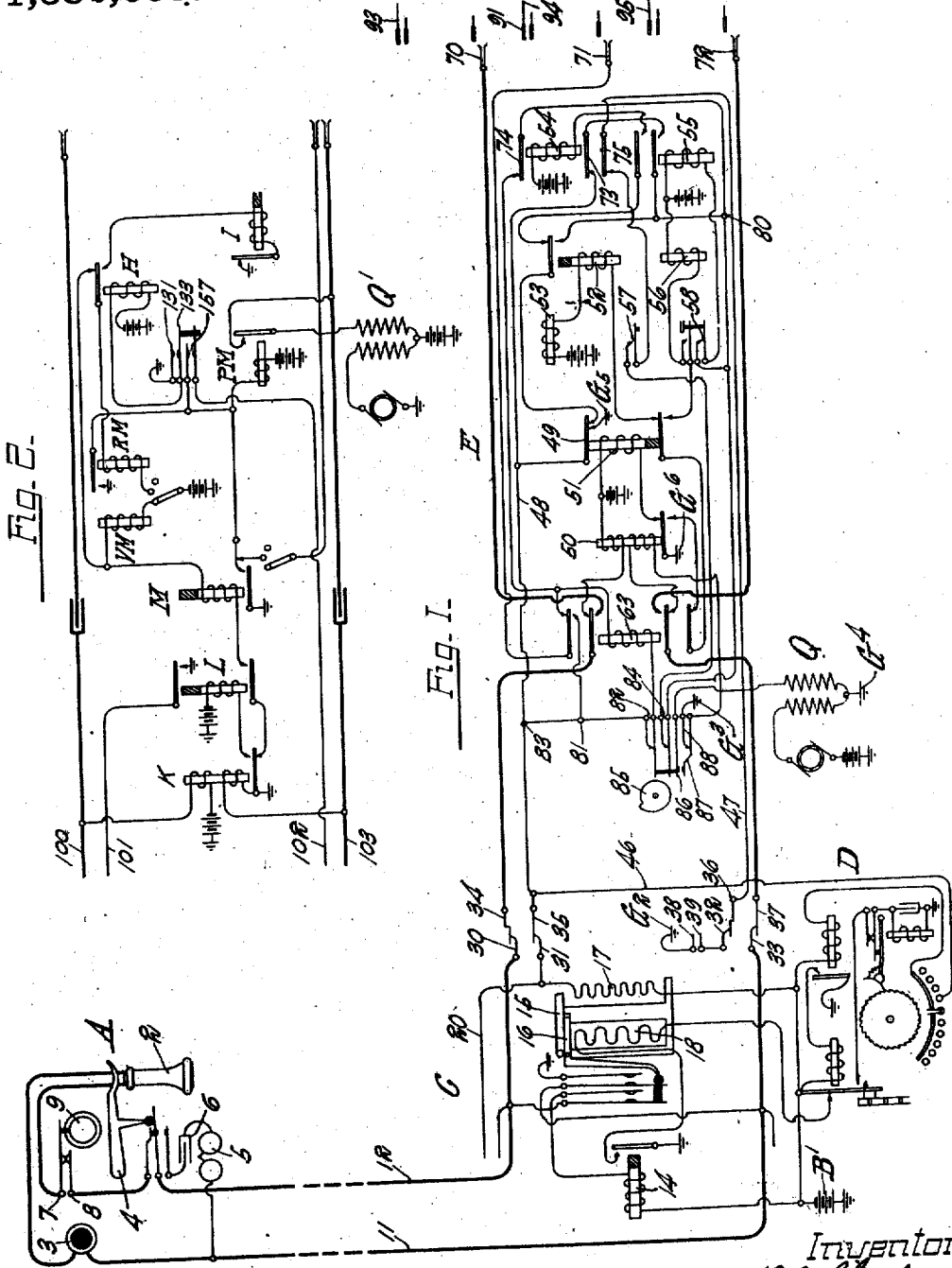


Patented May 31, 1921.

