

H. E. HERSHEY.
 AUTOMATIC TELEPHONE SYSTEM.
 APPLICATION FILED MAR. 10, 1916.

1,338,370.

Patented Apr. 27, 1920.

2 SHEETS—SHEET 1.

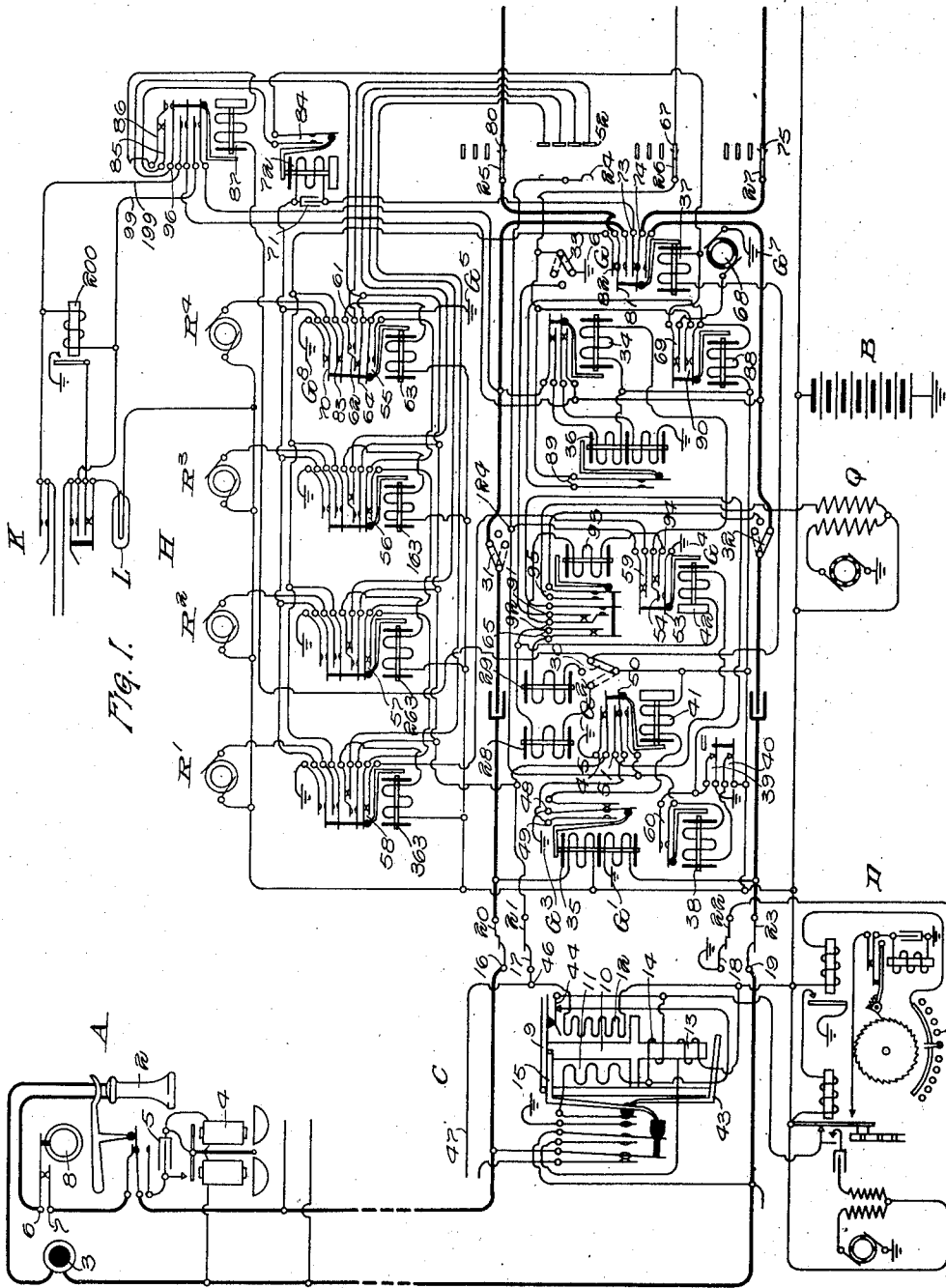


Fig. 1.

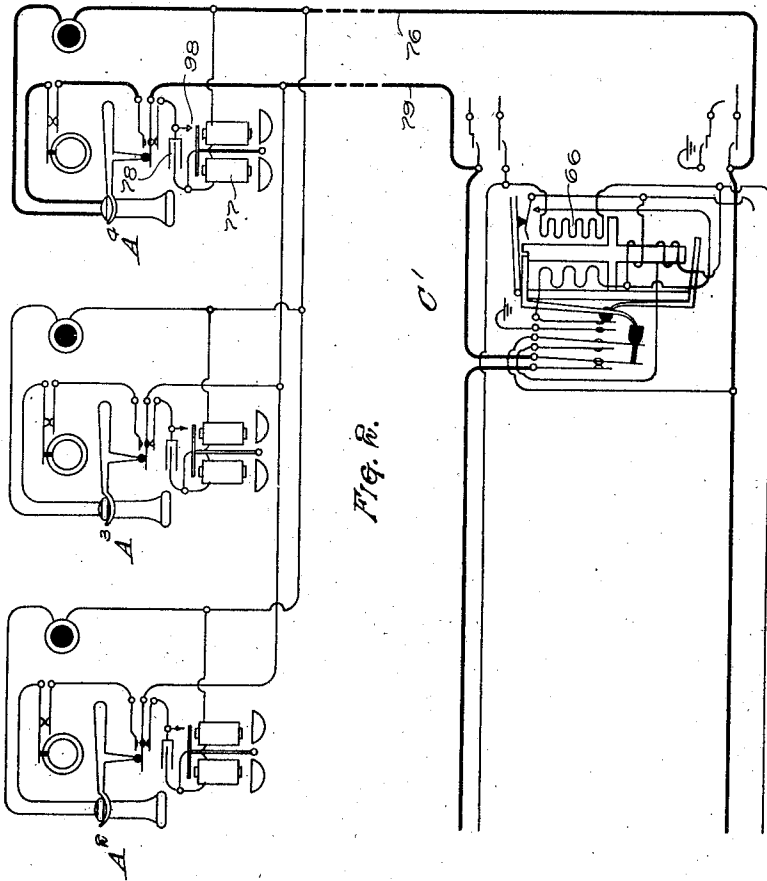
WITNESSES
Hicks & W. Thacker
Louis M. Landa.

