C. S. WINSTON.

AUTOMATIC TELEPHONE SYSTEM.

APPLICATION FILED DEC. 26, 1911.

1,290,822.

Patented Jan. 7, 1919.

3 SHEETS—SHEET 1.

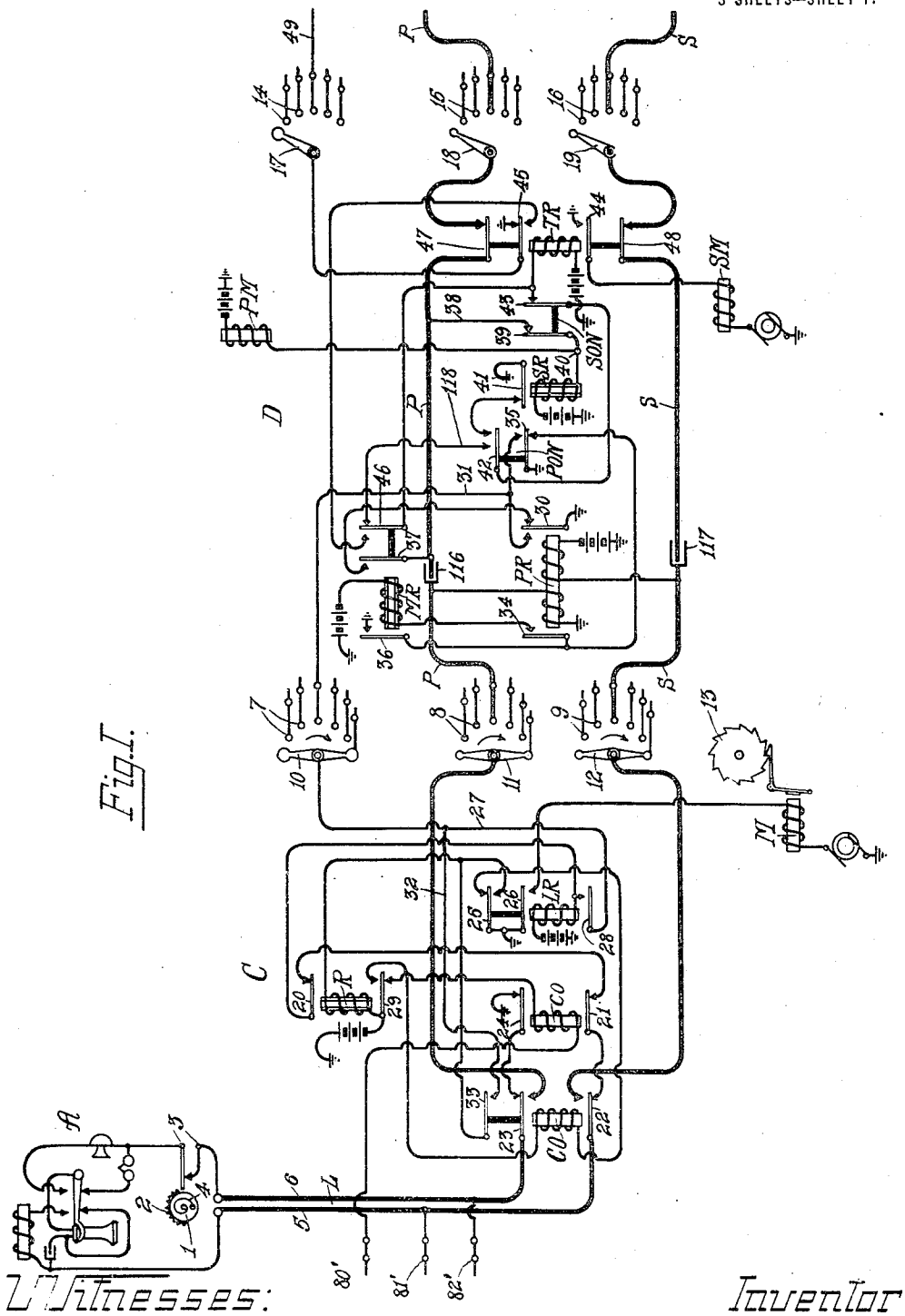

Fig. 1.