1,380,039.



Inventor
 W. A. Chapin
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 Attorney

UNITED STATES PATENT OFFICE.

WILLIAM A. CHAPIN, OF CHICAGO, ILLINOIS, ASSIGNOR TO AUTOMATIC ELECTRIC COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

AUTOMATIC TELEPHONE SYSTEM.

1,380,039.

Specification of Letters Patent. Patented May 31, 1921.

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To all whom it may concern:

Be it known that I, WILLIAM A. CHAPIN, 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 Automatic Telephone Systems, of which the following is a specification.

My invention relates in general to automatic telephone systems but is concerned more particularly with such systems as include a main exchange and one or more branch or private automatic exchanges auxiliary thereto. In systems of the foregoing character it is often desirable to give only a limited number of the substations at a private automatic exchange access to the main exchange, the remaining substations being restricted to local calling within the branch. This condition exists usually in the case of a large commercial establishment served by an automatic private branch exchange connected with a main exchange by trunk lines. In an installation of this kind it is generally required that the principal officials and department heads should be able to call main exchange as well as local subscribers, while the minor employees are unable to call the main exchange subscribers but are restricted to local calls.

The object of my invention, therefore, is to provide an improvement for automatic private branch exchange systems whereby the service at certain substations may be restricted while the service at other substations is unlimited; without, however, requiring different types of apparatus or separate grouping of the subscribers' lines.

To accomplish the foregoing and other useful ends my invention comprises means which will be fully described hereinafter, reference being had to the accompanying drawing, in which Figure 1 illustrates the invention by means of automatic private branch exchange equipment comprising a calling substation A, an individual line switch C, and a trunk line terminating in a selector switch E; while in Fig. 2, which may be considered a modification of Fig. 1, the invention is shown applied to a somewhat different type of switch.

Referring to Fig. 1 of the drawing, the automatic private branch exchange of which the equipment therein shown is a part, may have a capacity of 900 lines divided into

nine groups of 100 lines each. Connector switches are provided in each group for connecting with called lines, which connectors are accessible to calling lines through the medium of individual line switches and selector switches in the usual manner. One of the selector levels, usually the tenth, may be reserved for the trunk lines extending to the main exchange and terminating therein in second selector switches. In case the exchange is of small capacity, having not more than 90 lines, the selector switches may be omitted and a combined selector and connector is used (see Fig. 2) which operates as a connector on the first nine levels and as a selector on the tenth level, all of which will be explained more in detail hereafter.

All the apparatus shown is in general well known in the art and will be described but briefly, reference being had to prior patents hereinafter mentioned in lieu of a detailed description.

The substation A may be of any approved automatic type, such, for example, as the substation shown in British patent to Martin, No. 1419 of 1910. As represented herein, it comprises essentially the receiver 2, transmitter 3, switch hook 4, ringer 5 and condenser 6. Being an automatic substation, there is also provided a pair of impulse springs 7 and 8 controlled by an impulse wheel 9 through the medium of a finger hole dial (not shown).

The line conductors 11 and 12 of the substation A are connected at the private branch exchange to the individual line switch C which is of the general type of line switch disclosed in the British patent to James, No. 26,301 of 1906; being, however, of the particular type shown in U. S. Letters Patent No. 1,078,690, granted Jan. 17, 1912, to Frank Newforth. Through the medium of line switch C the line of substation A when calling is given access to a plurality of trunk lines extending to selector switches.

The line switch C and a plurality of similar line switches are controlled in their trunk selecting operations by means of a master switch D. The master switch D is of the general type of master switch disclosed in the above mentioned British patent to James, No. 26,301 of 1906; being, however, more nearly of the particular type disclosed in the British patent to Martin, No. 1419 of 1910, also previously referred to.