INVENTOR:
 HARRY E. HERSHEY
By Charles C. Bullock
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UNITED STATES PATENT OFFICE.

HARRY E. HERSHEY, OF WHITEWATER, KANSAS, ASSIGNOR TO AUTOMATIC ELECTRIC COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

AUTOMATIC TELEPHONE SYSTEM.

1,338,370.

Specification of Letters Patent. Patented Apr. 27, 1920.

Application filed March 10, 1916. Serial No. 83,250.

To all whom it may concern:

Be it known that I, HARRY E. HERSHEY, a citizen of the United States of America, and a resident of Whitewater, Butler county, Kansas, have invented certain new and useful Improvements in Automatic Telephone Systems, of which the following is a specification.

My invention relates to automatic telephone systems and has particular reference to selective signaling methods in such automatic systems as comprise poly-station lines. In these systems it is customary to provide those substations which are on the same line with ringers which are adapted to respond to ringing currents of different character. At the exchange, ringing current generators of different character are provided which in the course of the operation of the system may be selectively associated with called lines at proper times to signal wanted subscribers.

My invention relates, more specifically, to the method employed at the exchange for accomplishing the afore-mentioned selective action whereby the ringing current generator corresponding to a wanted substation may be selected; and as illustrated herein contemplates the use of the well known harmonic signaling system, in which the ringing currents differ in frequency, although other well known systems might equally well be used.

In practising my invention I employ a single group of connector switches for each group of poly-station lines. Each connector of the group is provided with a relay for each separate frequency of ringing current and has, in addition, a vertical row of contacts, one for each relay, and a wiper adapted to engage these contacts in the vertical movement of the switch. In the operation of my system, the connectors respond to three digits instead of two. When the first digit is received and the connector responds thereto to raise its shaft, one of the frequency selecting relays is operated through the medium of the special wiper and vertical row of contacts. After the first digit has been called the connector is automatically released and is then ready for operation in response to the remaining two digits in the regular manner.

A further object of my invention is the provision in a connector switch of the above

character of means whereby a calling subscriber, who is attempting to signal a second subscriber whose telephone has been taken out or disconnected, may be readily and conveniently apprised of that fact. To this end I provide a relay which operates, when the called line has no substation connected corresponding to the frequency of ringing current in use, to extend the calling line to an operator's position.

Further objects of my invention relate to circuit arrangements and devices through the medium of which the foregoing features are incorporated into automatic connector switches of well known type and construction to form a simple and efficient apparatus.

To accomplish the foregoing and other useful ends my invention comprises means which will be hereinafter set forth and fully explained, reference being had to the accompanying drawings, in which Figures 1 and 2, taken in order with the lines at the ends thereof in alinement, represent a complete connection between a calling substation A and a called substation A' in a system embodying the principles of my invention.

Referring now to Fig. 1, the automatic substation A comprises the usual receiver 2, transmitter 3, ringer 4 and condenser 5. Being an automatic substation, it is also provided with a suitable call sending mechanism for controlling the automatic switches, which mechanism is represented diagrammatically by a pair of impulse springs 6 and 7 and an impulse wheel 8, which latter may be controlled by a dial provided with finger holes in such a way that the impulse springs may be momentarily separated a number of times corresponding to the respective digits of the number of the called subscriber. A substation of the above general type is shown in British patent to Martin, No. 1419 of 1910.

Allotted to the line conductors of substation A at the exchange is an individual or line switch C, which may be of the general type of line switch shown in British patent to R. W. James, No. 26,301 of 1906; being, however, of the particular type disclosed in British patent to T. G. Martin, No. 1419 of 1910. This line switch comprises among other details a plunger (not shown) attached to the end of a so-called plunger arm 9 which is controlled by

the magnet 10. The magnet 10 comprises four windings, namely, a pull down winding 11, cut-off or holding winding 12, line winding 13 and an auxiliary winding 14.

5 The core of the magnet 10 is so constructed that the magnetic circuit of the windings 11 and 12 is separate from that of the windings 13 and 14. This magnet also controls the cut-off armature 15. The pull-in winding

10 11 operates both the plunger arm 9 and the armature 15, while the cut-off or holding winding 12 is only strong enough to operate the cut-off armature 15 and to hold the plunger arm 9 in its operated position.

