the first line, means for connecting the auxiliary circuit and said last branch circuit in response to the operation of said signal, means associated with said branch circuit for operating said switch to extend a connection from the first to the second line, means controlled by said switch for disconnecting the branch circuit of the second line from the second line, supervisory equipment associated with said auxiliary circuit, and means for operating said supervisory equipment over the circuit connecting the two lines from either line.

9. In a telephone system, a line, an automatic switch associated with said line, a second line, a terminal for said second line in said switch, a branch circuit for said second line, a branch circuit for said first line, an auxiliary circuit associated with the branch circuits, means for connecting said auxiliary circuit with said second line, a signal on said second line, a source of signaling current, means associated with said auxiliary circuit for applying said signaling current to the second line for operating said signal, means for connecting said auxiliary circuit with the branch circuit of the first line, means associated with said auxiliary circuit for operating said automatic switch to establish a connection between the first and the second lines, supervisory equipment associated with said auxiliary circuit, and means for operating said supervisory equipment over the circuit connecting the two lines from either line.

10. In a telephone system, a line, an automatic switch associated with said line, a second line, a terminal for said second line in said switch, a branch circuit for said second line, a branch circuit for said first line, an auxiliary circuit associated with said branch circuits, means for connecting said auxiliary circuit with said second line, a signal on said second line, a source of signaling current, means associated with said auxiliary circuit for applying said signaling current to the second line for operating said signal, means for connecting said auxiliary circuit with the branch circuit of the first line, means associated with said auxiliary circuit for operating said automatic switch to establish a connection between the first and the second lines, means controlled by said automatic switch for disconnecting the second line from its branch circuit, supervisory equipment associated with said auxiliary circuit, and means for operating said supervisory equipment over the circuit connecting the two lines from either line.

11. In a telephone system, a line, an auto-

matic switch associated with said line, a second line, a terminal for said second line in said switch, a branch circuit for said second line, a branch circuit for said first line, a signal associated with the branch circuit of said first line, an auxiliary circuit associated with said branch circuits, means for connecting said auxiliary circuit with said second line, a signal on said second line, a source of signaling current, means associated with said auxiliary circuit for applying said signaling current to the second line for operating said signal, means for operating said first signal over circuits including the first line, means for connecting said auxiliary circuit with the branch circuit of the first line in response to the operation of said first signal, means associated with said auxiliary circuit for operating said automatic switch to establish a connection between the first and the second lines, supervisory equipment associated with said auxiliary circuit, and means for operating said supervisory equipment over the circuit connecting the two lines from either line.

12. In a telephone system, a line, an automatic switch associated with said line, a second line, a terminal for said second line in said switch, a branch circuit for said second line, a branch circuit for said first line, a signal associated with the branch circuit of said first line, an auxiliary circuit associated with said branch circuits, means for connecting said auxiliary circuit with said second line, a signal on said second line, a source of signaling current, means associated with said auxiliary circuit for applying said signaling current to the second line for operating said signal, means for operating said first signal over circuits including the first line, means for connecting said auxiliary circuit with the branch circuit of the first line in response to the operation of said first signal, means associated with said auxiliary circuit for operating said automatic switch to establish a connection between the first and the second lines, means controlled by said automatic switch for disconnecting the second line from its branch circuit, supervisory equipment associated with said auxiliary circuit, and means for operating said supervisory equipment over the circuit connecting the two lines from either line.

13. In a telephone system, a line, an automatic switch associated with said line, a second line, a terminal for said second line in said switch, a branch circuit for said second line, a branch circuit for said first line, an auxiliary circuit associated with the branch circuit of the first line, means for connecting the auxiliary circuit and said last branch circuit, means individual to said auxiliary circuit for operating said switch over said last branch circuit to extend a connec-

tion from the first to the second line, means controlled by said switch for disconnecting the branch circuit of the second line from its branch circuit, and means for automatically releasing the connection between the two lines.

