G. W. LORIMER.

AUTOMATIC TELEPHONE EXCHANGE.

APPLICATION FILED MAY 31, 1906.

1,128,469.

Patented Feb. 16, 1915.

3 SHEETS—SHEET 1.

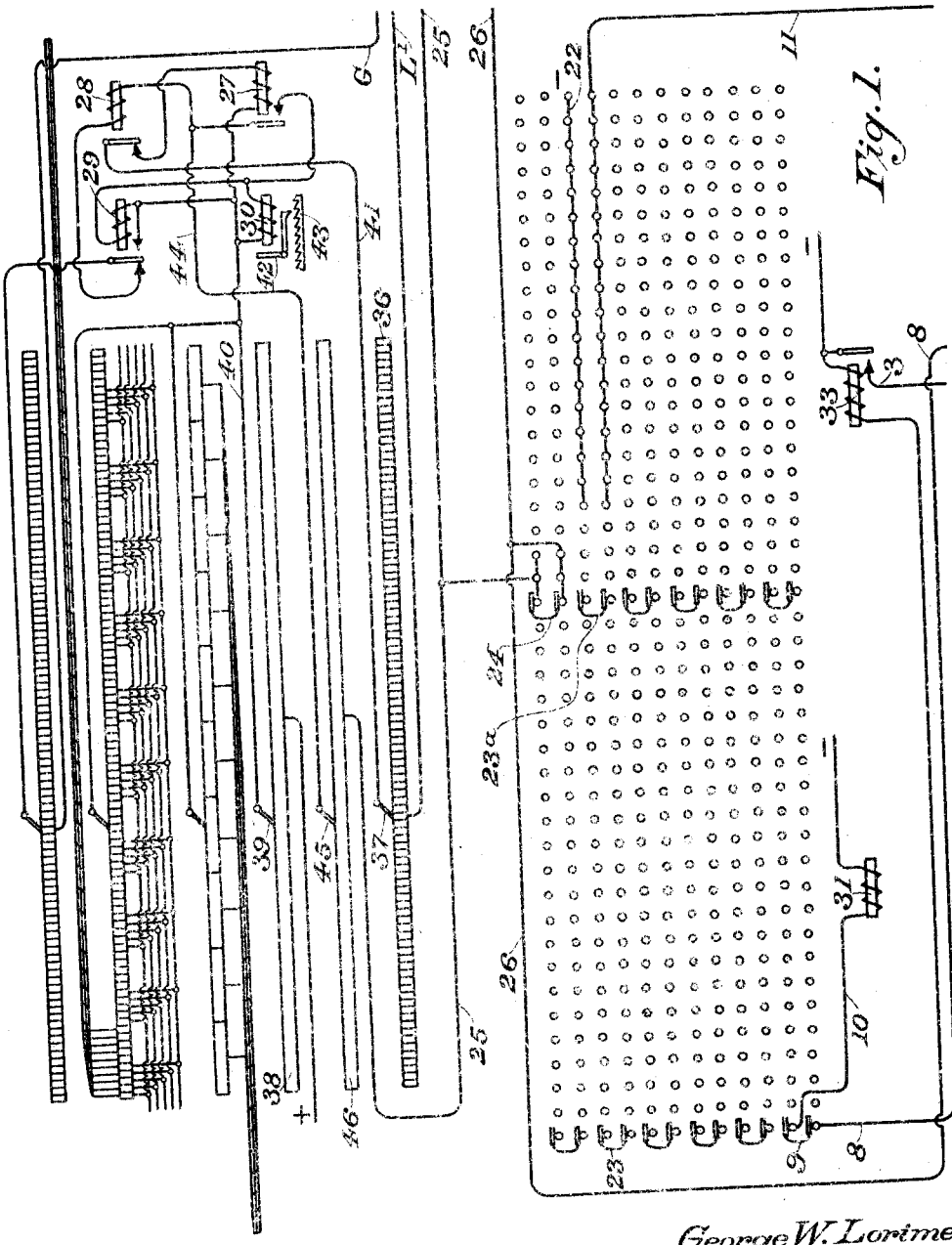


Fig. 1.

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3 SHEETS—SHEET 2.

Fig. 4.