15 When the plunger arm is operated, the plunger is forced into a bank of contact springs forcing the springs 16, 17, 18 and 19 into engagement, respectively, with the contacts 20, 21, 22 and 23.

20 Although only one set of contacts (20-23) is shown, each line switch is provided with a plurality of such sets, each set forming the terminal of a trunk line leading to a connector switch. Each trunk line is connected in

25 multiple with the corresponding contacts of all the line switches of the group which is controlled by the master switch D. The switch C is initially controlled by the subscriber through the medium of the line

30 winding 13, as will hereinafter be more fully explained.

The master switch D is of the same general type as that disclosed in British patent to R. W. James No. 26,301 of 1906; being,

35 however, of the particular type disclosed in British patent to T. G. Martin, No. 1419 of 1910. The function of the master switch, as is well known, is to maintain the plungers of all the idle line switches in position to engage the terminal of an idle trunk

40 line.

The connector switch H is of the same general type of connector switch disclosed in United States Letters Patent No. 815,176,

45 granted March 13, 1906, to Keith, Erickson, and Erickson, the circuits, however, being modified to adapt the switch to operate in a system in which the central office apparatus is controlled by impulses delivered over the

50 two sides of the line in series, as shown in British patent specification No. 2270 of 1914. Among other details, the connector H comprises a bank of contacts arranged in horizontal rows or levels, which contacts are

55 adapted to be engaged by a set of wipers, 25, 26 and 27 carried upon a shaft (not shown) which has a vertical movement controlled by the vertical magnet 28 and a rotary movement controlled by the rotary

60 magnet 29. The usual side switch comprising the wipers 30, 31, 32 and 33 is controlled by the private magnet 34 in the usual and well known manner. The operation of the various parts of the switch is controlled

65 through the medium of the line relay 35.

The called line is provided with talking current through the so-called back-bridge relay 36. The ringer relay 37 affords the means by which ringing current is applied to the called line. Means for permitting the switch

70 to be restored to normal position, are provided in the release magnet 38, which, upon energizing, withdraws the retaining double-dog from the shaft and returns the side switch wipers to first position. The springs

75 39 and 40 engage their respective contacts only when the switch shaft has been raised one or more steps from its lowest position. The relays 41 and 42 are slow acting, that is, slow to release their armatures upon deen-

80 ergizing.

In accordance with my invention the connector H is provided with a vertical row of contacts adapted to be engaged by the wiper

85 24 carried upon the same shaft as the wipers 25, 26, and 27. The contacts in the vertical row are spaced the same distance apart as are the levels in the horizontal banks, so that if the wipers are raised opposite the

90 first level, the special wiper 24 will engage the lowest vertical contact, while, if the wipers are raised opposite the third level, the wiper 24 will engage the third vertical

contact, etc.

The connector H is provided, further-

95 more, with a group of relays indicated by reference characters 63, 163, 263, and 363, which relays are associated, respectively, with the four contacts in the previously

100 mentioned vertical contact row. Each of the relays 63, 163, etc., is associated also with a particular source of ringing current, which ringing current sources are indicated by reference characters R⁴, R³, etc.

At the upper right hand corner of Fig. 1

105 are shown two relays whose function is to connect the connector H with the traffic trunk conductors 99 and 199 at the proper time as will be more fully explained hereinafter.

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Relay 72 is bridged by the condenser 71, is provided with a slug of copper at one end of the core, and is adjusted to respond to direct current but not to alternating or

115 ringing current. Relay 87 is also provided with a slug of copper at one end of the core and is so adjusted that it is slow to attract its armature. Other well known devices may be used to cause relay 87 to respond

120 slowly when its energizing circuit is closed, the means shown being chosen with regard to simplicity of illustration.

Referring now to Fig. 2, there is shown a poly-station line across the conductors 76 and 79 of which are bridged three substations indicated by reference characters A⁴,

125 A³, and A². A fourth substation for which capacity is provided in my system, is assumed to have been taken out or deenergized. Except for their ringers, the sub-

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stations shown in Fig. 2, together with the associated line switch C', may be precisely like substation A and line switch C (Fig. 1), already described. The ringers at substations A⁴, A³, and A² are adapted to respond, respectively, to ringing current from generators R⁴, R³, R², there being no substation on the line adapted to respond to current from generator R'.

In accordance with my invention each ringer movement is provided with a pair of contact springs, shown at 98 in connection with substation A⁴, which are closed intermittently in the operation of the ringer to short circuit the condenser in series therewith.

For supplying current for operating and talking purposes I have shown a battery B having its positive terminal grounded. The reference character Q indicates a busy signaling machine for supplying a busy tone to a calling line in case of an attempted connection with a busy line.

While I have shown in Fig. 1 the line switch C as having direct access to the connector H, it will be understood by persons versed in the art that selector switches may be interposed in order to increase the capacity of the system. Selector switches which may be used are disclosed in British patent to Automatic Telephone Mfg. Co., No. 2543 of 1914.

A general description of the apparatus having been given, it will now be explained how connection can be established between the line of substation A and the line of a called substation A⁴. The number of the called substation will be assumed to be 122. Since the automatic switching apparatus disclosed herein is in general well known in the art, and is described in the publications herein referred to, its operation will be explained in a more or less general manner.