Witnesses:

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Inventor:

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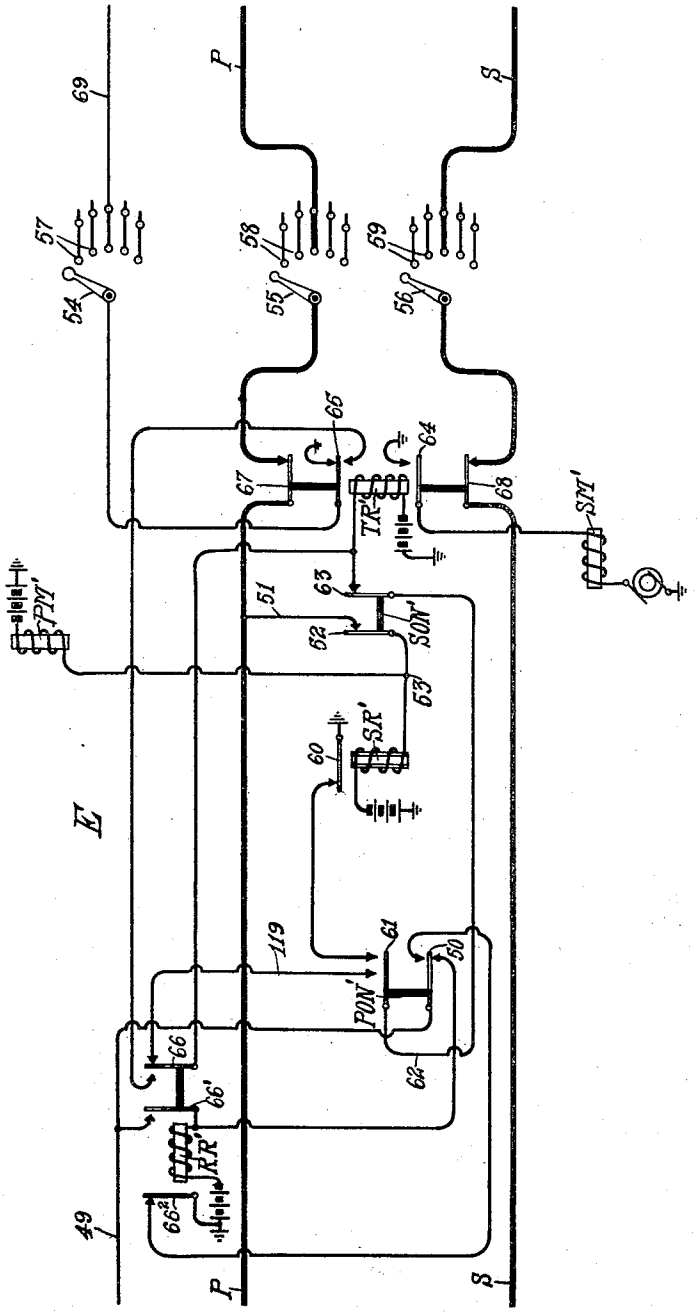

Fig. 2.

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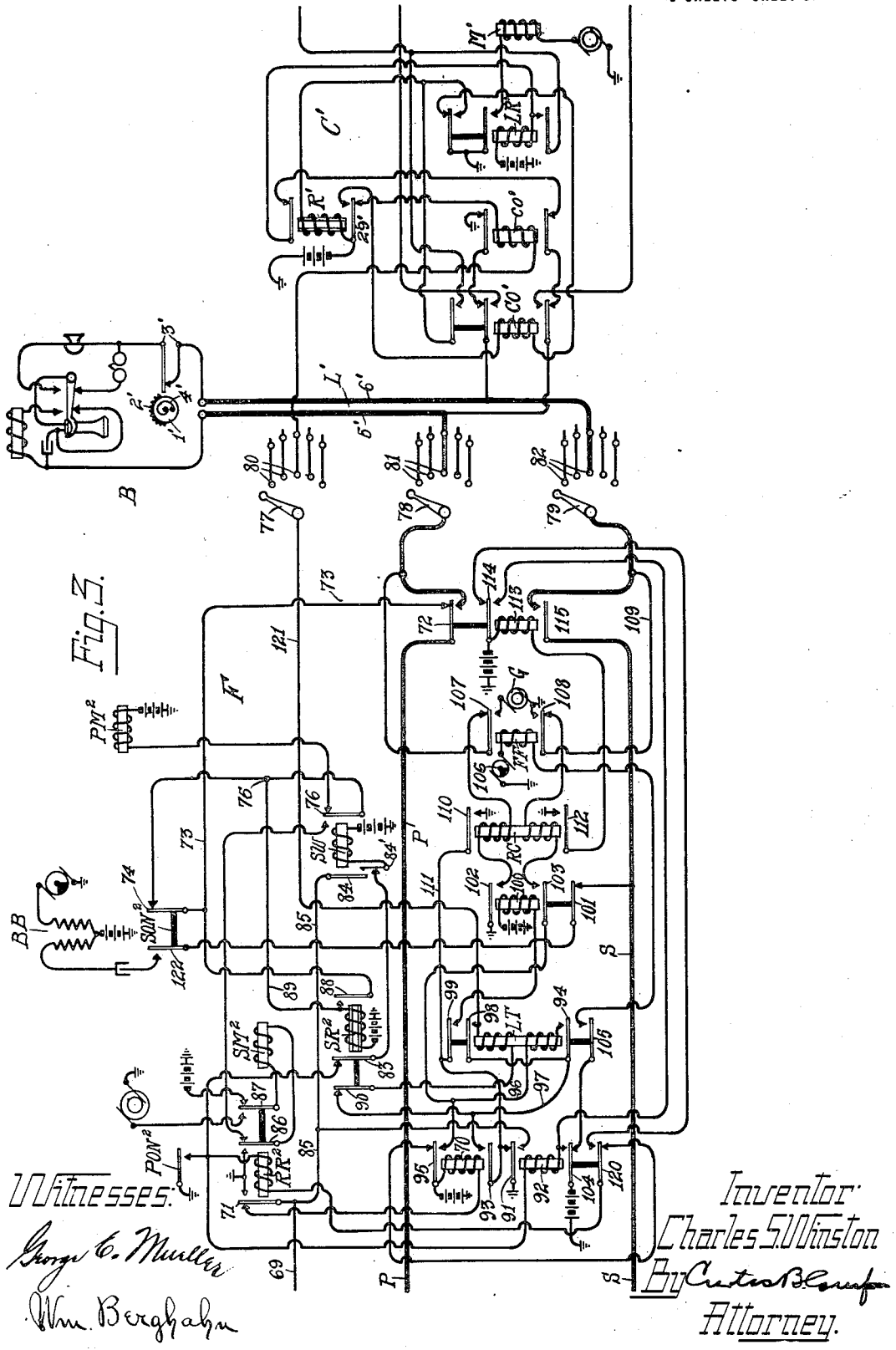

