Nov. 2, 1926. 1,605,734

J. H. HOMRIGHOUS

AUTOMATIC TELEPHONE SYSTEM

Original Filed May 23, 1919 2 Sheets-Sheet 1

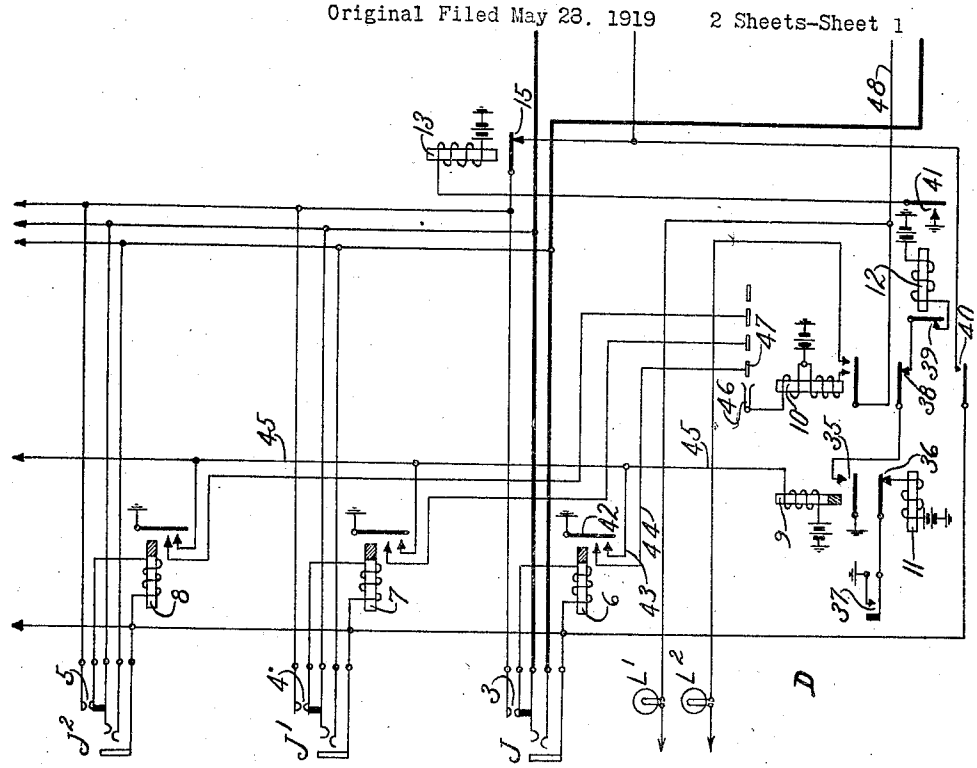
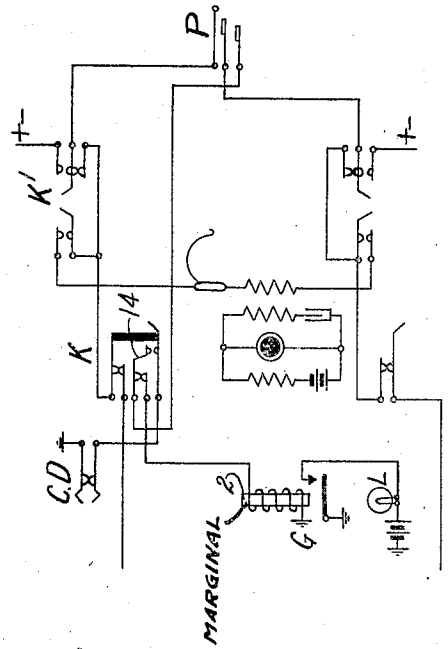