When the subscriber at substation A removes his receiver preliminary to making a call, an energizing circuit is closed through the line winding 13 of the individual switch C. The winding 13, upon energizing, closes a circuit through the pull-in winding 11 in series with the auxiliary winding 14. The pull-in winding, upon energizing, attracts the plunger arm 9, to force the plunger into the bank of springs 16 to 19. It also operates the cut-off armature 15, thereby disconnecting the line winding 13 from the line. The armature 43 does not fall back immediately, however, owing to the fact that the winding 14 is still in series with the pull-down winding 11. Upon the plunger arm 9 being attracted, the springs 44 are brought together to short-circuit the auxiliary winding 14, the armature 43, however, being held for an instant by currents induced in the short-circuited winding 14.

This slow action of the armature 43 allows sufficient time for a holding circuit to be closed in the switch ahead for the cut-off or holding winding 12. The engagement of springs 16 and 19 with contacts 20 and 23, respectively, extends the subscriber's line to the line relay 35 of the connector H. The line relay 35, thereupon energizes over a circuit extending from ground G' through the lower winding of relay 35, contact 23, spring 19 to and through substation A, spring 16, contact 20, and upper winding of relay 35 to battery B. The line relay 35, upon energizing, closes a circuit through relay 41. Relay 41, upon energizing, closes a holding circuit for the line switch C. This circuit may be traced from ground G² through springs 45, contact 21 and spring 17 to wire junction 46, thence one branch extends over the conductor 47 to the multiple connector private bank contacts associated with the line switch C. The other branch extends from the wire junction 46 through the holding winding 12 to battery B. The grounded private bank contacts prevent any connector from making connection with the line of substation A while the line switch C is operated.

The calling subscriber now operates his calling device for the first digit 1 of the called number, whereby the impulse springs 6 and 7 are separated once momentarily, thus breaking the circuit of the line relay 35. The relay 41, being slow acting, does not deenergize during the momentary interruptions of its circuit by the relay 35, and consequently, each time the latter relay deenergizes, an impulse is transmitted to the vertical magnet 28 over a circuit extending from ground G³ through contact springs 48 and 49, contact springs 50 and 51, relay 42, vertical magnet 28, and side switch wiper 30 (in first position) to battery B. The vertical magnet receives one impulse over this circuit and operates to raise the switch shaft and the wipers 25, 26 and 27 opposite the first row or level of bank contacts, and at the same time wiper 24 is brought into engagement with bank contact 52. The shaft controlled contacts 39 and 40 are also closed at this time. The slow acting relay 42 is maintained in its energized position continuously while impulses are being transmitted to the vertical magnet and in its energized position closes a circuit from ground G⁴ through contact springs 53 and 54, and private magnet 34 to battery B. When relay 42 deenergizes, at the end of the impulse or series of impulses, the circuit of the private magnet is broken and the side switch wipers move to second position in the well known manner. They are restored instantly, however, by the release magnet 38 which is included in one branch of a divided circuit, closed by relay 42 an instant

after the private magnet circuit is broken, and which may be traced as follows: ground at G^5 , contact springs 55, contact springs 56, contact springs 57, contact springs 58, and contact springs 59 to wire junction 124 where the circuit divides, one branch extending by way of release magnet 38 and off normal contact 40 to battery B, and the other branch extending by way of wiper 24, bank contact 52, contact springs 61 and 62, and winding of relay 63 to battery B. The release magnet, upon energizing, locks itself by way of off normal contact 39 and contact springs 60 and operates to restore the side switch wipers and shaft to normal position after which its circuit is opened at the off normal contacts. Relay 63, upon energizing, closes a locking circuit for itself over the following path: ground at G^2 , contact springs 45, contact springs 64 and 62 and winding of relay 63 to battery B. Further results of the operation of relay 63 are the connection of ground at G^3 to one side of relay 72 (of no consequence until later), the connection of one terminal of the generator R^4 to a lead extending to ringing relay 37, and the breaking of the previously described divided circuit extending from ground at G^5 .

The calling subscriber now operates his calling device for the second digit 2 in response to which the connector line relay operates to transmit two impulses through the vertical magnet 28, whereby the shaft wipers are raised opposite the second row or level of bank contacts. The relay 42 operates in response to the impulses for this digit in the same manner as for the previous digit to cause the private magnet to be energized. After the last impulse has been delivered to the vertical magnet, the relay 42 deenergizes and opens the circuit of the private magnet 34, which, upon deenergizing, permits the side switch to pass from first to second position. The movement of the side switch wiper 30 from first to second position transfers the battery connection from the vertical magnet 28 to the rotary magnet 29. The circuit previously closed at contact springs 59 will not be closed at this time owing to the fact that ground at G^5 has been removed from the circuit at springs 55.

The calling subscriber now operates his calling device for the last digit 2, in response to which the connector line relay operates to transmit two impulses through the rotary magnet 29, whereby the shaft wipers are rotated onto the contacts of the desired line. This circuit extends from ground G^3 through contact springs 48 and 49, contact springs 50 and 51, relay 42, contact springs 65, rotary magnet 28, and side switch wiper 30 (in second position) to

battery B. The relay 42 operates in response to the impulses for this digit in the same manner as for the previous digit to cause the private magnet 34 to advance the side switch to third position.