As is well known, the function of the master switch is to maintain the plungers of all idle line switches which it controls in position before the terminals of an idle trunk line.

One of the trunk lines to which the line switch C has access is shown in Fig. 1 extending to the selector switch E. The selector E may be of the general type of selector switch disclosed in U. S. Letters Patent No. 815,321, granted March 31, 1906, to Keith, Erickson, and Erickson; the side switch and private magnet being omitted, however, and the circuits being modified in accordance with the two-wire system of control. The circuits are further modified by the addition, in accordance with my invention, of a fourth conductor to the trunk line extending between the line switch and the selector switch, over which, in certain instances which will be pointed out, a circuit is closed by which the selector switch is prevented from connecting with a trunk line to the main exchange.

While I have shown throughout the drawing a plurality of batteries, it is understood that there is preferably but one battery having its positive pole grounded, the various battery leads of the drawing being connected together and extended to the negative pole thereof. The reference character Q indicates a busy signaling machine of the usual and well known type.

Having given a general description of the apparatus involved I will now proceed to explain more in detail the operation of the same. It will first be briefly explained how the connection is extended from the calling substation A to the selector switch E as shown in Fig. 1 of the drawing, after which the operation of the selector switch in selecting a trunk line to the main exchange will be described, it being assumed that the substation A has unlimited service. Thereafter it will be assumed that the substation A has restricted service, and the operation of the selector switch when an attempt is made to call the main exchange by the restricted service subscriber will be described.

When the calling subscriber at substation A removes his receiver to initiate the call, an energizing circuit is completed over the line conductors 11 and 12 for the line relay 14 of the line switch C. Upon attracting its armature, the line relay 14 closes a circuit for the pull-in winding 18. Upon energizing, the pull-in winding operates both the plunger arm 15 and the cut-off armature 16; the former through the medium of its plunger (not shown) forcing the bank springs 30—33, inclusive, into engagement, respectively, with contacts 34—37, inclusive; and the latter disconnecting the line conductors 11 and 12, respectively, from ground and from the line relay 14. By the engagement

of bank springs 30 and 33 with contacts 34 and 37, respectively, the line conductors 12 and 11 are extended through normally closed contacts of the switching relay 63 to the double wound line relay 50 of the selector E.

The line relay 50 is accordingly energized over the loop circuit including substation A and, upon attracting its armature, closes a circuit for the slow acting release relay 51. Upon energizing, the release relay closes a holding circuit for the line switch C which may be traced from ground G^s by way of the working contact of armature 49 and the said armature, conductor 48, contact 35, bank spring 31, and the holding winding 17 to battery B'. Since the line relay 14 is slow acting, it retains its armature to maintain the pull-in winding 18 energized until after the above holding circuit has been established. A branch of the holding circuit extends by way of conductor 20 to multiple test contacts in the banks of connector switches having access to the line of substation A whereby a ground potential on these test contacts the said line is made busy. A second branch of the holding circuit extends by way of conductor 46 to the test contact in the master switch bank which is associated with the trunk line terminating in selector E, whereby the master switch D is operated in the usual manner to advance the plungers of all the remaining idle line switches of the group which it controls into position before the terminals of the next idle trunk line. The engagement of bank spring 32 with contact 36 is functionless at this time, for in the case where substation A has unlimited service the terminals 38 and 39 will not be connected.

The foregoing operations have occurred in response to the removal of the receiver at substation A. It has been assumed that the calling subscriber desires to connect with a subscriber in the main exchange and he will therefore proceed to operate his calling device in accordance with the digit 0, for as previously stated, the trunk lines extending to the main exchange terminate in the tenth level of the selector E. By the operation of the calling device a series of ten interruptions is produced in the circuit of the line relay 50 of the selector E. At each interruption of its circuit, the line relay 50 de-energizes momentarily and sends an impulse from ground G^s through the slow acting relay 52 and the vertical magnet 53 in series. In response to these impulses the vertical magnet operates to raise the switch shaft step-by-step until wipers 70, 71 and 72 arrive at the tenth horizontal level of bank contacts. The slow acting relay 52 is energized in series with the vertical magnet and retains its armature attracted during the vertical movement of the switch. Upon the first upward movement of the