Fig. 3.

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UNITED STATES PATENT OFFICE.

CHARLES S. WINSTON, OF CHICAGO, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

AUTOMATIC TELEPHONE SYSTEM.

1,290,822. Specification of Letters Patent. Patented Jan. 7, 1919.

Application filed December 26, 1911. Serial No. 667,638.

To all whom it may concern:

Be it known that I, CHARLES S. WINSTON, a citizen of the United States of America, residing in 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 to telephone systems and more particularly to automatic telephone systems of the two wire or metallic line type in which the directively controlled switches such as the selector and connector switches are operated responsive to interruptions of the metallic circuit of the calling line. An object of my invention is to provide improved circuit arrangements of the selector switches and also an improved line switch, certain features and advantages thereof being pointed out in the specification and appended claims.

For a complete understanding of my invention, reference is to be made to the accompanying drawings which illustrate diagrammatically the apparatus used in establishing a connection from a calling to a called line and in which,

Figure 1 shows a calling line with its line switch and a first selector.

Fig. 2 which is to be placed to the right of Fig. 1 illustrates diagrammatically a second selector and

Fig. 3 which is to be placed to the right of Fig. 2 shows a connector switch, and a called line and part of its line switch circuit.

Generally speaking, in establishing a connection from calling substation A to called substation B, upon initiation of the call at substation A, its line switch C automatically selects an idle first selector D which together with second selector E and connector F are operated in turn by means of a calling device at substation A, to connect with terminals of the line of substation D whose call bell is automatically rung if the called line is idle, or if busy a characteristic busy signal is transmitted to the calling substation.

The system illustrated is adapted, by the use of hundred point selector and connectors to serve ten thousand lines. Each line, such as L, terminates at a substation A and at its central office end in a line switch such as C of which there would be of course ten thousand. Now on the usual basis of ten per cent. trunking, and with the line switch C a ten point switch, there are one thousand first selectors D, one thousand second selectors E and one thousand connectors F all grouped in a well known manner.

Substation A is a well known form of telephone comprising a receiver and switchhook normally bridged across the line, and a transmitter and impedance coil adapted to be connected in circuit when the receiver is removed. A calling device 1 is also provided for each substation comprising the toothed actuating member 2 and impulse springs 3, the teeth of member 2 and impulse spring 3 being so related that when the member 2 is rotated forwardly the contact of springs 3 is not interrupted, but upon releasing member 2 it is restored to normal by spring 4 whereby contact springs 3 are interrupted according to the number of teeth of member 2 which had been initially moved beyond the contact springs. Line L comprising conductors 5 and 6 extends from substation A to a line switch C at the central office.

The line switch C is preferably a ten point rotary switch comprising ten sets of contacts 7, 8 and 9 circularly disposed in a well known manner and having coöperating wipers 10, 11 and 12 respectively. Each wiper is preferably arranged with two oppositely extending arms, while the associated contacts are so disposed with relation to these arms that when the wiper is positioned as illustrated, one step thereof will cause the lower arm to leave the last contact of the bank as the upper arm engages the first contact of the bank. Wipers 10, 11 and 12 are secured to a single shaft also rigidly carrying a ratchet wheel 13 which is adapted to be actuated by the pawl mechanism controlled by motor magnet M. For each actuation of magnet M ratchet wheel 13 is stepped ahead one tooth thereby moving the wipers 10, 11 and 12 from one contact set to the next. In the selecting operation of switch C the wipers are advanced to an idle set of contacts and after conversation is completed they simply remain in connection with such contacts until another selecting operation of the switch.