Fig. 1



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AUTOMATIC TELEPHONE SYSTEM

Original Filed May 28, 1919 2 Sheets-Sheet 2

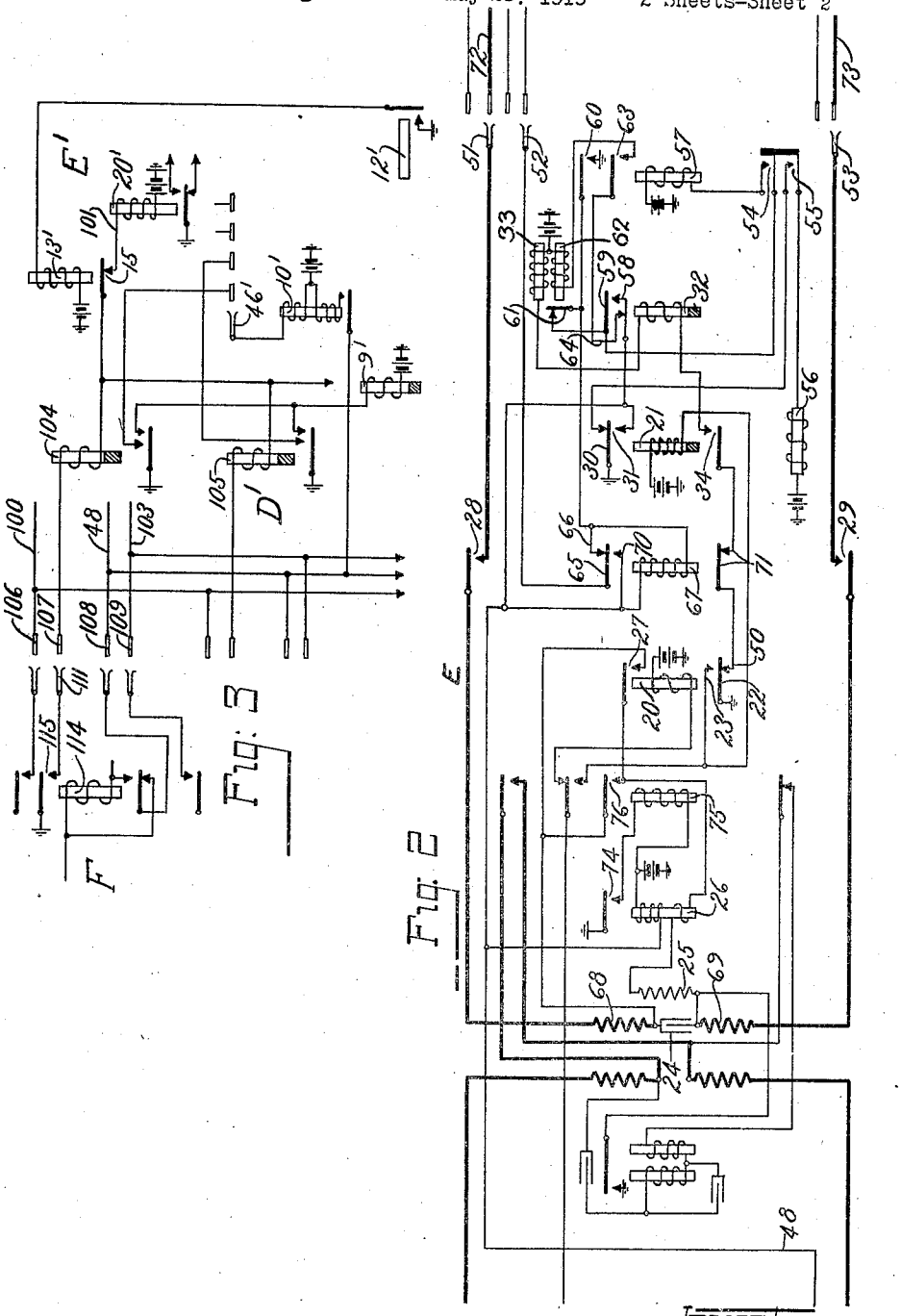


Fig. 3

Fig. 2

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1,605,734

UNITED STATES PATENT OFFICE.

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AUTOMATIC TELEPHONE SYSTEM.

Original application filed May 28, 1919, Serial No. 300,277. Patent No. 1,515,951, dated November 18, 1924. Divided and this application filed August 20, 1924. Serial No. 733,063.