By the engagement of the side switch wipers 31 and 32 with their third position contact points, the line connection is extended through to line wipers 25 and 27. Upon the engagement of the side switch wiper 33 with its third position contact point, a circuit is completed through the cut-off winding 66 of the called line switch C' . This circuit extends from ground G^6 through side switch wiper 33 (in third position), private wiper 26, bank contact 67, and cut-off winding 66 to battery B. The cut-off winding of the called line switch, upon energizing, operates to disconnect the line conductors 79 and 76 from their connections in line switch C' and to connect line conductor 79 to the normal conductor extending to connector bank contact 80. The connection of ground G^6 with the multiple connector private bank contacts of the called line, such as contact 67, prevents the called line from being seized by some other connector switch. By the engagement of the side switch wiper 30 with its third position contact point, the circuit of the ringer relay 37 is closed. This circuit extends from ground G^7 through interrupter 68, ringer relay 37, contact springs 69, and side switch wiper 30 (in third position) to battery B. The ringer relay 37 is energized intermittently through the medium of the interrupter 68 and operates to disconnect the calling line from the called line and to bridge the ringing current generator R^4 across the called line to signal the called subscriber. The circuit of the ringing current extends from ground G^8 through contact springs 70, condenser 71 in parallel with relay 72, contact springs 73 and 74, wiper 27, bank contact 75, line conductor 76, through ringer 77 and condenser 78 in parallel with the other ringers and condensers upon the line, line conductor 79, bank contact 80, wiper 25, contact springs 81 and 82, contact springs 83, ringing current generator R^4 and battery B to ground. Ringing current over the above path actuates the ringer at substation A^4 , the ringers at the other substations on the line not being affected.

By referring to Fig. 2 it will be seen that each time the ringer 77 responds to the ringing current the condenser 78 is short-circuited at the point 98; this short-circuiting of the condenser affords a path for direct current, and consequently, a pulsating direct current from battery B now flows through the slow acting relay 72, maintaining it energized.

When the side switch wiper 30 passed to

its third position and before relays 37 and 72 have had time to operate, a circuit including relay 87 is completed over the following path: ground at G^7 , interrupter 68, contact springs 69, contact springs 84, contact springs 85 and 86, winding of relay 87, and side switch wiper 30 (in third position) to battery B. The function of the relay 87, as before mentioned, is to connect the calling subscriber with an operator should a number be called for which there is no corresponding substation. It will be seen, therefore, that relay 87 should be made slow to energize so as to allow time for the relay 72 to operate and open the above described circuit in case a number is called for which there is a corresponding connected substation. In the present case, where substation A^4 is being signaled, relay 72 operates to open contact springs 84 before relay 87 has had time to energize.

When the called subscriber removes his receiver in response to the ringing of his bell, energizing circuit is completed in the well known manner for the back bridge relay 36 (ringing relay 37 being momentarily deenergized). Upon attracting its armature, relay 36 completes an energizing circuit for the ring cut-off relay 88, which latter, upon attracting its armature, locks itself from ground at G^6 and at the same time opens the conductor from the interrupter 68.

A complete talking circuit has now been established and the calling and called subscribers may converse without further effort. Current for the transmitter at substation A is supplied through the windings of the double wound line relay 35, while current for the transmitter at substation A^4 is supplied through the windings of the double wound answering bridge relay 36. The voice currents take the path shown in the heavy lines which is thought to be clear without further explanation.

When the conversation is finished, both subscribers will hang up their receivers. When the receiver at substation A is hung up, the energizing circuit of the line relay 35 is broken. Following the deenergization of relay 35, relay 41 deenergizes, whereupon the connector H and the line switch C are restored to normal position in the well known manner.

If the line of substation A^4 had been busy when called, the connector H would have operated to connect a lead from the busy signaling machine Q with one side of the calling line, the side switch wipers being held in the second position for this purpose and to prevent connection with the called line. Upon perceiving the busy signal the calling subscriber understands that he is temporarily unable to get the required connection and, accordingly, he replaces his re-

ceiver, whereupon the apparatus is restored to normal position as before mentioned.

Having described the operation of establishing a connection between two substations, I will now describe the operations which take place when an attempt is made to connect with a substation which has been disconnected. It has been mentioned before that the ringers at substations A^2 , A^3 , and A^4 are adapted to respond, respectively, to ringing currents from generators R^2 , R^3 and R^4 , there being no substation on the line corresponding to generator R' . Now if No. 422 be called instead of No. 122, the connector H will be operated as before except that in response to the first digit the wipers will be raised to the fourth level instead of the first level, resulting, accordingly, in the energization of relay 363 instead of relay 63. The connector is then automatically released as before and may be operated thereafter in accordance with the remaining two digits to again connect with the line conductors 76 and 79. Now, however, when the ringing operation begins, ringing current from generator R' is projected out over the called line and, since there is no responsive ringer in bridge of the line, relay 72 will not receive pulsations of direct current as would be the case if a connected substation were being called. Relay 72, therefore, remains inoperative and an instant after the ringing operation starts, relay 87 attracts its armature. A locking circuit for relay 87 may now be traced as follows: ground at G^2 , contact springs 45, contact springs 96 and 86, winding of relay 87, and side switch wiper 30 (in third position) to battery B. It will be seen that relay 87, when energized, connects the heavy talking conductors of connector H with the traffic trunk conductors 99 and 199 which extend to an operator's position. The relay 200, in bridge of the traffic trunk, is now energized in series with the back bridge relay 36, thereby stopping the ringing operation as previously described and lighting the lamp signal L. The operator, being informed by the glowing of the lamp that a call has been received, may bridge her head set (not shown) across the trunk conductors by means of the key K and is then able to converse with the calling subscriber. After having received the appropriate information, the calling subscriber will understand that he cannot get the required party and he will therefore replace his receiver, whereupon the apparatus is restored to normal position in the regular manner.