Line switch C also includes a line relay LR which is adapted to be energized upon

initiation of a call to close a circuit through motor magnet M. A cut-off relay CO is also included in each switch being adapted to be energized when switch C connects with an idle first selector D, to extend the circuit of the calling line to the selected first selector. A second cut off relay *co* is also provided for each switch C being adapted to be operated only upon connection with the line L as a called line, the operation of *co* removing the substation control of its line switch C. A relatively slow acting relay R is also provided for each line switch C being adapted to be energized upon energization of its associated line relay LR to control certain operations as will be more particularly pointed out. As previously stated, line switch C is a ten point switch and has its contacts connected to ten first selectors D, and with the line switches C in groups of one hundred which is a well known form of grouping, each group has its contacts 7, 8 and 9 multiply connected so that there are ten first selectors D for each one hundred lines and line switches C.

Each line L is multiply connected to contacts 80′, 81′, 82′ of the ten connector switches having access thereto.

I have not illustrated the mechanical switch adapted for use with the selector and connector circuits, but I preferably employ such a switch as is disclosed in an application of William Kaisling for automatic switch for telephone systems, Serial No. 600,664. The switch referred to is what is known as a one hundred point switch comprising one hundred sets of bank contacts 14, 15 and 16 divided into ten groups of ten contact sets each. Each set of contacts includes three contacts, comprising two line contacts 15, 16 and a private or test contact 14. A set of wipers 17, 18 and 19 are adapted for coöperation with said contacts 14, 15 and 16 respectively. The ten groups of contacts 14, 15 and 16 are arranged in ten radially disposed rows, each row being arcuate in shape as illustrated in the drawing, and containing ten sets of contacts. The wipers 17, 18 and 19 are pivoted at a point central to the rows of contacts so that in the operation of the switch they are primarily adjusted in a rotary direction to select a row of contacts and then secondarily adjusted in a rotary direction to wipe over the contacts of the selected row.

For adjusting the wipers in a primary direction a primary magnet PM and associated ratchet and pawl mechanism are provided while for adjusting the wipers in a secondary direction a secondary magnet SM and associated ratchet mechanism are provided. Primary off normal springs PON are adapted to be moved to their alternate position upon the first primary step of the wipers while the secondary off normal springs SON are adapted to be moved to their alternate position upon the first secondary step of the wipers. For controlling the operation of the magnets a primary relay PR is connected in bridge of the primary and secondary strands P and S, this relay being energized upon connection made with its first selector switch, by current flowing over the calling line. Said relay PR being connected in bridge of the line as stated is responsive to any interruptions of its circuit effected at the substation of the line, by means of the calling device 1. A relatively slow relay SR, which will be referred to as a secondary relay as it controls the starting of the secondary movement of the switch, is provided as is also a main release relay MR which is adapted to control the release of the switch. The test relay TR is adapted to be energized after the primary movement of the switch and controls the secondary movement of the switch in selecting an idle set of contacts.

In the release of the first selector D, secondary magnet SM is again actuated to advance the wipers 17, 18 and 19 beyond the last contact in the selected group whereby a release pawl is actuated to allow the wipers to be restored by a spring, the restoring movement of the wipers taking a different path from their actuating movement. That is in restoring they return from their primary adjustment first and thereafter return from their secondary adjustment. From this it will be seen that in a complete operation of the switch, that is a selecting and releasing operation, the wipers are first moved in a horizontal plane, but in a rotary direction, to a certain row or group of contacts and thereafter moved in a vertical plane, but also in a rotary direction, to select a contact in the selected group. Then when being released, this secondary vertical movement is continued until the wiper passes the last contact in the selected row whereby a release pawl is withdrawn to allow the wiper to be restored by a spring, first backward in a rotary horizontal direction and thereafter downward in a rotary vertical direction, to normal.

Selector switch E comprises a switch structure similar to the switch structure of the first selector D including wipers and bank contacts, and primary and secondary off normal switches. Relays and operating magnets are also provided those having a function similar to corresponding relays of first selector D having similar reference characters but with the suffix prime added thereto.

Connector switch F comprises a switch structure similar to the switch used for the first and second selectors. The relays, operating magnets and off normal switches of connector switch F which are similar to the

corresponding parts of first selector D, have similar reference characters but with the suffix "2" added. Connector switch F also includes a line test relay LT which is adapted following the connection with the terminals of the called line, to cause ringing current to be applied through the medium of a flip flop relay FF to the terminals of the called line if idle, while if the called line is busy a characteristic busy signal from busy back apparatus BB is transmitted to the calling substation A. A ringing control relay RC is adapted upon response from the called substation to cause disconnection of the ringing current. A switching relay SW is arranged to disconnect the primary magnet PM^2 after it has been operated, and to connect secondary magnet SM^2 in circuit whereby it may be operated.