My invention relates in general to semi-automatic telephone systems which comprise a plurality of exchanges interconnected by trunk lines or toll lines. More specifically my invention relates to such a system in which there are a plurality of groups of such trunk lines accessible to an operator in one exchange, each group leading to other exchanges, and in which there is means automatically controlled by the insertion of a plug in a jack by the operator to pick out a particular group of said trunk lines and automatically select an idle trunk in that group.

In a system of the above general character it has been the practice for the operator to operate an automatic switch by means of a calling device in order to pick out a particular group of trunk lines leading to a particular exchange.

The object of my invention, therefore, is to provide means for automatically operating said switch without requiring the manipulation of a calling device by the operator, said means automatically controlled by the insertion of a plug in a jack for operating said switch to pick out an idle trunk in a particular group leading to the desired exchange.

The main invention, as set forth, is claimed in my application, Serial No. 300,277, filed May 28, 1919, now a Patent No. 1,515,951, issued Nov. 18, 1924. This application is a division of the parent application and pertains specifically to the modification in which the switch which picks out an idle trunk to the desired exchange is accessible in various levels in the banks of a preceding switch, the level in which the switch is seized determining the group in which an idle trunk is selected.

In the drawings I have shown a selector switch E accessible from a plurality of jacks such as the jacks J, J′ and J² which switch in turn has access to a plurality of groups of trunk lines leading to other exchanges where they terminate in other selector switches (not shown).

Fig. 1 shows a cord circuit K having access to a plurality of multiple jacks individual to a single trunk line. The impulsing switch D is also associated with this trunk line.

Fig. 2 shows a selector switch E in which the trunk line terminates. Fig. 3 shows a modification of the invention in which the impulsing switch D′ is associated with a similar trunk line to that shown in Fig. 1, except that it is accessible to an automatic switch rather than to an operator's cord circuit.

Referring to Fig. 1, the cord circuit C, of which only the calling end is shown, may be of any suitable type and comprises the usual tip and ring talking strands terminating in the plug P, a combined listening and ringing key K′, and a supervisory relay 2 in the sleeve of the cord circuit. The calling device CD may be of any well known two wire type, such for example as is shown in British Patent to Dicker #29654 of 1910. Associated with the jacks J, J′, etc., is the impulsing mechanism D, which is controlled in its operation by the relays individual to each jack, such as the relays 6, 7 and 8.

I will now point out more in detail, referring to the accompanying drawings, the method of operation. The operator first inserts the calling plug P of her cord circuit into the jack corresponding to the exchange in which the wanted subscriber's line terminates, which may be designated by the first digit of the called number or by a prefix such as the name of the office; in either case the operation will be the same. Suppose the operator desires to connect with a subscriber's line in the exchange in which the trunk lines leading from the first level of contacts in the bank of switch E terminate. Then the operator will insert the plug P into the jack J thereby closing at springs 3 a circuit for the line relay 20 in series with relays 2 and 6, as follows: From ground G, winding of relay 2, springs 14, sleeve of plug P, sleeve of jack J, winding of relay 6, springs 3, springs 15, winding of

relay 20, to battery. The relay 20 will immediately energize over this circuit and close a circuit for the slow relay 21 from ground through springs 22 and 23, and relay 21 to battery. The relay 20 also closes a high resistance shunt around the condenser 24 which is connected between a pair of windings of the repeating coil, said circuit extending from the lower side of condenser, 24, resistance 25, lower winding of relay 26, spring 27, to the upper side of the condenser 24. The closure of this shunt circuit, however, has no effect at this time as the talking conductors are still open at the springs 28 and 29. The energization of slow relay 21 over the previously traced circuit supplied a ground to the supervisory circuit to light the busy lamp L′ and others which may be multipled therewith, through springs 30 and 31, grounds the upper winding of the electropolarized relay 26, which relay is arranged so that it will not operate its armature unless the current flowing in both windings is in the same direction, and also prepares a circuit from the back contact of relay 20 through the slow series relay 32 for the vertical magnet 33.