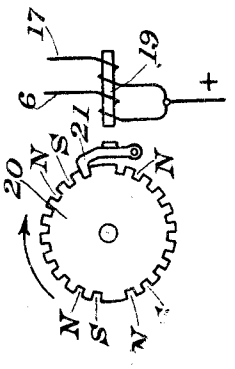
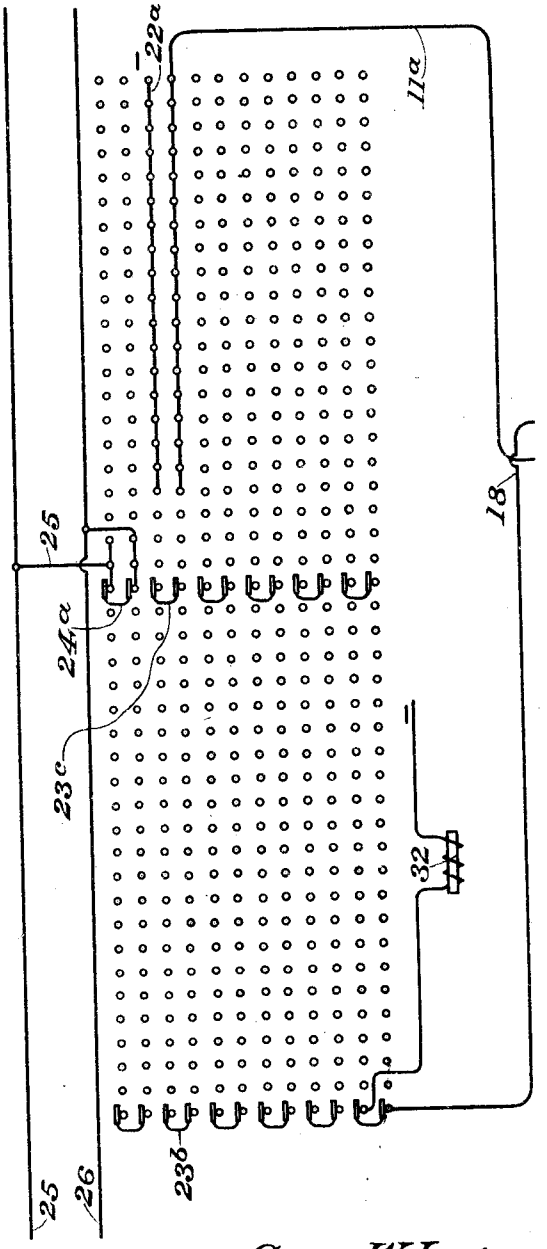


Fig. 2.



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3 SHEETS—SHEET 3.