shaft the off-normal springs 58 are closed, thereby completing an initial energizing circuit for relay 55, which may be traced as follows: Ground at G⁵, the working con-
 5 tacts of armature 49, armature of relay 52 and its working contact, junction point 80, the said off-normal springs 58 and the winding of relay 55 to battery. Upon energizing, relay 55 locks itself at its lower arma-
 10 ture independent of the relay 52 and at its upper armature prepares a circuit for the rotary magnet 54, which is held open however during the vertical movement of the switch by the relay 52. At this point it
 15 should be mentioned that by the closure of the off-normal springs 58, the line switching relay 63 was connected in series with relay 55. The junction point 80, however, has already been connected to ground as
 20 previously described. Hence it will be seen that line switching relay 63 is short circuited for the present and remains inoperative.

When the slow acting relay 52 deenergizes at the end of the series of impulses it
 25 completes at its back contact the previously mentioned circuit of the rotary magnet. Upon energizing, the rotary magnet operates to rotate the wipers 70, 71 and 72 into engagement with the first set of bank con-
 30 tacts of the tenth horizontal level. Near the end of its stroke, the rotary magnet breaks at its armature 73 the locking circuit of relay 55; breaks at its armature 74 the circuit connecting the switching relay 63 with
 35 the relay 55, a branch of which circuit extends to the private wiper 71; and at its armature 75, disconnects the conductor 47. In the case under present consideration, how-
 40 ever, this latter operation is of no consequence. Upon deenergizing, the relay 55 breaks the circuit of the rotary magnet, which accordingly retracts its armature to close its several contacts represented herein
 45 as being controlled by the separate armatures 73, 74, and 75. The operation now depends upon whether the first trunk line, the terminals of which are now engaged by the switch wipers, is busy or not. If this trunk
 50 line is busy, the test contact 91 with which the private wiper 71 is in engagement will have ground potential upon it, which ground potential will serve to maintain the line
 55 switching relay 63 short circuited and also to energize the relay 55. The rotary magnet circuit is therefore again completed and the same cycle of operations is repeated where-
 60 by the switch wipers advance into engagement with the next set of contacts. It will be seen then, that the relay 55 will operate as an interrupter to step the switch wipers
 65 around through the medium of the rotary magnet as long as the private wiper 71 continues to engage grounded or busy test con-
 tacts. When a non-busy or ungrounded test

contacts its armature, the relay 55 cannot again energize and the switching relay 63 being no longer short circuited is energized in series with the relay 55. The relay 63 is of
 70 such high resistance, that relay 55 remains inoperative. By the attraction of its armature the switching relay 63 opens a contact in the circuit of the release magnet 56 to provide against the deenergization of re-
 75 lays 50 and 51; shifts the private wiper from connection to the upper terminal of relay 63 into connection with holding conductor 48; and disconnects the incoming line
 80 conductors from the windings of the line relay 50 and extends them instead by way of the line wipers 70 and 72, and the con-
 ductors 93 and 95 to the line relay of a second selector switch at the main exchange.

This second selector switch has not been shown but is understood to be similar to the
 85 selector E. The line and release relays of the second selector are now energized in the usual manner, whereby ground is placed upon the conductor 94 in order to provide a holding circuit for the selector E and the
 90 line switch C. This holding circuit may be traced as follows: From ground on conductor 94, bank contact 91, wiper 71 and upper armature of relay 63 and its working con-
 95 tact to junction point 81, where the circuit divides, one branch extending by way of rotary off-normal springs 82, the winding of
 100 the relay 63, the resting contact of armature 74 and said armature, off-normal springs 58, and the winding of relay 55 to battery B³, while the other branch joins the previously
 105 described holding circuit extending back to the line switch C at junction point 83.