The called substation B is equipped similar to substation A and is connected by means of line L′ to the line switch C′ at the central office. Line L′ is also multiply connected to the bank terminals 80, 81, 82, of connector switches having access thereto.

Operation.

Having described in a general way the apparatus used in the system of my invention, a complete operation thereof in establishing a connection from calling substation A to called substation B will now be described, and we will assume that the number of called substation B is 2343.

To initiate a call the subscriber at substation A removes his receiver from its switch-hook whereby a circuit for line relay LR is established over a path traced from battery through the winding of relay LR, normal contacts 20, 21, 22, conductor 5, substation A, returning over conductor 6 and normal contacts 23, 24 to ground, energizing relay LR. A circuit for relay R is thereby established from ground through alternate contact 25, causing energization of relay R. Also responsive to energization of LR a circuit for motor magnet M is established from ground at alternate contact 26 through the winding of magnet M to the alternating current generator whereby magnet M attracts its armature and advances wipers 10, 11 and 12 into connection with the next set of contacts 7, 8 and 9 respectively. Assuming these contacts lead to a busy first selector D, test contact 7 has a busy or ground potential connected thereto, as will be described, and therefore a locking circuit for relay LR is established from the said ground through wiper 10, conductor 27, alternate contact 28 and the winding of relay LR to battery. Therefore the energizing circuit for magnet M being maintained it advances the wipers as long as wiper 10 is passing over grounded contacts 7 to maintain the relay LR energized.

Assuming that the first selector D illustrated is the first idle one reached, its test contact 7 being ungrounded or idle, relay LR deënergizes interrupting the circuit for magnet M whereby the wipers remain in connection with the contacts leading to said selector D. Although the opening of alternate contact 25 of relay LR interrupts the energizing circuit for said relay R, this relay being sluggish does not immediately restore its armature, but maintains it in an attracted position until a substitute energizing circuit is provided as will now be described. Upon deënergization of LR its normal contact 25 is again closed and an energizing circuit for the cut-off relay CO is established from said ground through the winding of relay CO to battery at alternate contact 29.

The energization of relay CO causes the closing of its alternate contacts 22, 23, whereby the line circuit is extended to first selector D, establishing an energizing circuit for the primary relay PR, traced from ground through the left hand winding of relay PR, primary conductor P, contact 8, wiper 11, alternate contact 23, conductor 6, substation A, conductor 5, alternate contact 22, wiper 12, contact 9, secondary conductor S and the right hand winding of relay PR to battery. The following energization of relay PR, causes the closing of its alternate contact 30 whereby a locking circuit for relay R of the switch C is established, traced from the said ground through alternate contact 30, conductor 31, contact 7, wiper 10, conductor 32, alternate contact 33 and winding of relay R to battery, maintaining the said relay energized. This ground connection from alternate contact 30 it will be noted also places a busy or ground potential upon the multipled test contacts 7 thereby preventing any other line switch from connecting with the selected first selector D. Also responsive to the energization of PR, a circuit for main release relay MR is established from battery through the winding of said relay MR, alternate contact 34 to ground at normal contact 35 of the primary off normal switch PON. Relay MR is thereupon energized and establishes an alternate energizing path for itself through its alternate contact 36, this being provided to take the place of the initial energizing circuit which will be interrupted upon the movement of primary off normal switch PON. It will thus be seen that substation A now is connected to first selector D and that relay PR is energized over a metallic circuit including the line conductors and calling substation A.

It will be remembered that the number assigned to the called substation B is 2343, therefore the first act of the calling subscriber to complete the connection is to oper-

ate calling device 1 to cause two interruptions of contacts 3 which results in two operations or deënergizations of relay PR. Although the operations of relay PR cause the interruption of the circuit of relay MR at contact 34, relay MR being a sluggish relay does not retract its armature until a continued deënergization of relay PR is affected as will be readily seen. The said operations of relay PR which are effected by the calling device as stated, cause two current impulses to be transmitted through the primary magnet PM and secondary relay SR over a path traced from ground at normal contact 30, alternate contact 37, conductor P, conductor 38, normal contact 39 to point 40 dividing and flowing through the windings of relay SR and magnet PM to battery. Relay SR being a sluggish relay is energized responsive to the first impulse and maintains its armature attracted until the cessation of the impulses, maintaining its normal contact 41 interrupted thereby. Two operations of magnet PM resulting from the two current impulses as described, effect two primary steps of wipers 17, 18 and 19 to the second row of contacts which are the contacts 14, 15, 16 illustrated and lead to second selectors E which are adapted to extend the connection to connectors in the two thousand group, in a well known manner.