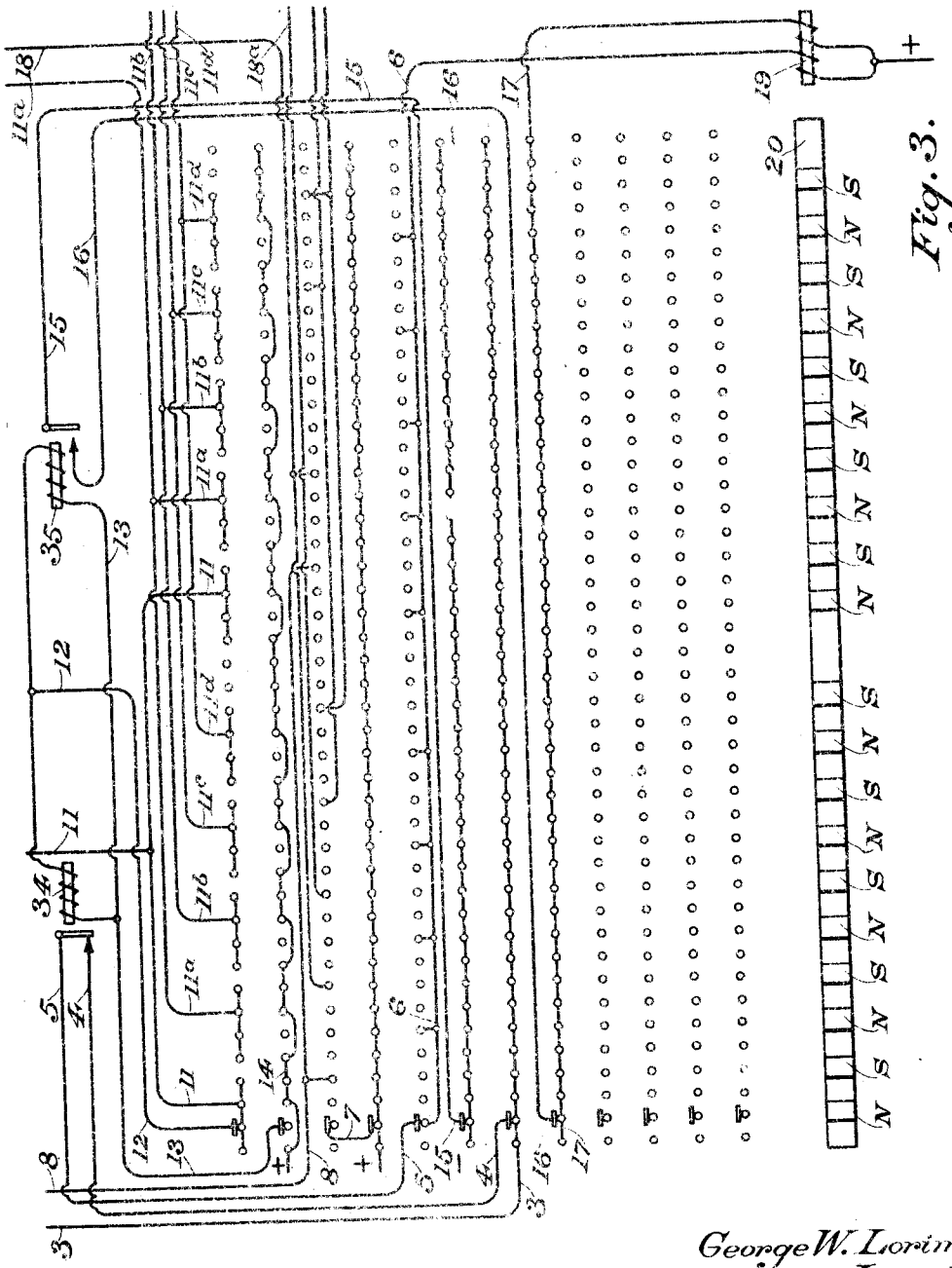


Fig. 3.

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UNITED STATES PATENT OFFICE.

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AUTOMATIC TELEPHONE-EXCHANGE.

1,128,469. Specification of Letters Patent. Patented Feb. 16, 1915.

Application filed May 31, 1906. Serial No. 319,416.

To all whom it may concern:

Be it known that I, GEORGE W. LORIMER, a citizen of the United States of America, and a resident of Piqua, county of Miami, and State of Ohio, have invented a new and useful Improvement in Automatic Telephone-Exchanges, of which the following is a specification.

My invention relates to division starters for automatic telephone exchanges, and has for its object to enable calls made by a substation equipment in an automatic exchange to be held in abeyance for future completion, if the necessary connecting devices for such completion are first found engaged, and to accomplish this result without derangement of connecting devices or loss of traffic. Its further object is to regulate the control of the unitary groups of connecting devices without wasteful operations on the part of the controlling devices.

My invention is of a character to operate in harmony with and as a part of the system of automatic telephone exchanges which I have invented jointly with James Hoyt Lorimer, and which is disclosed in Letters Patent of Great Britain granted to us in 1901, and numbered 8648 of that year. In this system the lines of the exchange are divided into groups, each group comprising a convenient or desired number of lines, say for example 100. Our earlier invention permits switching apparatus to be provided in a relatively small plurality of connecting units, each like another. For example, for 100 lines there may be provided from three to seven unitary connecting outfits. These are practically duplicates of one another and are adapted alike to be used by any one of the substations of a group of lines for effecting connection with the line of another substation in that or another group. Each of these sets of apparatus for connecting purposes is termed a "division," and in practice as many divisions are to be employed as may be necessary to switch the calling lines at the time of the greatest traffic which is considered at the time the extent of the installation is determined. In connection with a plurality of divisions installed for switching a group of lines, is installed one set of devices for the group, and these have to do with the control of various operations performed by the divisions. One of these devices common to a plurality of divisions, is the decimal indicator, another is the division starter or division selector and another is the decimal register controller. It is to the division starter in particular that my present invention is addressed, although it is as well related to other devices which coöperate with the division starter in its functions.

My invention is illustrated in the accompanying drawings in which similar letters refer to similar parts, and in which:

Figure 1 shows the decimal indicator, its relays and one rotary switch; Fig. 2 shows another rotary switch; Fig. 3 shows the division starter and Fig. 4 details of the division starter clutch.

The three sheets of drawings comprising these figures are capable of being viewed as one drawing by causing the lines 3 and 8 of Fig. 1 to register with those lines of Fig. 3, and lines 25 and 26 of Fig. 1 to register with those lines of Fig. 2. When so joined, Figs. 1, 2 and 3 become a single drawing through which the various circuits may be traced.

The decimal indicator shown in Fig. 1 is a combination of several commutators and collecting rings, having various circuits permanently connected to the segments of the commutators or to the collecting rings themselves. In the form here considered, the decimal indicator has four commutator rings and two collecting rings, upon each of which one brush moves. The brushes are adapted to revolve each in the circumference of its own ring, while the rings themselves are stationary, and the carrier which bears all the brushes is constantly driven by a friction clutch connecting it with a main power shaft. This carrier is further adapted to be capable of arrest when required, and the brushes, when the carrier is so arrested, will stand, while the driving shaft continues to rotate in the friction clutch. When the arrest is interrupted the brush carrier will recommence rotation.