The subscriber at substation A may now manipulate his dial in accordance with the
 105 remaining digits of the number, whereby the automatic switches at the main exchange are controlled in the usual and well known manner to extend the connection to the de-
 110 sired subscriber. It should be mentioned here that a repeater is usually included in each trunk line to the main exchange, there-
 115 by permitting the use of two-conductor trunks in the well understood manner. But since my invention is confined to the branch
 120 equipment nothing would be gained by showing in detail these trunks or the selectors to which they extend.

Having briefly explained the ordinary operation of the selector E incident to the serv-
 120 ing of an unlimited service subscriber, I will now proceed to consider its operation when seized by a restricted service subscriber who desires to call the main exchange, and will
 125 explain how its operation in such case is modified by my invention. It will be evident that inasmuch as the selector switch is required to operate differently, dependent upon the kind of line to be served, it must
 130 be able to discriminate in some way between

the different kinds of calling lines by which it is seized. To this end the fourth conductor 47 is added to the trunk line and is grounded or not grounded at the individual line switch of the calling line, dependent upon whether the calling subscriber is to have his service restricted or not. In the case now under consideration, where it is assumed that the substation A is not to be given access to the main exchange, the terminals 38 and 39 associated with the individual line switch C will be soldered together.

To proceed, when the line of substation A is extended by the operation of the line switch C to the selector switch, the conductor 47 will be grounded by the engagement of bank spring 32 with the contact 36. The calling subscriber will now manipulate his calling device in accordance with the digit 0, desiring to obtain a main exchange connection, whereby the switch shaft is raised as before to the tenth horizontal level of bank contacts, and is then automatically started rotating. The rotary movement does not cease when an idle trunk is reached, as in the former case, but continues independent of the busy or idle condition of the trunk lines. This result is due to an alternative circuit for relay 55, closed when the switch shaft reached its uppermost position, and which may be traced as follows: ground at (G², terminals 38 and 39 (now soldered together), bank spring 32, contact 36, conductor 47, armature 75 and its resting contact, shaft controlled springs 57, contact springs 84, off-normal springs 58, and the winding of relay 55 to battery B. It will be seen then that the junction point 80 will be maintained grounded independent of the private wiper 71, whereby the selector will continue to rotate until the wipers pass the last set of contacts in the bank. On the eleventh rotary step the shaft cam 85 operates to switch the rotary off-normal springs with the following results: By the separation of contact springs 84 the previously described circuit including conductor 47 is broken, whereby the rotation is stopped; by the separation of contact springs 82 the energization of the switching relay 63 is prevented; and finally, through the medium of contact springs 86, 87, and 88, ground G⁴ is substituted for ground G³ in the circuit of the line relay 50. Since the above circuit now includes the secondary of the transformer of the busy signaling machine, the calling subscriber will be given the busy signal, and will accordingly replace his receiver.

I will now refer to Fig. 2 in order to describe briefly a modification of my invention in which the same is applied to a so called selector connector switch. It has been thought unnecessary to show all the details

of this switch, consequently everything except the bare operating circuits has been omitted. At this time reference is had to U. S. Letters Patent #1,164,479, granted Dec. 14, 1915 to Gerald Deakin. As previously mentioned a selector connector is of utility in an automatic private branch exchange of a capacity of 90 lines or less, in which case the selectors such as the selector E would be omitted and selector connectors such as the one shown in Fig. 2 substituted therefor. The specific substitution mentioned would be accomplished by removing the selector E and connecting the conductors 100, 101, 102, and 103, respectively, of Fig. 2, to contacts 34, 35, 36, and 37, of Fig. 1.