After the said two impulses have been transmitted, secondary relay SR retracts its armature closing its normal contact 41, and as switch PON moved to its alternate position upon the first primary step of the wipers, a circuit for test relay TR is established from said ground at normal contact 41, alternate contact 42, normal contact 43 and the winding of relay TR to battery. Relay TR is thereupon energized closing its alternate contact 44 to establish an energizing circuit for secondary magnet SM whereby the wipers 17, 18 and 19 are stepped into engagement with the first set of contacts 14, 15 and 16 of the group responsive to a current impulse from the alternating current generator. Upon this first secondary step of the wipers, switch SON moves to its alternate position opening its contact 43 and interrupting the initial energizing circuit for relay TR, but assuming that the first set of contacts 14, 15 and 16 lead to a busy selector and test contact 14 is grounded as will be described, relay TR does not deenergize, as a substitute or maintaining circuit is established from said grounded contact 14, wiper 17, alternate contacts 45, 46, and the winding of relay TR to battery, thus maintaining the operating circuit for the secondary magnet SM. Therefore magnet SM is again operated to advance wipers 17, 18 and 19, and continues to do so until an idle set of contacts are reached whereby the circuit for relay TR is interrupted allowing it to deënergize and interrupt the circuit for magnet SM. Upon deënergization of relay TR, ground is connected to the multiple test contacts 14 from normal contact 45, thereby rendering the selected set of contacts 14, 15, 16, busy and preventing any other switch from connecting thereto. It will be noted that during the secondary movement of the wipers 17, 18 and 19 while they are wiping over bank contacts, the circuit of the line wipers 18 and 19 is interrupted at normal contacts 47, 48, thus preventing interference with any existing connections.

Referring now to second selector E, its release relay RR′ is energized upon connection made with said switch E, the energizing circuit being traced from the grounded test contact 14, conductor 49, normal contact 50 and the winding of relay RR′ to battery, causing its energization but with no effect at this time.

A locking circuit through alternate contact 66′ is also established to substitute for the initial circuit which is interrupted when PON′ is moved.

The calling subscriber now actuates calling device 1 to cause three interruptions of impulse springs 3, thereby effecting three operations of the primary relay PR. Three impulses of current are therefore transmitted through primary magnet PM′ and secondary relay SR′ at second selector E, the circuit thereof being traced from ground at normal contact 30 of relay PR, alternate contact 37, normal contact 47, wiper 18, contact 15, conductor P, conductor 51, normal contact 52, to connection 53 dividing at this point part of the current flowing through primary magnet and PM′ and part through secondary relay SR′. Secondary relay SR′ is energized responsive to the first impulse, and being a sluggish relay retains its armature attracted until the cessation of the impulses. Primary magnet PM′ responsive to the three impulses of current effects three primary steps of wipers 54, 55 and 56 to the third row of contacts which include contacts 57, 58 and 59, these contacts leading to connector switches in the third hundred sub group of the second thousand group of lines.

Upon cessation of the said three impulses, secondary relay SR′ retracts its armature thereby closing a circuit through test relay TR′, traced from ground at normal contact 60, alternate contact 61 of switch PON′ which moved to its alternate position upon the first primary step of the wipers, conductor 62, normal contact 63, the winding of relay TR′ to battery, causing its energization. The circuit for secondary magnet SM′ is thereby closed from ground through alternate contact 64 and the winding of magnet SM′ to alternating current gener-

ator, the first current impulse from said generator causing magnet SM′ to step wipers 54, 55 and 56 in a secondary direction to engage the first set of contacts 57, 58 and 59 respectively of the selected group. Upon the first secondary step of the wipers as stated switch SON′ moves to its alternate position thereby interrupting the initial energizing circuit for relay TR′ at contact 63, but assuming that the first set of contacts 57, 58 and 59 lead to a busy connector, their test contact 57 is grounded or busy and a maintaining circuit for relay TR′ is therefore provided, traced from said grounded contact 57, wiper 54, alternate contacts 65, 66, the winding of relay TR′ to battery. Therefore magnet SM′ advances wipers 54, 55 and 56 another step and in fact continues to do so until an idle set of contacts 57, 58 and 59 are reached. The test contact 57 of an idle set of contacts is not grounded and therefore as soon as the test wiper 54 reaches such an idle contact which we will assume is the test contact leading to the connector switch F illustrated, the maintaining circuit for relay TR′ is interrupted thereby causing its deënergization and the interruption of the circuit for magnet SM′, whereby wipers 54, 55 and 56 are rendered inert.

It will be noted that during the secondary movement of the wipers 54, 55 and 56, line wipers 55, 56 have their circuit interrupted at contacts 67, 68 of relay TR′ so that they will not interfere with any existing connections, but upon deënergization of relay TR′ contacts 67, 68 are closed and also normal contact 65, whereby ground is connected to wiper 54 and the multiple test contacts 57 thereby placing a busy potential upon these contacts and preventing any other second selector from making connection with the selected connector switch.