It will be understood that while my improved system of selective ringing and my improved method of giving traffic trunk service are particularly adapted for use in combination with each other, there is no

such inherent dependency between the two as would preclude the use of either feature separately or in combination with other systems directed to the same general objects.

5 It will be understood, furthermore, that various changes may be made in the exact disclosure shown herein for the purpose of adapting my invention for use in connection with other types of apparatus. I desire to
10 include, therefore, and have protected by Letters Patent all forms and modifications of my invention which shall hereafter be devised, limited only by the scope of the appended claims.

15 What I claim as my invention is:

1. In a telephone system, a party line connector switch responsive to a plurality of digits in a called number, party lines and selectable terminals therefor in said connector,
20 sources of ringing current of different character for signaling substations on said lines selectively, means in said connector responsive to one of said digits for selecting one of said sources and responsive thereafter to a
25 plurality of said digits for selecting any of said terminals.

2. In a telephone system, a party line connector switch responsive to a plurality of digits in a called number, party lines and selectable terminals therefor in said connector, means for operating said connector to extend a talking circuit to any of said party lines, sources of ringing current of different character for signaling substations on said lines selectively, and means in said connector responsive to one of said digits for selecting one of said sources before selecting any of said terminals, said means including an operating magnet for
40 said switch controllable thereafter in response to another digit for the selection of certain of said line terminals, the circuit for said operating magnet excluding the talking circuit.

3. In a telephone system, a party line connector switch responsive to a plurality of digits in a called number, party lines and selectable terminals therefor in said connector, sources of signaling current of different character, and electro-magnetic means for operating said switch, said means responsive to one of said digits for selecting one of said sources independent of any selection of said terminals and responsive
55 thereafter to one or more digits for selecting the terminal of one of said party lines.

4. In a telephone system, a party line connector switch responsive to a plurality of digits in a called number, party lines and selectable terminals therefor in said connector, sources of signaling current of different character, electro-magnetic means for operating said switch, said means responsive to one of said digits for selecting
60 one of said sources independent of any

selection of said terminals and responsive thereafter to one or more other digits for selecting the terminal of one of said party lines, a plurality of substations in bridge of each of said lines, signals at said stations
70 corresponding to said different sources of signaling current, and means for connecting a selected source with a selected line to signal a wanted substation thereon.

5. In a telephone system, a party line connector switch and an operating magnet therefor, a plurality of party lines divided into groups, each line having a terminal in said switch, a plurality of sources of signaling current of different character for signaling substations on said lines selectively, a controlling circuit for said magnet, means controlled by said magnet in response to a series of current impulses produced in said circuit for selecting one of said sources, and
85 means controlled by the same magnet in response to another series of current impulses produced in said circuit for selecting a group of said lines.

6. In a telephone system, a party line connector switch and an operating magnet therefor, a plurality of party lines each having a terminal in said connector, said terminals arranged in groups, a plurality of sources of signaling current of different character for signaling substations on said lines selectively, a controlling circuit for said magnet, means for producing series of current impulses in said circuit for operating said magnet, means controlled by said
100 magnet in response to one series of impulses for selecting one of said sources and a group of terminals simultaneously, and means for automatically releasing said switch only in so far as said group selection is concerned, whereby the same or another terminal group may be selected thereafter in response to another series of impulses.

7. In a telephone system, a connector switch, a plurality of lines having terminals in said connector arranged in groups, a plurality of signaling circuits associated with said connector, an operating magnet for said connector, means controlled by said magnet for closing one of said circuits,
115 means for releasing said switch and for maintaining said circuit closed after the switch is released, and means controlled by said magnet thereafter for selecting one of said groups of line terminals, whereby any one of said circuits may be closed and any one of said groups may be selected contemporaneously.

8. In a telephone system comprising party lines, a connector switch, a multiple terminal for each line in said switch, sources of signaling current of different character for calling substations on said lines selectively, means for operating said connector in accordance with a digit of a called number to
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effect a selection of one of said sources and of one or more of said lines, and means for nullifying the effect of such operation upon the line selection, whereby said connector
5 may be operated thereafter in accordance with one or more other digits of the called number to select a called line.

9. In a telephone system comprising party lines, a connector switch, a multiple
10 terminal for each line in said switch, sources of signaling current of different character for calling substations on said lines selectively, means for operating said connector in accordance with a digit of a
15 called number to effect a selection of one of said sources and of one or more of said lines, and means for releasing said connector in so far as concerns the line selection, whereby it may be operated in accordance with one
20 or more other digits of the called number to select a wanted line.

10. In a telephone system comprising party lines, a connector switch, a multiple
25 terminal for each line in said switch, sources of signaling current of different character for calling substations on said lines selectively, means for operating said connector in accordance with a digit of a called number to effect a selection of one of said
30 sources and of one or more of said lines, means for nullifying the effect of such operation upon the line selection, whereby said connector may be operated thereafter in accordance with one or more other digits of
35 the called number to select a called line, and means for connecting a selected source with a selected line to signal a wanted substation thereon.

11. In a telephone system comprising
40 party lines, a connector switch, a multiple terminal for each line in said switch, sources of signaling current of different character for calling substations on said lines selectively, means for operating said connector in accordance with a digit of a called number to effect a selection of one of said sources
45 and of one or more of said lines, means for releasing said connector in so far as concerns the line selection, whereby it may be operated in accordance with one or more other digits of the called number to select
50 a wanted line, and means for connecting a selected source with a selected line to signal a wanted substation thereon.