The line from a subscriber is composed of two wires, and in the central office is associated with a third, the latter being for guarding purposes, to prevent a busy line from being called. Only one of the two wires of the line is carried to the decimal indicator, 100 such wires, one each of 100 lines, being brought to the commutator 36, where each wire ends in a conducting but

insulated segment. The act of instituting a call from a substation is to connect one wire of the line with the earth or common return wire, this conductor, whether earth or wire, having connection at the central office with one of the terminals of the central office battery or equivalent. In this specification the terminal so grounded is taken as the negative one. The wire grounded at the substation in instituting the call is in this specification designated as L'; the wire so marked in Fig. 1 will be engaged by the brush 37 when the decimal indicator is in the position shown in that drawing. When such contact is made, current will flow from the positive pole of the battery, through the collector ring 38, by brush 39, wire 40, relay 27, back contact of relay 28, wire 41, brush 37, wire L', to the substation, and by ground to the negative pole of the central office battery. Relay 27 closing will operate the clutch magnet 30, causing the pawl 42 to engage the circular rack 43. As the pawl 42 is carried with other relays and magnets with the brushes of the decimal indicator, and as the rack 43 is stationary with the commutators and rings, all the brushes will be arrested so long as the rack 43 is engaged. The circuit by which the magnet 30 is energized is as follows: positive battery terminal, wire 40, magnet 30, contacts of relay 27, wire 44, brush 45, ring 46, wire 25, pair of brushes 24 or 24ª, either or both, perhaps in parallel with others equivalently related, then by wire 26 and relay 33 to the negative terminal of the battery. In addition to operating the clutch to stop the decimal indicator, the relay 33 is operated. But it will be observed that neither the clutch magnet 30 nor the relay 33 could have received current but for the path between the wire 26 and the wire 25 being closed by a brush 24, 24ª, or some other similarly related connection. These brushes, such as 24, are in the rotary switches, of which one is shown in Fig. 1, and another in Fig. 2. And the relation of such switches to other devices is that there is one of them in each division of connecting apparatus, and that they assist in setting up the connection by changing functions and relations among the devices as their brushes step from one position to another. These rotary switches, as well as the division starter shown in Fig. 3, are conveniently made in a cylindrical form, being composed of contact pieces set in insulating material, and adapted to be engaged, where exposed on the inner surface of the insulating cylinder, by brushes attached to an axis at the center of the cylinder. Permitting the cylinder to remain fixed, wires can be attached to the various contact pieces on the outside, leaving their inner ends free to be engaged by the brushes as described. In these drawings the cylinder switches are all three shown as developed surfaces, and the same is true of the commutators and rings of the decimal indicator. Likewise I have shown the contact pieces in the form of circles, for clearness in the drawings, whereas they may be in this form, or may be flat conducting pieces adapted to be engaged by flat brushes in the common manner.

The position of the brushes 24 and 24ª in the figures is a normal one, and one in which they would rest if the division owning the rotary switch were not in use setting up a connection or permitting a conversation; but if it is doing either, the brushes 24 and 24ª will be in some other than normal position, and except in the very beginning of setting up a connection, will be out of contact with the two points in a row which immediately succeed the contacts here shown to be made. In a given rotary switch, then, out of normal position, there will be no connection between the wires 25 and 26. These wires are related to all the rotary switches of a given group of divisions exactly as they are to the two which I show. Thus, for each decimal indicator there are a number of divisions; for each division there is one rotary switch; in each rotary switch there is a tap from the wire 25, and one from the wire 26; if any one rotary switch associated with a given decimal indicator (a given "section") is in normal position, the wires 25 and 26 will be connected together. If none is in normal position these wires will not be connected together, while if more than one is in normal position the condition will be the same as that of one only being in normal position. Recalling that the relay 33 operated simultaneously with the clutch magnet 30 in the act which stopped the decimal indicator in rotation, it may now be seen that at the relay 33 the negative terminal of the battery is connected at the contact to the wire 3. In the division starter (Fig. 3) it will be seen that the brush connecting with the wire 4 is also connected to the wire 3 in whatever position that cylinder switch may stand. The circuit then continues from wire 4 to 5, thence to wire 6, unless the brush of the wire 5 be out of contact with one of the terminals of the wire 6; this will extend circuit through one winding of the magnet 19 to the positive terminal of the battery, so energizing the magnet 19. But this magnet is that of a clutch adapted to start and stop the rotatable brushes of the division starter shown in Fig. 3, and as a result of being energized by the described connections, the division starter will be caused to rotate through an angle, for the following reasons and with the following results: The magnet 19 operates the pawl 21, shown in Fig. 4, and this is adapted to engage notches in the perim-