A calling subscriber, whether restricted service or not, who desires to connect with another local subscriber, will remove his receiver, whereupon his line switch operates to extend his line to an idle selector connector, which is then controlled in a two digit operation to connect with the wanted line. Should a subscriber whose service is not restricted desire to call a main exchange subscriber, the first digit to be called will be the digit 0, whereby the vertical magnet VM is controlled by the line relay K to raise the switch shaft to the tenth level. The sluggish relay M is in series with the vertical magnet and is maintained energized during the series of impulses to close a circuit for the private magnet PM. When the shaft reaches its uppermost position the contact springs 133 and 131 are closed, thereby bringing about the energization of relay H, which operates to effect the switching of the rotary magnet RM from directive to automatic control. The shaft controlled springs 157, are also closed at this time, but without effect, for the calling line is not restricted as to its service and conductor 102 therefore will be ungrounded. When the relay M and the private magnet deenergize at the end of the series of impulses the side switch wipers are advanced to their second position in the usual manner, whereupon a circuit is completed for the rotary magnet in series with the interrupter relay I, which magnet then operates to rotate the switch wipers under control of the private magnet in search of an idle trunk line.

From the foregoing the operation in case a restricted service subscriber calls the main exchange may be readily understood. When the switch shaft arrives at the tenth level and the contact springs 157 are closed, the grounded conductor 102 is extended to the private magnet PM, which accordingly is prevented from deenergizing at the end of the first series of impulses, and the side switch wipers are thereby held in first position. The rotation of the switch is thus effectually prevented. At the same time the calling subscriber is given a busy signal by

the connection of the busy signaling machine Q' to the lower conductor of the trunk line.

Having described my invention what I consider to be new and desire to have protected by Letters Patent will be pointed out in the appended claims.

What I claim as my invention is:

1. In a telephone system, an automatic selector switch having directly controlled primary movement for selecting groups of lines and automatic secondary movement to select an idle line in a group, means for causing the primary movement of said switch and for initiating the secondary movement, and means for continuing the secondary movement whether all the lines in the group selected in the primary movement are busy or not.
2. In a telephone system, a group of lines, an automatic switch having means for testing said lines, and for selecting an idle one, a second automatic switch having access to said first switch, means for operating said switches, and a circuit controlled from said first switch and effective to cause said second switch to pass over said lines while testing whether the said lines are busy or not.
3. In a telephone system, a temporarily established connection including movable contacts in a first automatic switch and terminating in a second automatic switch, a trunk line, means for operating said second switch to connect with said trunk line when the same is idle, and additional means controlled from said first switch for causing said second switch to pass by said trunk line whether idle or not.
4. In a telephone system, a temporarily established connection including movable contacts in a first automatic switch and terminating in a second automatic switch, a group of trunk lines, means for operating the said second switch to select an idle one of said trunk lines, and means controlled from said first switch for causing said second switch to pass over all of said trunk lines whether idle or not.
5. In a telephone system, subscribers' lines of different character, a selector switch, a group of trunk lines, means for extending a calling line to said switch and for controlling the same to select an idle one of said trunk lines including automatic means for causing said selector to pass over busy trunk lines, and a circuit closed only when the calling line is of a particular kind for causing said selector to pass over all of said trunk lines whether busy or not.
6. In a telephone system, a plurality of subscribers' lines, a selector switch, a group of trunk lines, means for controlling said switch over a calling one of said lines to select an idle one of said trunk lines including means for causing said selector to pass over

busy trunk lines, and means for preventing certain of said subscribers' lines from having access to said trunk lines, said means comprising a circuit closed only when one of the latter subscribers is calling and effective to cause said selector to pass over all of said trunk lines whether busy or not.

7. In a telephone system, subscribers' lines of different character, a selector switch, a group of trunk lines, means for extending a calling line to said switch and for controlling the same to select an idle one of said trunk lines including automatic means for causing said selector to pass over busy trunk lines, a circuit closed only when the calling line is of a particular kind for causing said selector to pass over all of said trunk lines whether busy or not, and means operated when all the said trunk lines are unselectable for transmitting a busy signal to the calling subscriber.