14. In a telephone system, a line, an automatic switch associated with said line, a second line, a terminal for said second line in said switch, a branch circuit for said second line, a branch circuit for said first line, a signal individual to the branch circuit of said first line, an auxiliary circuit associated with the branch circuit of the first line, means for operating said signal over circuits including the first line, means for connecting the auxiliary circuit and said last branch circuit in response to the operation of said signal, means associated with said branch circuit for operating said switch to extend a connection from the first to the second line, means controlled by said switch for disconnecting the branch circuit of the second line from the second line, and means for automatically releasing the connection between the two lines.

15. In a telephone system, a line, an automatic switch associated with said line, a second line, a terminal for said second line in said switch, a branch circuit for said second line, a branch circuit for said first line, an auxiliary circuit associated with said branch circuits, means for connecting said auxiliary circuit with said second line, a signal on said second line, a source of signaling current, means individual to said auxiliary circuit for applying said signaling current to the second line for operating said signal, means for connecting said auxiliary circuit with the branch circuit of the first line, means associated with said auxiliary circuit for operating said automatic switch to establish a connection between the first and the second lines, and means for automatically releasing the connection between the two lines.

16. In a telephone system, a line, an automatic switch associated with said line, a second line, a terminal for said second line in said switch, a branch circuit for said second line, a branch circuit for said first line, an auxiliary circuit associated with said branch circuits, means for connecting said auxiliary circuit with said second line, a signal on said second line, a source of signaling current, means individual to said auxiliary circuit for applying said signaling current to the second line for operating said signal, means for connecting said auxiliary circuit with the branch circuit of the first line, means associated with said auxiliary circuit for operating said automatic switch to establish a connection between the first and the second lines, means controlled by said automatic switch for disconnecting the

second line from its branch circuit, and means for automatically releasing the connection between the two lines.

17. In a telephone system, a line, an automatic switch associated with said line, a second line, a terminal for said second line in said switch, a branch circuit for said second line, a branch circuit for said first line, a signal associated with the branch circuit of said first line, an auxiliary circuit associated with said branch circuits, means for connecting said auxiliary circuit with said second line, a signal on said second line, a source of signaling current, means individual to said auxiliary circuit for applying said signaling current to the second line for operating said signal, means for operating said first signal over circuits including the first line, means for connecting said auxiliary circuit with the branch circuit of the first line in response to the operation of said first signal, means associated with said auxiliary circuit for operating said automatic switch to establish a connection between the first and the second lines, and means for automatically releasing the connection between the two lines.

18. In a telephone system, a line, an automatic switch associated with said line, a second line, a terminal for said second line in said switch, a branch circuit for said second line, a branch circuit for said first line, a signal individual to the branch circuit of said first line, an auxiliary circuit associated with said branch circuits, means for connecting said auxiliary circuit with said second line, a signal on said second line, a source of signaling current, means associated with said auxiliary circuit for applying said signaling current to the second line for operating said signal, means for operating said first signal over circuits including the first line, means for connecting said auxiliary circuit with the branch circuit of the first line in response to the operation of said first signal, means associated with said auxiliary circuit for operating said automatic switch to establish a connection between the first and the second lines, means controlled by said automatic switch for disconnecting the second line from its branch circuit, and means for automatically releasing the connection between the two lines.

19. In a telephone system, a line, an automatic switch associated with said line, a second line, a terminal for said second line in said switch, a branch circuit for said second line, a branch circuit for said first line, an auxiliary circuit associated with the branch circuit of the first line, means for connecting the auxiliary circuit and said last branch circuit, means associated with said branch circuit for operating said switch to extend a connection from the first to the second line, means controlled by said switch

for disconnecting the branch circuit of the second line from its branch circuit, supervisory equipment associated with said auxiliary circuit, means for operating said supervisory equipment over the circuit connecting the two lines, and means for automatically releasing the connection between the two lines.

20. In a telephone system, a line, an automatic switch associated with said line, a second line, a terminal for said second line in said switch, a branch circuit for said second line, a branch circuit for said first line, a signal associated with the branch circuit of said first line, an auxiliary circuit associated with the branch circuit of the first line, means for operating said signal over circuits including the first line, means for connecting the auxiliary circuit and said last branch circuit in response to the operation of said signal, means associated with said branch circuit for operating said switch to extend a connection from the first to the second line, means controlled by said switch for disconnecting the branch circuit of the second line from the second line, supervisory equipment associated with said auxiliary circuit, and means for operating said supervisory equipment over the circuit connecting the two lines, and means for automatically releasing the connection between the two lines.