12. In a telephone system, a plurality of
55 party lines each having a plurality of substations, a connector switch having vertical and rotary movements and containing a multiple terminal for each of said lines, sources of ringing current of different character for signaling the substations on a line
60 selectively, means operated by the first vertical movement of said switch for selecting one of said sources, automatic means for releasing said switch thereafter while retain-

ing the selected source in selected condition, and means effective upon further operation of said switch for connecting the selected source with one of said lines to signal a
70 wanted substation thereon.

13. In a telephone system, a plurality of party lines each having a plurality of substations, a connector switch containing a multiple terminal for each of said lines and having a plurality of operating movements
75 for selecting a wanted line, sources of ringing current of different character for signaling the substation on a line selectively, means operated by the first movement of said switch for selecting one of said sources,
80 means for releasing said switch thereafter while maintaining the selected source in selected condition, and means effective upon further operation of said switch for connecting the selected source with a selected
85 line whereby to signal a wanted substation thereon.

14. In a telephone system, a plurality of party lines, a connector switch having vertical and rotary movements for selecting a
90 wanted line, a plurality of sources of signaling currents of different character for signaling substations on said lines selectively, a relay for each source for extending the same to said connector, contacts for said relays
95 arranged in a vertical row, a wiper adapted to engage said contacts successively in the vertical movement of said switch, and means for operating said switch to operate one of said relays through the medium of
100 said wiper and one of said contacts.

15. In a telephone system, a plurality of party lines, a connector switch having vertical and rotary movements for selecting a
105 wanted line, a plurality of sources of signaling currents of different character for signaling substations on said lines selectively, a relay for each source for extending the same to said connector, contacts for said relays arranged in a vertical row, a wiper
110 adapted to engage said contacts successively in the vertical movement of said switch, means for operating said switch to operate one of said relays through the medium of said wiper and one of said contacts, and
115 means for releasing said connector thereafter and for maintaining the selected relay energized, whereby upon further operation of said switch to select a wanted line the source selected by the operated relay may be
120 connected with the said line to signal a particular substation thereon.

16. In a telephone system, a plurality of party lines each having substation signals responsive to signaling currents of different
125 character, sources of signaling current of different character, a calling line, a connector switch accessible to said calling line for extending connections to said lines, said connector switch having line and test wipers
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and a progressively movable wiper, means in said connector for operating said wipers simultaneously; for selectively associating said sources with a called line in accordance with a called number, a trunk to an operator's position, and means associated with said connector for connecting the calling line with said trunk should the substation corresponding to the called number be disconnected, said first means including a magnet which is operated by two series of impulses during the same call for operating said progressively movable wiper.

17. In a telephone system, a plurality of party lines each having substation signals responsive to signaling currents of different character, sources of signaling current of different character, a calling line, a connector switch accessible to said calling line for extending connections to said lines, means in said connector for selectively associating said sources with a called line in accordance with a called number, a trunk to an operator's position, means associated with said connector for connecting the calling line with said trunk, and means for preventing connection with said trunk when the substation corresponding to the called number is in service.

18. In a telephone system, a party line and a plurality of substations in bridge thereof, each substation having a signal responsive to a particular character of ringing current, different sources of ringing current corresponding to said signals, a calling line, a connector switch for extending said calling line to said party line, line and test wipers and a progressively movable wiper for said connector switch, means in said connector for operating said wipers simultaneously for connecting a particular source of ringing current with said party line to signal a wanted substation, a trunk extending to an operator's position, and means associated with said connector for extending the calling line to said trunk should the wanted substation be disconnected from the line, said first means including a magnet which is operated by two series of impulses during the same call for operating said progressively movable wiper.

19. In a telephone system, a party line and a plurality of substations in bridge thereof, each substation having a signal responsive to a particular character of ringing current, different sources of ringing current corresponding to said signals, a calling line, a connector switch for extending said calling line to said party line, means in said connector for connecting a particular source of ringing current with said party line to signal a wanted substation, a trunk extending to an operator's position, means associated with said connector for extending the calling line to said trunk, and means re-

sponsive to the actuation of the signal at the called substation for preventing the operation of said second means.

20. In a telephone system, a party line and a plurality of substations in bridge thereof, each substation having a signal responsive to a particular character of ringing current, different sources of ringing current corresponding to said signals, a calling line, a connector switch for extending said calling line to said party line, means in said connector for connecting a particular source of ringing current with said party line to signal a wanted substation, a talking branch of said connector extending to an operator's position, means for closing said branch if the wanted substation is disconnected from said line, and means for preventing the closure of said branch if the wanted substation is connected to said line.

21. In a telephone system, a substation and a line therefor, a signal at said substation responsive to a particular character of ringing current, sources of ringing current of different character, a calling line, a connector switch for extending the said calling line to said first line and for connecting said sources thereto selectively, a trunk line extending to an operator's position, means for connecting the calling line thereto, and means for preventing such connection when the particular ringing current source corresponding to the substation on said line has been connected therewith.

22. In a telephone system, a substation and a line therefor, a signal at said substation responsive to a particular character of ringing current, sources of ringing current of different character, a calling line, a connector switch for extending the said calling line to said first line, and for connecting said sources thereto selectively, a talking branch of said connector extending to an operator's position, means for closing said branch after said lines have been connected, and means for preventing the closure of said branch should the particular source have been selected which is adapted to actuate said signal.