eter of the disk 20. This perimeter is shown developed in the lower part of Fig. 3, and it should be observed that the notches bear a relation to the vertical rows of contact pieces in the upper part of Fig. 3. The perimeter of the disk 20 has twenty notches in two sets of ten each. If the pawl 21 be in any normal notch, as indicated in Fig. 4, the brush of the wire 5 will rest upon a contact connected with the wire 6. But if the pawl be out of a notch, or in any other than a normal notch, connection between wires 5 and 6 will be broken. The disk 20 is related to a constantly rotating shaft in a relation somewhat similar to that described concerning the decimal indicator. The relation is that the shaft continually rotates while the disk 20 is only geared to it when the pawl 21 is drawn out of a notch. The described operation of the clutch 19 draws the pawl 21 out of the notch in which it rests,—this being a normal or N notch,—in each successive beginning of operation of the division starter. Assuming the left hand N notch of 20 in Fig. 3, the pair of brushes 7 will be caused to move two steps, producing contact between the positive battery terminal of the fourth row of contacts, counting downward, and the wire 8 of the third row; thence through the pair of brushes 9 of the first rotary switch, and the clutch magnet 31 to the negative battery terminal. The clutch 31 is similar to that of other selector switches, and upon operation causes the brushes to begin rotation within that rotary switch. The reason for clutch 31 operating instead of the clutch 32, or that of still some other rotary switch, is that the wire 8, rather than the wire 18 or 18^a, etc., was engaged by this step of the division starter. If, however, the wire 8 were one representing a rotary switch already engaged by another connection, the division starter would have discriminated, and would have sought and found a non-busy rotary switch as will be described later. It is to be noted that on the division starter brushes moving from the N position of 20, 5 is broken from 6, so deënergizing the connected coil of the clutch 19, and that this took place immediately upon the movement of the division starter. But as shown in Fig. 4, the pawl 21 when out of a notch in 20, cannot stop that disk until it presents another notch, so that the division starter will turn until pawl 21 falls in the next S, or sub-normal notch; and similarly there occurs a movement from that notch to the next normal notch, because of the following reasons: The construction of the rotary switch is such that upon the operation of its clutch 31, it moves from the normal position of Fig. 1, so as to bring the brushes into the fourth vertical row to the right of the shown normal position. At this point 23^a or 23^c will engage wires 11 and 22 or 11^a and 22^a. This will connect the wire 11 or 11^a with the negative terminal of the battery, so energizing all four of the successive contacts in the division starter, which are connected to the wire 11, and by the wire 12, whose brush rests on these points, will extend this circuit to the relays 34 and 35 respectively. Through the conductor 13 and its brush, this circuit then extends from the relays mentioned to the positive terminal of the battery, in all positions of the division starter except when the pawl 21 is in an N notch of the disk 20. In any S position, therefore, the relays will be energized with the described conditions. Any operation of the relay 34 is immaterial in this connection, but the operation of the relay 35 will connect wires 15 and 16, with the result that the clutch magnet 19 will be energized over the path from negative battery 15, 16, 17, magnet 19, to the positive battery terminal. Pawl 21 will be drawn out of the S notch in 20, and the gearing of 20 to the constantly rotating shaft will move the brushes borne by 20 forward until, by the breaking of contact between the brush of the wire 13 and the positive terminal of the battery, the clutch magnet 19 is deënergized. Because of this, the pawl 21 engages 20, but this time in an N notch, ready for a successive complete cycle. It is to be noted that the engagement, in the rotary switch, of 22 and 11 by the brush 23^a, or a similar engagement in any other rotary switch of the entire section, is extended through the rotary switch which is in a position to make that contact. Other things are done in the rotary switch relative to the control of various elements of the division, but this condition of connection between 22 and 11, or of similar conductors in other rotary switches, can only exist when a rotary switch is out of its normal position, and will be maintained after once established, until the rotary switch returns to its normal position. If in receiving its original impulse, the division starter relay 33 had set the division starter in motion from the normal position selected in this description, and if the brushes of conductor 9 had been out of engagement with conductors 8 and 10 because that rotary switch were out of normal position, there would have been no seizing of that rotary switch because the circuit of the clutch magnet 31 would have been open. Also, instead of the brush of 12 finding no potential on the last contact of the wire 11, it would have found negative potential, preventing, through the action of the relay 35, a stoppage of the division starter in the S position. If the contacts of 11^a, 11^b, etc., corresponding to successive rotary switches, had been found of negative potential by the brush of 12, it would mean that the rotary switch of those groups of contacts were in

use, that is, out of normal position. Therefore in engaging each such group, the relay 35 would be caused to continue the division starter in motion, and it would not stop on an S position until it had engaged an idle rotary switch, operated its clutch, and moved its brushes far enough from normal position to deënergize the clutch 19, leaving the division starter finally in one of its normal positions. Of these, it will be recalled, there are ten.