Referring now to connector switch F, upon connection therewith by second selector E and the grounding of test conductor 69, relay 70 of switch F is energized by current flowing from battery through the winding of relay 70, normal contact 71 to grounded conductor 69. Although relay 17 is energized upon connection made with switch F it has no effect upon switch F at this time.

The subscriber at substation A actuates calling device 1 for the third time, causing four interruptions of impulse springs 3 and thereby effecting four operations of primary relay PR. Four impulses of current are therefore transmitted through primary magnet PM^2 and secondary relay SR^2 of connector switch F, the circuit thereof being traced from ground at normal contact 30 over the previously described path to conductor P of switch E, normal contact 67, wiper 55, contact 58 continuing along conductor P to normal contact 72, conductor 73, normal contact 74 to connection 75, dividing at this point part of the current flowing through secondary relay SR^2 and part through normal contact 76 and magnet PM^2. Responsive to the first impulse of current relay SR^2 is energized and being a sluggish relay maintains its armature attracted until the cessation of the four impulses. The four impulses of current flowing through magnet PM^2 causes four operations of the said primary magnet and effecting four primary steps of wipers 77, 78 and 79 to the fourth row of contacts which includes contacts 80, 81 and 82, this row of contacts including the terminals of the line of the called substation B. Following the cessation of said four impulses, secondary relay SR^2 deënergized closing a path for current through switching relay SW, being traced from battery through the winding of said relay SW, normal contacts 84′, 83 and contact PON^2 (which closed upon the first primary step of the switch) to ground whereby said relay SW is energized and a locking for itself established through its alternate contact 84, conductor 85 to the grounded test conductor 69. The operation of relay SW disconnects the primary magnet PM^2 and connects secondary magnet SM^2 in circuit with conductor P to take the next set of impulses.

The calling subscriber now actuates calling device 1 to effect three interruptions of impulse springs 3, thereby causing three operations of primary relay PR. Responsive to these three operations, three impulses of current are transmitted through secondary relay SR^2 and secondary magnet SM^2, traced from ground at normal contact 30 of relay PR over the previously described path along conductor P to normal contact 72, conductor 73, normal contact 74, connection 75, dividing at this point and part of the current flowing through relay SR^2 and part through alternate contact 76, normal contact 86, magnet SM^2 and normal contact 87 to battery. It will be noted that relay SR^2 is energized upon the first impulse, closing its alternate contact 88 so that the following impulses flow through this alternate contact 88, as upon the first secondary step of the switch, contacts SON^2 are moved to their alternate position thereby interrupting the initial path for the current impulses through normal contact 74. Also due to the interruption of normal contact 74 responsive to the first impulse, a new path for the impulses flowing through magnet SM^2 is provided, being from conductor 73 through alternate contact 88, conductor 89, connection 75, alternate contact 76, then over a previously traced path through magnet SM^2.

The result of these three impulses of current is that magnet SM^2 steps wipers 77, 78 and 79 into engagement with the third set of

contacts 80, 81, 82 respectively of the row, which are the terminals of the line of called substation B, relay SR^2 of course being maintained energized by these three impulses. Following the last impulse, relay SR^2 deënergizes closing its normal contact 90, thereby connecting the upper winding of line test relay LT to the test terminal 80 of the called line for the purpose of testing said line for its idle or busy condition.

Called line idle.

Up to this period in the operation of the system, the operation is the same whether connecting to an idle or busy line. Assuming now that the called line is idle a path for current through the upper winding of relay LT is provided by the closing of said normal contact 90, being traced from ground at normal contact 91 of relay 92, alternate contact 93, normal contact 90, the upper winding of relay LT, conductor 121, test wiper 77, contact 80 and the winding of cut-off relay *co'* to battery at normal contact 29', resulting in the energization of both relays LT and *co'*. The energization of relay *co'* removes the substation control of line switch C', while upon energization of relay LT a locking circuit for itself is established through its alternate contact 94, traced from battery at the alternate contact 95 of relay 70, conductor 96, the lower winding of LT, alternate contact 94, conductor 97, alternate contact 93, normal contact 91 to ground. The closing of alternate contact 98 of relay LT shunts its upper winding, and places a direct ground from conductor 97 through alternate contact 98, conductor 121, to test wiper 77, maintaining relay *co'* energized and also preventing any other connector switch from establishing connection with the terminals of line L'.

The closing of alternate contact 99 of relay LT establishes an energizing circuit for relay 100 traced from ground at normal contact 91, alternate contact 99 and the winding of relay 100 to battery, causing its energization whereby its contact 101 is interrupted disconnecting busy back apparatus BB from secondary conductor S. The closing of contacts 102, 103 of relay 100, connects battery and ground to the terminals of ringing control relay RC.