23. In a telephone system, a substation and a line therefor, a signal at said substation responsive to a particular character of ringing current, sources of ringing current of different character, a calling line, a connector switch for extending the said calling line to said first line and for connecting said sources thereto selectively, a normally disconnected talking branch of said connector extending to an operator's position, means for closing said branch, and means dependent upon the actuation of the signal at said substation for preventing the closure of said branch.

24. In a telephone system, a substation and a line therefor, a signal at said substa-

tion responsive to a particular character of ringing current, sources of ringing current of different character, a calling line, a connector switch for extending the calling line into connection with said first line, means in said connector for connecting a particular one of said sources with said first line to actuate said signal, a normally disconnected talking branch of said connector extending to an operator's position, a relay for closing said branch, means for preventing the operation of said relay during the signaling operation, and means actuated upon the response of the called subscriber for stopping the signaling operation and for preventing the operation of said relay thereafter.

25. In a telephone system, a plurality of substations and lines therefor, a signal in bridge of the line at each substation, said bridge insulated to direct currents, a connector switch for connecting a calling and a called one of said lines, a source of signaling current, a source of direct current, a branch extending from talking conductors of said connector to an operator's position, means for closing said branch, means in said connector for completing a signaling circuit including a called line and said sources all in series, a relay in said circuit for preventing the closure of said branch, said relay irresponsive to signaling current, and means at each substation for closing a direct current bridge across said line when the signal thereat is actuated, whereby said relay may be operated.

26. In a telephone system, a party line and a plurality of substations in bridge thereof, each substation having a signal responsive to a particular character of ringing current and each substation normally insulated to direct current flow over said line, different sources of ringing current corresponding to said signals, a connector switch for completing connection to said line, a normally disconnected branch extending from the talking conductors of said connector to an operator's position, a relay for closing said branch, means in said connector for selectively connecting said sources with said line to actuate said signals, a source of direct current and a second relay in series with said ringing current source when so connected, said second relay irresponsive to ringing currents, means controlled by said second relay for preventing the operation of said first relay, and means for closing a direct current bridge across said line when one of said signals is actuated to thereby operate said second relay.

27. In a telephone system, a plurality of lines, substation signals in bridge of certain of said lines, said bridges insulated to direct currents, a connector switch for completing connections to said lines, a source of signaling current and a source of direct cur-

rent, means in said connector for completing a signaling circuit, including a called line and said sources in series, a normally disconnected branch extending from talking conductors of said connector to an operator's position, means for closing said branch, a relay in said signaling circuit for preventing the closure of said branch, said relay irresponsive to signaling current, and means at each substation controlled by the signal thereat for closing a direct current bridge across its associated line to operate said relay, whereby the closure of said branch is made to depend upon whether or not the called line has a connected substation.

28. In a telephone system, a plurality of lines each having a substation in bridge thereof, a plurality of other lines without substations, a connector switch for completing connections to said lines, a normally disconnected branch extending from talking conductors of said connector to an operator's position, means for automatically closing said branch when connection is completed to a line without a substation, and means for preventing the closure of said branch when connection is completed to a line with a substation in bridge thereof.

29. In a telephone system, a plurality of substations and lines therefor extending to an exchange, a plurality of other lines without substations also terminating at said exchange, a connector switch accessible to a calling line of said first plurality for extending connection to any one of said first or second pluralities, a normally disconnected branch extending from talking conductors of said connector to an operator's position, means for closing said branch when connection is completed to a line of said second plurality, whereby the calling line is extended to the said operator's position, and means for preventing the closure of said branch when connection is completed to a line of said first plurality.

30. In a telephone system comprising party lines, a connector switch, a multiple terminal for each line in said switch, sources of signaling current of different character for calling substations on said line selectively, means for operating said connector in accordance with a digit of a called number to effect a selection of one of said sources and of a group of said lines, and means for nullifying the effect of such operation upon the line selection, whereby said connector may be operated thereafter in accordance with one or more other digits of the called number to select a called line.

31. In a telephone system comprising party lines, a connector switch, a multiple terminal for each line in said switch, sources of signaling current of different character for the calling substations on said lines se-

lectively, means for operating said connector in accordance with a digit of a called number to effect a selection of one of said sources and of one or more of said lines, and means for nullifying the effect of such operation upon the line selection, whereby said connector may be operated thereafter in accordance with a plurality of other digits of the called number to select a called line.

32. In a telephone system comprising party lines, a connector switch, a multiple terminal for each line in said switch, sources of signaling current of different character for calling substations on said lines selectively, means for operating said connector in accordance with a digit of a called number to effect a selection of one of said sources and of a group of said lines, means for nullifying the effect of such operation upon the line selection, whereby said connector may be operated thereafter in accordance with one or more other digits of the called number to select a called line, and means

for connecting a selected source with a selected line to signal a wanted substation thereon.

33. In a telephone system comprising party lines, a connector switch, a multiple terminal for each line in said switch, sources of signaling current of different character for calling substations on said lines selectively, means for operating said connector in accordance with a digit of a called number to effect a selection of one of said sources and of one or more of said lines, means for nullifying the effect of such operation upon the line selection, whereby said connector may be operated thereafter in accordance with a plurality of other digits of the called number to select a called line, and means for connecting a selected source with a selected line to signal a wanted substation thereon.

Signed by me at St. Paul, Ramsey county, State of Minn., this 1st day of March, 1916.

HARRY E. HERSHEY.