21. In a telephone system, a line, an automatic switch associated with said line, a second line, a terminal for said second line in said switch, a branch circuit for said second line, a branch circuit for said first line, an auxiliary circuit associated with said branch circuits, means for connecting said auxiliary circuit with said second line, a signal on said second line, a source of signaling current, means associated with said auxiliary circuit for applying said signaling current to the second line for operating said signal, means for connecting said auxiliary circuit with the branch circuit of the first line, means associated with said auxiliary circuit for operating said automatic switch to establish a connection between the first and the second lines, supervisory equipment associated with said auxiliary circuit, means for operating said supervisory equipment over the circuit connecting the two lines, and means for automatically releasing the connection between the two lines.

22. In a telephone system, a line, an automatic switch associated with said line, a second line, a terminal for said second line in said switch, a branch circuit for said second line, a branch circuit for said first line, an auxiliary circuit associated with said branch circuits, means for connecting said auxiliary circuit with said second line, a signal on said second line, a source of signaling current, means associated with

said auxiliary circuit for applying said signaling current to the second line for operating said signal, means for connecting said auxiliary circuit with the branch circuit of the first line, means associated with said auxiliary circuit for operating said automatic switch to establish a connection between the first and the second lines, means controlled by said automatic switch for disconnecting the second line from its branch circuit, supervisory equipment associated with said auxiliary circuit, means for operating said supervisory equipment over the circuit connecting the two lines, and means for automatically releasing the connection between the two lines.

23. In a telephone system, a line, an automatic switch associated with said line, a second line, a terminal for said second line in said switch, a branch circuit for said second line, a branch circuit for said first line, a signal associated with the branch circuit of said first line, an auxiliary circuit associated with said branch circuits, means for connecting said auxiliary circuit with said second line, a signal on said second line, a source of signaling current, means associated with said auxiliary circuit for applying said signaling current to the second line for operating said signal, means for operating said first signal over circuits including the first line, means for connecting said auxiliary circuit with the branch circuit of the first line in response to the operation of said first signal, means associated with said auxiliary circuit for operating said automatic switch to establish a connection between the first and the second lines, supervisory equipment associated with said auxiliary circuit, means for operating said supervisory equipment over the circuit connecting the two lines, and means for automatically releasing the connection between the two lines.

24. In a telephone system, a line, an automatic switch associated with said line, a second line, a terminal for said second line in said switch, a branch circuit for said second line, a branch circuit for said first line, a signal associated with the branch circuit of said first line, an auxiliary circuit associated with said branch circuits, means for connecting said auxiliary circuit with said second line, a signal on said second line, a source of signaling current, means associated with said auxiliary circuit for applying said signaling current to the second line for operating said signal, means for operating said first signal over circuits including the first line, means for connecting said auxiliary circuit with the branch circuit of the first line in response to the operation of said first signal, means associated with said auxiliary circuit for operating said automatic switch to establish a connection

between the first and the second lines, means controlled by said automatic switch for disconnecting the second line from its branch circuit, supervisory equipment associated with said auxiliary circuit, means for operating said supervisory equipment over the circuit connecting the two lines, and means for automatically releasing the connection between the two lines.

25. In a toll switching system, a plurality of toll lines extending through a switching station and then terminating in manual connective terminals at a toll board, operators' equipment for interconnecting said toll lines manually by way of said terminals, automatic switches at the switching station containing multiple fixed terminals of said lines, and means for operating said switches to interconnect said lines automatically.

26. In a toll switching system, a plurality of toll lines extending through a switching station and then terminating in manual connective terminals at a toll board, operators' equipment for interconnecting said toll lines manually by way of said terminals, automatic switches at the switching station containing multiple fixed terminals of said lines, and controlling circuits for said switches accessible to toll operators whereby said lines may be interconnected automatically.