The slow relay 6 individual to the jack J is energized over the previously traced circuit although this operation is delayed somewhat by reason of a copper slug with which its core is provided and closes a circuit for the starting relay 9 in the impulsing switch D, as follows, from ground through springs 42 and 43, common conductor 45, winding of relay 9 to battery, also places ground potential on the first contact 47 in the bank of switch D. Relay 9, upon energizing, closes a circuit for stepping magnet 12, as follows: From ground through springs 35, springs 38, springs 39, winding of magnet 12 to battery, and opens a point in the circuit of the release magnet 11 at springs 36.

The magnet 12, upon energizing, steps the wiper 46 into engagement with the first contact 47. If the first contact is not grounded the magnet 12 will again be energized, since it interrupts its own circuit at springs 39, to step the wiper 46 into engagement with the next contact. This operation will continue until a grounded contact is reached. Each time the magnet 12 energizes a circuit is closed for relay 13 at springs 41 which in turn interrupts the circuit of relay 20 to be hereinafter described. Since the first contact 47 is grounded by the energization of relay 6 it follows that relay 10 will be energized as soon as the wiper 46 engages the contact 47, over the following path: From ground through springs 42 and 44, contact 47, wiper 46, upper winding of relay 10 to battery. Relay 10, upon energizing, closes a holding circuit for itself from grounded conductor 48, through its lower winding to battery, and closes a circuit for the lamp L^2 notifying the operator that she may now manipulate her calling device, also opens a point in the circuit of magnet 12 at springs 38 and by the closure of springs 40 the slow relay 6 is short-circuited, which relay, upon deenergizing, opens the circuit of relay 9 to in turn close the circuit of release magnet 11, as follows: From ground through off normal springs 37, closed on the first rotary step, springs 36, winding of magnet 11, to battery. The release magnet, upon energizing, restores the wiper 46 to normal position in the well known manner.

To proceed: Relay 13, upon energizing, interrupts the circuit of line relay 20 at springs 15 which allows the relay 20 to momentarily de-energize each time the relay 13 is energized. Relay 6 being slow acting, maintains its armature in an operated position during the series of interruptions of its circuit, while the relay 2 in the cord circuit may be slow acting so as to prevent the flashing of lamp L′. Each time the relay 20 deenergizes it closes a circuit from ground through springs 22 and 50, winding of relay 32, and the vertical magnet 33 to battery. The vertical magnet 33 operates in response to this series of impulses to lift the wipers 51, 52 and 53 opposite some level of contacts to which trunk lines extending to the desired office terminate, corresponding to the particular jack in which the plug P is inserted. Although the circuits of relays 21 and 32 are interrupted momentarily at each operation of relay 20 both will remain energized during transmission of such impulses and after the impulses cease and relay 20 comes to rest energized, the relay 32 will fall back and relay 21 will remain energized. Since the connection is established by way of jack J the vertical magnet will lift the shaft and wipers 51, 52 and 53 opposite the first level of contacts and as soon as the vertical magnet operates the shaft one step, the off normal springs 54 and 55 close. The springs 55 close the circuit of release magnet 56 at one point and at springs 54 close a point in the circuit of the rotary interrupter relay 57. The circuit of the release magnet 56 is maintained open at the back contact of relay 21. The relay 57, however, energizes as soon as the springs 54 close over a circuit extending from ground through springs 30 and 31 of relay 21, springs 58 and 59 of relay 32, springs 54, and relay 57 to battery. The relay 57, upon energizing, closes a locking circuit for itself at springs 60 extending from ground through springs 60, interrupter springs 61 of the rotary magnet 62, springs 54, and relay 57 to battery, and also closes one point in the circuit of the rotary magnet 62 at springs 63. Now, after the impulses cease, and the relay 32