In the absence of special precautions to the contrary, an operation of the division starter relay 33 would set the division starter in motion in search of an idle rotary switch, and if there were no rotary switch so idle, and in normal position, the division starter would repeat its cycles of search indefinitely, until a rotary switch, having passed out of use, might receive an impulse through its clutch magnet, and in response furnish potential over its conductor 11, 11^a, etc. This useless and continuous search is obviated by the extension of conductors 25 and 26 through an entire section with taps to the various rotary switches. It will be observed that the conductor 26 so taps in parallel to the various rotary switches, and ends by passing through the winding of the relay 33 to the negative terminal of the battery. The conductor 25, in a somewhat similar manner, is tapped into the rotary switches in parallel, but terminates in the ring 46, having a circuit finally ending in the positive battery terminal. As previously described then, current may reach the relay 33 under certain conditions, but never when all rotary switches are off their normal position. The division starter, therefore, may not begin a search for a rotary switch unless the existing fact is that some rotary switch of that section is idle and is waiting to be selected.

The main control circuit from positive battery terminal through 38, 39, 40, 30 and 29 in parallel, contact of 27, 44, 45, 46, 25, 26, 33 to negative battery is adapted to start the main starting switch only when one or more subsidiary switches are in normal position, thereby providing one or more bridges 24, 24^a between wires 25 and 26. This circuit constitutes at the same time a main control circuit for the main starting switch, and a stop circuit for the decim indicator. The starting circuit or control circuit for each subsidiary switch extends from negative battery terminal through 31, 9, 8 and is under control of brush 7 in the main starting switch, and also is inoperative when brush 9 is not in normal position. A secondary control circuit or guard circuit exists for each subsidiary switch, extending from negative battery terminal through 22, 23^a, 11, 12, 34 and 35, 13, 14 to positive terminal of battery, this circuit being closed in the subsidiary switch only when such switch is off normal. The starting circuit extending through 19, 6, 5, 4, 3, 33, is controlled directly by contact of relay 33 whose helix is included in the main starting circuit, or stop circuit for the line-seeking brush.

The relay 29 is a relay whose function is the placing of a busy test upon the line detected by the division indicator during the period between the stopping of the indicator upon the line and the taking of the line by an answering device or division. The wire G is the guard wire or busy-test wire of the line L', and by the contact of relay 29 this wire is connected during the period mentioned through 40—39—38 to the positive terminal of the battery. The relay 29 is in parallel with the clutch magnet 30 and is energized only during the period when that clutch magnet is energized. The operation of the relay 29 therefore is dependent upon the continuity of the circuit through wires 25—26. The object of the relay 29 therefore is to prevent the calling line from being taken by some distant automatic selecting and connecting device which, under control of another subscriber through a distant answering device may be seeking the line herein assumed to be calling through the decimal register of Fig. 1.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In an automatic telephone exchange, a main starting switch, one or more associated switches each adapted to be moved from normal position in response to current under control of said main starting switch, a circuit for said starting switch extending to each of said associated switches, and means in said circuit adapting said main starting switch to move only when one or more of said associated switches is in normal position.

2. In an automatic telephone exchange, a main starting switch, one or more subsidiary switches, a control circuit for said main starting switch adapted to start the same only when one or more of such subsidiary switches is in normal position, a starting circuit for each said subsidiary switch under control of said main starting switch and means rendering said starting circuit inoperative when its associated switch is not in normal position.

3. In an automatic telephone exchange, a main control circuit, a starting switch controlled thereby, one or more subsidiary switches under control of said starting switch, a control circuit for each subsidiary switch open when the subsidiary switch is not in normal position, and over which its subsidiary switch may be controlled, and a secondary control circuit leading from each

of said subsidiary switches to said starting switch and closed when such subsidiary switch is in predetermined positions away from normal, and controlling said starting switch.

4. In an automatic telephone, a main control circuit, and a relay therefor, a starting switch controlled thereby, one or more subsidiary switches under control of said starting switch, a control circuit for each subsidiary switch, open when its switch is not in normal position, and a secondary control circuit leading from each said subsidiary switch and closed when such switch has moved from normal position, said secondary circuit controlling in part said starting switch.

5. In an automatic telephone exchange, a main starting switch and a control relay therefor, one or more subsidiary switches controlled by said main starting switch, and a current supply circuit for said control relay, open when all said subsidiary switches are out of normal position.

6. In an automatic telephone exchange having lines in groups, a starting switch, one or more subsidiary switches and a control relay for each group; a clutch magnet for each subsidiary switch, operable over a control circuit from said starting switch except when said subsidiary switch is out of normal position; a guard circuit for each subsidiary switch, open when the subsidiary switch is in normal position, and contacts in said starting switch, one or more for each guard circuit.

7. In an automatic telephone exchange having lines in groups, a starting switch for each group, one or more subsidiary switches for each group, a control relay for said starting switch, a control circuit therefor, open when all the subsidiary switches of a group are out of normal position, a second control relay for said starting switch and a clutch magnet operable thereby.

8. In an automatic telephone exchange, a unitary group of switches comprising a starting switch and subsidiary switches and control circuits for each; each of said subsidiary switches being controlled initially only through said starting switch; successive series of contacts in said starting switch, one for each control circuit of said subsidiary switches and a brush adapted to engage them one at a time; means adapting the control circuit of the starting switch to set it in motion, and means adapting the control circuits of subsidiary switches to advance the starting switch in successive steps if they are closed at the time of engagement of their contacts by said brush.