27. In a toll switching system, a plurality of toll lines extending through a switching station and then terminating in manual connective terminals at a toll board, operators' equipment for interconnecting said toll lines manually by way of said terminals, a branch of each toll line terminating in an automatic switch at the switching station, multiple fixed terminals of said lines in said switches, and means for operating said switches to interconnect said lines automatically.

28. In a toll switching system, a plurality of toll lines extending through a switching station and then terminating in manual connective terminals at a toll board, operators' equipment for interconnecting said toll lines manually by way of said terminals, a branch of each toll line terminating in an automatic switch at the switching station, multiple fixed terminals of said lines in said switches, and controlling circuits for said switches accessible to toll operators whereby said lines may be interconnected automatically.

29. In a toll switching system, a plurality of toll lines extending through a switching station and then terminating in manual connective terminals at a toll board, operators' equipment for interconnecting said toll lines manually by way of said terminals, a branch of each toll line terminating in an automatic switch at the switching station, multiple fixed terminals of said lines in said switches,

a controlling circuit for each switch including that portion of the associated toll line extending between the switching station and the toll board, and operator controlled means for actuating said switches over their respective controlling circuits to interconnect said lines automatically.

30. In a toll switching system, a plurality of toll lines extending through a switching station and then terminating in manual connective terminals at a toll board, operators' equipment for interconnecting said toll lines manually by way of said terminals, automatic switches at the switching station each comprising a movable terminal individual to a particular toll line and multiple fixed terminals of all the toll lines, and means for operating said switches to interconnect said lines automatically.

31. In a toll switching system, a plurality of toll lines extending through a switching station and then terminating in manual connective terminals at a toll board, operators' equipment for interconnecting said toll lines manually by way of said terminals, automatic switches at the switching station each comprising a movable terminal individual to a particular toll line and multiple fixed terminals of all the toll lines, and controlling circuits for said switches accessible to toll operators whereby said lines may be interconnected automatically.

32. In a toll switching system, a plurality of toll lines extending through a switching station and then terminating in manual connective terminals at a toll board, operators' equipment for interconnecting said toll lines manually by way of said terminals, automatic switches at the switching station each comprising a movable terminal individual to a particular toll line and multiple fixed terminals of all the toll lines, a controlling circuit for each switch including that portion of the associated toll line extending between the switching station and the toll board, and operator controlled means for actuating said switches over their respective controlling circuits to interconnect said lines automatically.

33. In a toll switching system, a plurality of toll lines extending through a switching station and then terminating at a toll operator's position, manual equipment for answering calls received over said lines, automatic switches at the switching station each comprising a movable terminal individual to a particular toll line and multiple fixed terminals of all the toll lines, and means for operating said switches to interconnect said lines automatically.

34. In a toll switching system, a plurality of toll lines extending through a switching station and then terminating at a toll operator's position, manual equipment for

answering calls received over said lines, automatic switches at the switching station containing multiple fixed terminals of said lines, and controlling circuits for said switches accessible to toll operators whereby said lines may be interconnected automatically.

35. In a toll switching system, a plurality of toll lines extending through a switching station and then terminating at a toll operator's position, manual equipment for answering calls received over said lines, a branch of each toll line terminating in an automatic switch at the switching station, multiple fixed terminals of said lines in said switches, and means for operating said switches to interconnect said lines automatically.

36. In a toll switching system, a plurality of toll lines extending through a switching station and then terminating at a toll operator's position, manual equipment for answering calls received over said lines, a branch of each toll line terminating in an automatic switch at the switching station, multiple fixed terminals of said lines in said switches, and controlling circuits for said switches accessible to toll operators whereby said lines may be interconnected automatically.

37. In a toll switching system, a plurality of toll lines extending through a switching station and then terminating at a toll operator's position, manual equipment for answering calls received over said lines, a branch of each toll line terminating in an automatic switch at the switching station, multiple fixed terminals of said lines in said switches, a controlling circuit for each switch including that portion of the associated toll line extending between the switching station and the toll board, and operator controlled means for actuating said switches over their respective controlling circuits to interconnect said lines automatically.