deenergizes, a circuit is closed for the rotary magnet extending from ground through springs 30 and 31, springs 58 and 64, springs 63, and magnet 62 to battery. The rotary magnet therefore, operates to step the wipers 51, 52 and 53 one step onto the first set of contacts in the first bank level. Another result of the operation of the rotary magnet is to open the locking circuit of the relay 57 at springs 61. The relay 57 will therefore deenergize and open a contact in its own locking circuit at springs 60. As soon as the springs 63 open, the rotary magnet will deenergize and again close springs 61. Assuming now that the trunk line selected is busy, then a ground potential will be found on the private contact with which the wiper 52 is now in contact. As soon, therefore, as the springs 61 come into contact a new circuit will be closed for the relay 57 extending from ground over the wiper 52, springs 65 and 66, springs 61, springs 54 and relay 57 to battery. The relay 57 will again operate to close the circuit of magnet 62 and its own circuit to step the wipers to the next contact. This alternate operation of the relay 57 and the rotary magnet 62 continues until an idle trunk line is reached, at which time no ground will be found upon the private contact and the relay 57 will therefore remain deenergized after the springs 61 are closed. It may be here noted that during the energization of the relay 32 and also during the rotation of the wipers, the relay 67, although in series with the relay 57, is maintained short circuited, first by the ground through springs 30, 31, 58 and 59 and during rotation by the ground on the private wiper. The last mentioned short circuit extends from ground on wiper 52, springs 65 and 66, relay 67, springs 30 and 31 to ground. Now, however, when an idle trunk is reached, this short circuit is removed and the relay 67 which is of high resistance, energizes in series with relay 37. The circuit for energizing relay 67 extends from ground through the springs 30 and 31, relay 67, springs 61, springs 54 and relay 57 to battery. The relay 57 does not energize over this circuit on account of the high resistance of the winding of relay 67. The relay 67, upon energizing, extends the talking circuit from the windings 68 and 69 of the repeating coil to the wipers 51 and 53, and spring 65 disconnects test wiper 52 from the junction of its own winding and that of stepping relay 57 and connects it instead to the grounded conductor 48, thereby placing a ground potential on the contact engaged by the wiper 52 to prevent seizure of the trunk line by another switch. Another result of the energization of relay 67 is to open the springs 71, thereby preventing any further operation of the operating magnets.

Now, as soon as the relay 67 closes its springs 28 and 29, a shunt is closed across the trunk conductors 72 and 73 for the double wound line relay of the seized selector switch (not shown) in a second exchange, which extends as follows: Trunk conductor 72, wiper 51, springs 28, winding 68 of repeating coil, springs 77, lower winding of relay 26, resistance 26, winding 69 of repeating coil, springs 29, wiper 53, trunk conductor 73. The relay 26 of the selector E does not energize at this time as the current in its two windings flows in opposite directions.

The foregoing operations have all occurred in response to the insertion of the plug P into the jack J. The operator noticing the lamp L^2 glowing will actuate the calling device key K which substitutes ground through the calling device C. D. for the ground through the relay 2 in the circuit of relay 20.

Now, when the operator operates the calling device to send out a series of impulses corresponding to a digit of the called number, the line relay 20 of the selector E will be operated as previously described to retract and attract its armature a predetermined number of times. The closure of springs 22 and 50 has no effect at this time due to the springs 71 being held open by relay 67. The opening and closing of springs 27, however, opens and closes the circuit previously traced across the trunk conductors 72 and 73 to in turn operate selector switches and a connector switch (not shown) to thereby establish a connection with a called line. Upon the response of a called subscriber the current flowing in the trunk conductors is reversed in the well known manner, which causes the lower winding of relay 26 to assist the upper winding. Therefore relay 26 will operate and close a circuit for relay 75, at springs 74. The relay 75, upon energizing, closes a new circuit for the lower winding of relay 26 at springs 76, and places the relay 21 in the circuit of supervisory relay 2 in place of relay 20 which now deenergizes. The relay 21, being of higher resistance than relay 20 causes the marginal relay 2 to fall back and open the circuit of supervisory lamp L to notify the operator that the calling party has removed his receiver, it being assumed that the calling device key K was restored to normal after the last series of impulses was sent in.

Conversation may proceed over the heavy conductors shown in the drawings and when the conversation is completed the switch E may be released by the removal of the plug P from the jack J, thereby opening the circuit of relay 21 at springs 3. Relay 21, upon deenergizing, closes an energizing circuit for

the release magnet 56, which causes the switch E to restore its shaft and wipers to normal, also removes ground from conductor 48, whereupon relay 10 will deenergize, also the circuits of lamps L′ and L² will be opened.