9. In a starting switch for automatic telephone exchanges, a clutch magnet having two windings, the said windings having like operative effect on the clutch and each in a circuit normally open, means closing one circuit only when a call is instituted by a subscriber, and means closing the other circuit only thereafter.

10. In a starting switch for automatic telephone exchanges, fixed contacts and movable brushes therefor, a clutch-magnet having two windings, the said windings having like operative effect on the clutch and each in a circuit normally open, means closing the circuit through one winding when a call is instituted by a subscriber, and means closing the circuit of the other winding only thereafter.

11. In an automatic telephone exchange, a starting switch, a line-seeking brush, a line commutator and a stopping clutch therefor, one or more rotary switches, and a stop circuit for said line-seeking brush, operable only when one or more rotary switches are in normal position.

12. In an automatic telephone exchange, a starting switch, a line-seeking brush, a line commutator and a stopping clutch therefor, one or more rotary switches, a stop circuit for said line-seeking brush operable only when one or more rotary switches are in normal position, and a starting circuit for said starting switch operable only when said stop circuit is energized.

13. In an automatic telephone exchange, a normally moving line-seeking brush, a line commutator, a normally idle starting switch, subsidiary switches, a stop for said line brush, starting means for said starting switch, and means simultaneously energizing said stop and said starting means, said last means being operable only when one or more subsidiary switches are in normal position.

14. In an automatic telephone exchange, a normally moving line-seeking brush, a line commutator, a normally idle starting switch, subsidiary switches, a stop for said line brush, starting means for said starting switch, and means simultaneously energizing said stop and said starting means when a call is instituted by a line, said last means being operable only when one or more subsidiary switches are in normal position.

15. In an automatic telephone exchange, a normally moving line-seeking brush, a line commutator, a normally idle starting switch, subsidiary switches, a stop for said line brush, starting means for said starting switch, and means simultaneously energizing said stop and said starting means only when a subsidiary switch is in normal position.

16. In an automatic telephone exchange, a normally moving line-seeking brush, a line commutator, a normally idle starting switch, subsidiary switches, a stop for said line brush, starting means for said starting switch, and means simultaneously energiz-

ing said stop and said starting means only when a call is instituted by a line while a subsidiary switch is in normal position.

17. In an automatic telephone exchange, a division starter, a decimal indicator clutch-magnet, one or more rotary switches, a control relay for said division starter and a control circuit including said clutch magnet, said control relay and parallel contacts in all said rotary switches.

18. In an automatic telephone exchange, a stop magnet, a starting relay, coördinate rotary switches and a circuit closer in each, and a control circuit serially including the stop magnet, the starting relay and one or more of said circuit closers in parallel if two or more are included.

19. In an automatic exchange, a rotary switch, a starting circuit normally closed in said switch, a guard circuit normally open, a control circuit normally closed included therein, and means opening said starting and control circuits when said guard circuit is closed.

20. In an automatic telephone exchange, a starting switch; a line-seeking brush; a line commutator for said brush; a stopping clutch for said brush; a plurality of subsidiary switches; and a stop circuit for said line-seeking brush, said stop circuit passing through normally closed contacts of said subsidiary switches, said contacts being open when said subsidiary switches are off normal and said contacts being in multiple with each other, said stop circuit thus being closed through said switches when one switch is in its normal position, substantially as described.

21. In an automatic telephone exchange, a starting switch; a line-seeking brush; a line commutator for said brush; a stopping clutch for said brush; a plurality of subsidiary switches; and a stop circuit for said line-seeking brush, said stop circuit passing through normally closed contacts of a plurality of said subsidiary switches, said contacts being open when said subsidiary switches are off normal and said contacts being in multiple with each other, said stop circuit thus being closed through said switches when one switch is in its normal position, substantially as described.

22. In an automatic telephone exchange, a starting switch; a line-seeking brush; a line commutator for said brush; a stopping clutch for said brush; a plurality of connective units having off-normal switches; and a stop circuit for said line commutator and passing through the off-normal switches of said connective units and closed when any connective device is in normal position, substantially as described.

23. In an automatic telephone exchange, a starting switch; a line-seeking brush; a line commutator for said brush; a stopping clutch for said brush; a plurality of connective units having normally closed off-normal switches; a stop circuit for said line commutator and passing through the off-normal switches of said connective units; and a starting circuit for said starting switch operable only when said stop circuit is operated, substantially as described.