8. In a telephone system, a plurality of subscribers' lines, a selector switch, a group of trunk lines, means for controlling said switch over a calling one of said lines to select an idle one of said trunk lines including means for causing said selector to pass over busy trunk lines, means for preventing certain of said subscribers' lines from having access to said trunk lines, said means comprising a circuit closed only when one of the latter subscribers is calling and effective to cause said selector to pass over all of said trunk lines whether busy or not, and means operated when all the said trunk lines are unselectable for transmitting a busy signal to the calling subscriber.

9. In a telephone system, subscribers' lines of different character, a selector switch accessible to said lines, a plurality of groups of trunk lines, means for controlling said switch over a calling line to select a desired group of trunk lines and an idle line in the selected group including means for causing said selector to pass over busy trunk lines, a circuit closed only when the calling line is of a particular kind for causing said selector to pass over all of the lines in the selected group whether busy or not, and means for preventing the closure of said circuit when a particular one of said groups is selected.

10. In a telephone system, subscribers' lines of different character, a selector switch accessible to said lines, a plurality of groups of trunk lines, means for controlling said switch over a calling line to select a desired group of trunk lines and an idle line in the selected group including means for causing said selector to pass over busy trunk lines, a circuit effective to cause said selector to pass over all of the lines in the selected group whether busy or not, said circuit normally open at two points, means for closing said circuit at one point only when the

calling line is of a particular character, and means for closing said circuit at the other point only when a particular group of trunk lines has been selected.

11. In a telephone system, a trunk line terminating in an automatic selector switch, other lines, means for operating said switch to select an idle one of said other lines including automatic means for causing said switch to pass over busy lines, and additional automatic means for causing said switch to pass over all of said lines whether busy or not.

12. In a telephone system, a trunk line terminating in an automatic selector switch, other lines, means for operating said switch to select an idle one of said other lines including automatic means for causing said switch to pass over busy lines, and additional means for causing said switch to pass over all of said lines whether busy or not, said last means comprising a circuit including a conductor of said trunk line.

13. In a telephone system, subscribers' lines, a trunk line terminating in an automatic switch, an individual switch for each line responsive to a call thereover for connecting with said trunk line, means for operating said first switch over a connected calling line, a circuit including a conductor of said trunk line effective when closed to limit the connecting possibilities of said first switch, said circuit normally open at two points, means in said first switch for closing said circuit at one point, and means in certain of said individual switches for closing said circuit at the other point.

14. In a telephone system, subscribers' lines, a trunk line terminating in an automatic switch, an individual switch for each subscriber's line responsive to a call thereover to connect with said trunk line, means for operating said first switch over a connected calling line, a circuit including a conductor of said trunk line, means in certain of said individual switches for grounding said conductor when the said trunk line is seized, and means responsive to such grounding to limit the effective operation of said first switch.

15. In a telephone system, subscribers' lines, a trunk line having line and test conductors and terminating in an automatic switch, an individual switch for each subscriber's line responsive to a call thereover for connecting with said trunk line, means for operating said first switch over a connected line, a circuit including a fourth conductor of said trunk line for limiting the effective operation of said first switch, and means in certain of said individual switches for closing said circuit.

16. In a telephone system, subscribers' lines of different character, a trunk line accessible to calling lines and terminating in

a selector switch, another line, means for connecting a calling line with said trunk, means for controlling said switch over a connected calling line to establish connection with said other line, and a circuit including a conductor of said trunk line closed only when a calling line of a particular kind is connected thereto, said circuit effective to prevent said switch from connecting with said other line and for giving a busy signal to the calling subscriber.

17. In a telephone system, an automatic selector switch having directly controlled primary movement for selecting groups of lines and an automatic secondary movement over the lines in a group to select an idle line in a group, means for causing the primary movement of said switch and for initiating the secondary movement, and means for continuing said secondary movement over all the lines in a group selected in a primary movement whether all the said lines are busy or not.