It will be noted when the plug P is inserted in the jack J′ relay 7 will be energized instead of relay 6, which causes the switch D to step to the second contact, thereby interrupting the circuit of relay 20 two times, to in turn raise the wipers of switch E opposite the second level of contacts. Likewise the insertion of the plug into jack J² causes the switch E to select an idle trunk in the third level.

Referring to Fig. 3, I have shown a trunk line accessible from various levels of a selector switch and which terminates in a switch similar to the switch E. Associated with this trunk line is an impulsing switch D′ which is similar in all respects to the switch D. It is to be understood that the trunk lines 100 and 103 may be accessible from several of the levels in the bank of switch F.

When the switch F is operated to seize the trunk line from a particular level the switch D′ will operate to interrupt the operating circuit a certain number of times corresponding to the contact grounded in the bank of the impulsing switch D′.

The selector switch F is of the usual Strowger type of selector switch; only the wipers and line switching relay are shown.

Assume that the trunk line terminals 106, 107, 108 and 109 are seized by the selector switch F. Then as soon as the switching relay 114 is energized a circuit is closed for relay 104 in series with the line relay 20′ of switch E′ (relay 20′ corresponds to the line relay 20 of switch E) as follows: From ground through springs 115, wiper 111, contact 107, winding of relay 104, conductor 101, winding of relay 20′ to battery. Relay 104, upon energizing, places ground potential on the first contact in the bank of switch D′, also closes a circuit for the starting relay 9′ of the impulsing switch D′. The switch D′ operates in a manner hereinbefore described to open the circuit of line relay 20′ twice, whereby the wipers of switch E′ (not shown) are raised to the first level of contacts in its bank.

The wipers of the switch E′ will be automatically rotated in the usual manner to pick out an idle trunk line in the elected group which may extend to an operator's position in another exchange.

It is not thought necessary to describe the operations of switches D′ and E′ in detail, as they are similar to the switches D and E, respectively, and similar reference characters have been applied to like parts. It will be seen that the switch E′ is automatically operated to the level corresponding to the level in the banks of switch F in which the selector E′ is seized.

Having fully described and ascertained my invention in the foregoing specification, what I claim to be new and desire to have protected by Letters Patent will be pointed out in the appended claims.

What is claimed is:

1. In a telephone system, a switch having a primary and a secondary movement in different directions, a plurality of paths leading thereto, means including automatic switching mechanisms for extending a connection to said switch over any one of said paths, means for primarily operating said switch responsive to the extension of such connection, the extent of the movement depending upon the path over which the connection is extended, and means responsive to the completion of such primary movement for adapting the switch to perform said secondary movement.

2. In a telephone system, an automatic switch, a plurality of terminals, automatic switching mechanisms for seizing any desired one of said terminals, and means responsive to such seizure for operating the wipers of said switch in accordance with the terminal seized.

3. In a telephone system, an automatic switch, an impulse sender individual to said switch, automatic switching mechanism for seizing said switch over any one of a plurality of paths, and means responsive to such seizure for operating said sender to transmit a predetermined number of impulses to said switch, the number transmitted being different in each case depending on the path over which said switch is seized.

4. In a telephone system, an automatic switch directively controlled to pick out a group of lines, a trunk line leading to said switch having a plurality of branches, an automatic switch for seizing said trunk by way of any one of said branches, and automatic means responsive to said seizure for automatically operating said switch to pick out the particular group of lines corresponding to the branch over which the trunk line is seized.

5. In a telephone system, a trunk line, an impulse sender, an automatic switch for seizing said trunk line, means responsive to such seizure for operating said impulse sender to transmit a variable series of impulses over said trunk line, and means including a counting switch for determining the number of impulses transmitted.

6. In a telephone system, an automatic switch directively controlled to pick out a group of lines, a trunk line leading to said switch having a plurality of branches, auto-

matic switching mechanism for seizing said trunk line via one branch, automatic means responsive to said seizure for automatically operating said switch to pick out a particular group of lines, said last means responsive to the seizure of said trunk via another branch to operate said switch to pick out a different group of lines.