24. In an automatic telephone exchange, a starting switch; a line-seeking brush; a line commutator for said brush; a stopping clutch for said brush; a plurality of subsidiary switches; a stop circuit for said line-seeking brush, said stop circuit passing through normally closed contacts of a plurality of said subsidiary switches, said contacts being open when said subsidiary switches are off normal and said contacts being in multiple with each other, said stop circuit thus being closed through said switches when one switch is in its normal position; and a starting circuit for said starting switch operable only when said stop circuit is operated, substantially as described.

25. In a telephone exchange system, a normally moving line-seeking brush; a line commutator; a normally idle starting switch; subsidiary switches; a stop device for said line-seeking brush; a starting means for said starting switch; and a circuit controlling said stop device and depending for operative continuity upon the normal position of normally closed off-normal switches belonging to said subsidiary switches, substantially as described.

26. In a telephone exchange system, a normally moving line-seeking brush; a line commutator; a normally idle starting switch; subsidiary switches; a stop device for said line-seeking brush; a starting means for said starting switch; a circuit controlling said stop device and depending for operative continuity upon the normal position of normally closed switches belonging to the said subsidiary switches; and a starting circuit for said starting switch operable only when said stop circuit is operated, substantially as described.

27. In a telephone exchange system, a group of lines; a call-seeking device pertaining to said lines; connective devices for answering calls upon said lines; means whereby said call-seeking device may indicate a calling line when a connective device is available for use; and means rendering said call-seeking device inoperative to indicate a call when a connective device is not available, substantially as described.

28. In a telephone exchange system, a group of lines; a call-seeking device pertaining to said lines; connective devices for answering calls upon said lines; means whereby said call-seeking device may indicate a call and designate the calling line

when a connective device is available for use; and means rendering said call-seeking device inoperative when a connective device is not available, substantially as described.

29. In a telephone exchange system, a group of lines; a call-seeking device pertaining to said lines; connective devices for answering calls upon said lines; a connective-device starter; means whereby said call-seeking device may indicate a calling line when a connective device is available for use; and means rendering said call-seeking device and said connective-device starter inoperative when a connective device is not available, substantially as described.

30. In a telephone exchange system, a group of lines; a call-seeking device pertaining to said lines; connective devices for answering calls upon said lines; a connective-device starter; means whereby said call-seeking device may indicate a calling line when a connective device is available for use; and means rendering said connective-device starter inoperative when a connective device is not available, substantially as described.

31. In a telephone exchange system, a group of lines; a call-seeking device; connective devices; a connective-device selector; and means for rendering said connective-device selector inert when all connective devices are busy, substantially as described.

32. In a telephone exchange system, a group of lines; a call-seeking device; connective devices; a connective-device starter; and means for rendering said call-seeking device inoperative when all of said connective devices are in positions other than their normal position of waiting, substantially as described.

33. In a telephone exchange system, a group of lines; a call-seeking device; connective devices; a connective-device selector; and means for maintaining said connective-device selector inert when all connective devices are in positions other than their normal position of waiting, substantially as described.

34. In a telephone exchange system, a group of lines; connective devices for said lines; a connective-device starter; a call-seeking device; means whereby a calling line may act through said call-seeking device to control said connective-device starter; said means acting through off-normal switches of all of said connective devices and being inoperative when all of said off-normal switches are out of their normal positions, substantially as described.

35. In a telephone exchange system, a group of lines; connective devices for said lines; a connective-device starter; a call-seeking device; means whereby a calling line may act through said call-seeking device to control said connective-device starter, said means acting through off-normal switches of all of said connective devices and being operative when any one or more of said connective devices is in normal position of idleness and therefore available for service, substantially as described.

36. In an automatic telephone system a group of lines, a call seeking device pertaining to said lines, connective devices for answering calls upon said lines, a starting device for said connective devices, said starting and said connective devices being each adapted to control the starting of the other.

37. In a starting switch for automatic telephone exchanges, fixed contacts and movable brushes therefor, a clutch magnet having two similar windings, means for momentarily including one winding in a closed circuit when a subscriber institutes a call, and means for thereafter including the other winding in a closed circuit.

38. In a telephone system, the combination with a telephone line, of a plurality of switches for association with said line, a common relay and a circuit for its winding having branches extending to a plurality of said switches, and means controlled by said relay for starting an idle one of said switches when a call is initiated on said line.

39. In an automatic telephone system, one or more connecting switches, a starting switch associated with said connecting switches, a circuit therefor, branches of said circuit controlled by the connecting switches to prevent the operation of the starting switch if all of said connecting switches are out of normal position, and means controlled by the starting switch to start said connecting switches.

40. In a telephone system including a telephone line, a line relay, a plurality of similar switches, a common starting device for said switches and a circuit therefor controlled by said relay, said circuit having branches extending to a plurality of said switches.

Signed by me at Piqua, county of Miami, State of Ohio, in the presence of two witnesses.

GEORGE W. LORIMER.

Witnesses:
GEORGE A. VANGIER,
WILBER C. ROBISON.