18. In a telephone system, subscribers' lines of different character, trunk lines, and an automatic switch accessible to a calling one of said subscribers' lines and controllable thereover to select an idle one of said trunk lines, including means for causing said switch to pass over the busy lines, and additional means for causing said switch to pass over either idle or busy lines, the operation of said last means depending on the character of the calling subscriber's lines.

19. In a telephone system, an automatic selector switch having a directly controlled primary movement for selecting groups of lines and an automatic secondary movement to select any idle line in a group, means for causing the primary movement of said switch and for initiating the secondary movement, and means for continuing the secondary movement whether all the lines in the group selected in the primary movement are idle or not.

20. In a telephone system, an automatic selector switch having a directly controlled primary movement for selecting groups of lines, and an automatic secondary movement to select any idle line in a group, means for causing the primary movement of said switch and for initiating the secondary movement, and means for continuing the secondary movement over all the lines in a group selected in the primary movement whether all the said lines are idle or not.

21. In a telephone system, an automatic selector switch having a directly controlled primary movement for selecting groups of lines, and an automatic secondary movement to select any idle line in the group, means for causing the primary movement of said switch and for initiating the secondary movement, and means for con-

tinuing the secondary movement over all the lines in a group selected in the primary movement whether all the said lines or part of said lines are idle.

22. In a telephone system, a trunk line terminating in an automatic switch, groups of lines accessible to said switch, means for seizing said trunk line and for operating said switch to select one of said groups of lines, means for initiating an automatic secondary movement of said switch to select any idle line in the selected group of lines, and means operative at one time for continuing the secondary movement of said switch when all the lines in the selected group are idle.

23. In a telephone system, a trunk line terminating in an automatic switch, groups of lines accessible to said switch, means for seizing said trunk line and for operating said switch to select one of said groups of lines, means for initiating an automatic secondary movement of said switch to select any idle line in the selected group of lines, and means operative at one time for continuing the secondary movement of said switch when all the lines or part of the lines in the selected group are idle.

24. In a telephone system, an automatic selector switch having a directionally controlled primary movement for selecting groups of lines and an automatic secondary movement for selecting an idle line in a group, means for causing the primary movement of said switch and for initiating the secondary movement, and means exclusive of said lines for continuing the secondary movement of said switch whether all the lines in the selected group are busy or not.

25. In a telephone system, a four conductor trunk line terminating in an automatic switch, said switch having a directionally controlled primary movement for selecting groups of lines and an automatic secondary movement to select an idle line in a group, means for causing the primary

movement of said switch and for initiating the secondary movement, and means controlled over the fourth conductor of said trunk line for preventing said switch from connecting with any line in the selected group whether said line is idle or not.

26. In a telephone system, a four conductor trunk line terminating in an automatic switch, said switch having a directionally controlled primary movement to select groups of lines and an automatic secondary movement to select an idle line in a group, means for causing the primary movement of said switch and for initiating the secondary movement, and means controlled over the fourth conductor of said trunk line for preventing said switch from connecting with any line in the selected group.

27. In a telephone system, a four conductor trunk line terminating in an automatic switch, said switch having a directionally controlled primary movement to select groups of lines and an automatic secondary movement to select an idle line in a group, means for causing the primary movement of said switch and for initiating the secondary movement, and means for placing ground on the fourth conductor of said trunk line for preventing said switch from connecting with any line in the selected group.

28. In a telephone system, a trunk line terminating in an automatic switch, said switch having a directionally controlled primary movement to select groups of lines and an automatic secondary movement to select an idle line in a group, means for causing the primary movement of said switch and for initiating the second movement, and means for grounding one conductor of said trunk line for preventing said switch from connecting with any line in a selected group.

Signed by me at Chicago, Cook county, State of Illinois, this 23rd day of October, 1916.

W. A. CHAPIN.