7. In a telephone system, a trunk line having an automatic switch at one end thereof, and multiple terminals at the other end thereof, an impulse sender associated with said multiple terminals, automatic switching mechanism for seizing said terminals, and means controlled by the seizure of each of said terminals for causing said impulse sender to automatically transmit a different series of impulses over said trunk line to operate said automatic switch.

8. In a telephone system, a trunk line having a plurality of branches, automatic switching mechanism for seizing any one of said branches, an impulse sender automatically operated in response to the seizure of any terminal, and means associated with each terminal and operating when that particular terminal is seized for predetermining the number of impulses to be sent over said trunk line by said impulse sender.

9. In a telephone system, a trunk line having a plurality of branches, an automatic switch for seizing any of said branches, an impulse sender common to said branches for sending impulses over said trunk line, a relay individual to each branch, each relay operated when its associated branch is seized to start the operation of said impulse sender and to predetermine the number of impulses transmitted thereby.

10. In a telephone system, a trunk line having a plurality of branches at one end thereof, an automatic switch at the other end of said trunk line, other trunk lines accessible to said switch and arranged in groups, said groups corresponding, respectively, to said branches, a switch controller associated with said first trunk line, automatic switching mechanism for connecting with said first trunk line via any one of said branches, and means responsive to the completion of the connection for automatically operating said controller to cause said switch to select an idle trunk line in the particular one of said groups which corresponds to the branch in use.

11. In a telephone system, a trunk line having a plurality of branches at one end thereof, automatic switching mechanism for extending a connection to said trunk line via any one of said branches, a finder switch operated automatically responsive to the completion of the connection to hunt for and locate the branch in use, means controlled by said finder for transmitting a series of impulses over said trunk line, the number of impulses in the series varying according to the branch in use, and an automatic switch at the other end of said trunk line responsive to said series of impulses.

12. In a telephone system, a trunk line having a plurality of branches at one end thereof, automatic switching mechanism for extending a connection to said trunk line via any one of said branches, a finder switch operated automatically responsive to the completion of the connection to hunt for and locate the branch in use, said finder switch being of the step-by-step type, means for transmitting impulses over said trunk line corresponding in number to the number of steps taken by said finder, and an automatic switch at the other end of said trunk line responsive to said impulses.

13. In a telephone system, a trunk line having a plurality of branches at one end thereof, automatic switching mechanism for extending a connection to said trunk line via any one of said branches, a finder switch operated automatically responsive to the completion of the connection to hunt for and locate the branch in use, an automatic switch at the other end of said trunk line having a plurality of off normal positions each corresponding to a different one of said branches, and circuit arrangements whereby said finder controls said automatic switch over the trunk line to advance it to the particular position which corresponds to the branch in use.

14. In a telephone system, a first switch, a second switch accessible to said first switch over a plurality of paths, a third switch associated with said second switch, and means responsive to the seizure of said second switch by said first switch for automatically operating said second switch and said third switch in synchronism, the extent of operation depending upon the path over which said second switch is seized.

15. In a telephone system, a first switch, a second switch accessible to said first switch over a plurality of paths, a third switch associated with said second switch, and means responsive to the seizure of said second switch by said first switch for automatically operating said second switch and said third switch in synchronism, the extent of operation depending upon the path over which said second switch is seized, and means for automatically restoring said third switch and for causing an automatic secondary operation of said second switch at the completion of said first operation.

16. In a telephone system, a first switch, a second switch accessible to said first switch over a plurality of paths, a third switch associated with said second switch, and means responsive to the seizure of said sec-

ond switch by said first switch for automatically operating said second switch and said third switch in synchronism, the extent of the operation being controlled by said third switch in accordance with the path over which the second switch is seized.

17. In a telephone system, a trunk line, an impulse sender, an automatic switch for seizing said trunk line, a second switch terminating the talking conductors of said trunk line, means responsive to such seizure for operating said impulse sender to transmit a variable series of impulses over said trunk line to operate said second switch, and means including a counting switch for determining the number of impulses transmitted.

In witness whereof, I hereunto subscribe my name this 18th day of August, 1924.

JOHN H. HOMRIGHOUS.