38. In a toll switching system, a plurality of toll lines extending through a switching station and then terminating at a toll operator's position, manual equipment for answering calls received over said lines, automatic switches at the switching station each comprising a movable terminal individual to a particular toll line and multiple fixed terminals of all the toll lines, and means for operating said switches to interconnect said lines automatically.

39. In a toll switching system, a plurality of toll lines extending through a switching station and then terminating at a toll operator's position, manual equipment for answering calls received over said lines, automatic switches at the switching station each comprising a movable terminal individual to a particular toll line and multiple

fixed terminals of all the toll lines, and controlling circuits for said switches accessible to toll operators whereby said lines may be interconnected automatically.

40. In a toll switching system, a plurality of toll lines extending through a switching station and then terminating at a toll operator's position, manual equipment for answering calls received over said lines, automatic switches at the switching station each comprising a movable terminal individual to a particular toll line and multiple fixed terminals of all the toll lines, a controlling circuit for each switch including that portion of the associated toll line extending between the switching station and the toll board, and operator controlled means for actuating said switches over their respective controlling circuits to interconnect said lines automatically.

41. In a telephone system, a plurality of lines each having three branches, the branches of each line extending, respectively, to an operator's position, a movable terminal of an automatic switch, and a multiple fixed terminal in each of said switches, and an operator's controlling circuit for each switch including the associated first branch whereby any switch may be operated to connect its associated line with any one of the other lines.

42. In a telephone system, a plurality of lines each having three branches, the branches of each line extending, respectively, to an operator's position, a movable terminal of an automatic switch, and a multiple fixed terminal in each of said switches, an operator's controlling circuit for each switch including the associated first branch whereby any switch may be operated to connect its associated line with any one of the other lines, and operator's equipment for interconnecting any two of said lines manually independent of the associated switches.

43. In a telephone system, a plurality of lines each having three branches, the branches of each line extending, respectively, to an operator's position, a movable terminal of an automatic switch, and a multiple fixed terminal in each of said switches, an operator's controlling circuit for each switch including the associated first branch whereby any switch may be operated to connect its associated line with any one of the other lines, and means for disconnecting the branch of any line which extends to the operator's position when such line is seized by one of said switches.

44. In a telephone system, a line provided at one end with first and second branches terminating, respectively, in an automatic switch and in an operator's position, other lines accessible to said switch, a controlling circuit for said switch including the conduc-

tors of said second branch in parallel, and means controlled by an operator for transmitting current impulses over said circuit to operate said switch to connect said first line
5 with one of said other lines.

45. In a telephone system, a plurality of lines each terminating in an automatic switch, a multiple fixed terminal of each line in each switch, a branch of each line extend-
10 ing to an operator's position, means at the operator's position for answering calls received over said lines by way of said branches, and operator controlled means for
15 operating any switch to extend its associated line into connection with any one of the other lines.

46. In a toll switching system, a plurality of toll lines each terminating in an automatic switch, multiple fixed terminals of
20 said lines in said switches, a branch of each line extending to an operator's position, and a controlling circuit for each switch including a conductor of the associated branch.

47. In a toll switching system, a plurality
25 of toll lines each terminating in an automatic switch, multiple fixed terminals of said lines in said switches, a branch of each line extending to an operator's position, means at the operator's position for answer-

ing calls, and an operator's controlling circuit for each switch whereby any switch may be operated to connect its associated line with any one of the other lines.

48. In a toll switching system, a plurality of toll lines each terminating at a switching
35 station in an automatic switch, multiple fixed terminals of said lines in said switches, a branch of each line extending to a toll board, and a controlling circuit for each switch including the conductors of the associated
40 branch in parallel.

49. In a toll switching system, a plurality of toll lines extending via a switching station to a toll board, operator's equipment including cord circuits at the toll board, automatic switches at the switching station
45 controllable from the toll board, and means whereby operators may at their option connect said toll lines manually by way of said cord circuits or automatically by way of said
50 switches.

Signed by me at Chicago, Cook county, Illinois, this 20th day of February, 1915.

BERNARD C. GROH.

Witnesses:

ALBERT ANDERSEN,
CHAS. M. CANDY.