The called line being idle as stated, the means for applying ringing current to the terminals thereof will now be described. Also upon energization of relay LT a circuit for flip flop relay FF is established from battery at the normal contact 104 of relay 92, alternate contact 105, and the winding of relay FF to the grounded interrupter 106, resulting in a periodic energization and deenergization of relay FF. Upon each closing of alternate contacts 107, 108 of relay FF, ringing generator G is connected in bridge of the called line L' whereby the call bell at substation B is operated, the operating current flowing over a path traced from ungrounded terminal of generator G, alternate contact 107, wiper 78, contact 81, conductor 5', condenser and call bell of substation B and returning over conductor 6', contact 82, wiper 79, conductor 109 and alternate contact 108 to ground. Now upon each deënergization of relay FF the windings of relay RC are connected in bridge of the terminals of line L', but as long as the receiver is on the switch-hook at substation B direct current can not flow through the windings of said relay RC due to the condenser at substation B, but upon response from the subscriber thereat who removes the receiver from its switch-hook, and upon the following deënergization of FF, a path for direct current through the windings of relay RC is established traced from ground at alternate contact 102, the upper winding of RC, normal contact 107, wiper 78, contact 81 over the previously described path including the line conductors and substation B back to normal contact 108 of relay FF, the lower winding of relay RC, alternate contact 103 to battery at alternate contact 95. Responsive to this circuit relay RC is energized closing its contact 110 thereby connecting ground to conductor 111 as a substitute for the ground connection at normal contact 91, which is interrupted as will be described. Also responsive to the energization of RC, its alternate contact 112 is closed, thereby establishing an energizing circuit for relay 113 which now attracts its armature whereby its alternate contact 114 is closed establishing an energizing circuit for relay 92 traced from battery through said alternate contact 114, the winding of relay 92 to ground at closed contact PON^2. Relay 92 is therefore energized interrupting its normal contact 104, thereby rendering relay FF inert, and due to the closing of its alternate contact 104 a locking circuit for itself is established whereby it remains energized until primary off normal contact PON^2 is restored. The closing of alternate contacts 72, 115 of relay 113 establishes the continuity of a talking circuit between the substations A and B being traced over the heavily marked conductors and having the condensers 116, 117 interposed at first selector D. Talking current for the called substation B is provided through the windings of relay RC, while talking current for the calling substation A is provided through the windings of primary relay PR, over the previously described paths.

Release.

After the subscribers have finished conversation they may cause restoration of the switches used in establishing the connection,

the subscriber at substation A controlling the release of switches C, D and E while the subscriber at substation B controls the release of connector F.

Assuming that the subscriber at A is the first to restore his receiver to its switch-hook, the circuit for relay PR is interrupted, causing its restoration, the interruption of its alternate contact 34 allowing the deënergization of main release relay MR. The deenergization of relay MR establishes a circuit for relay TR effecting the restoration of the switch in the following manner.

The circuit for relay TR established by the deënergization of relay MR is traced from ground at normal contact 41 of relay SR, alternate contact 42 to conductor 118, normal contact 46, the winding of relay TR to battery. Following the energization of relay TR, a circuit for secondary magnet SM is established by the closing of alternate contact 44, whereby wipers 17, 18 and 19 are stepped ahead by the operation of magnet SM until they have passed one step beyond the last contact set in the row. Upon reaching this position a release pawl is automatically tripped whereby the wipers restore from their primary adjustment by a spring, whereby switch PON is restored interrupting its alternate contact 35 to effect the restoration of switch C as will be described. Upon the wipers being restored from their primary adjustment, a second pawl is tripped whereby they are restored by a spring from their secondary adjustment reaching normal and causing the restoration of switch SON. It will be noted that while wipers 17, 18 and 19 are being advanced in their restoring movement, the line wipers have their circuit interrupted at normal contacts 47, 48, thus preventing interference with any existing connections. Further it will be remembered that as the wipers restore from their primary adjustment switch PON restores, opening its alternate contacts 42 and interrupting the circuit for relay TR which restores.

It will be noted that the initial energizing circuit for release relay MR is traced from ground at normal contact 35 of switch PON. But upon energization of MR and after the switch D has moved off normal, relay MR is maintained energized from its grounded alternate contact 36 during the operations of relay PR as before stated. Thus when relay PR is deënergized by restoration of the receiver to cause release of switch D, its contact 34 is interrupted allowing restoration of MR which in turn causes a restoring operation of the secondary magnet SM. Now while magnet SM is restoring the wipers 17, 18, 19, should the subscriber at A again remove his receiver, relay PR will again be energized, but as primary off normal switch PON is in its alternate position it will be seen that MR after once deënergizing can not be energized again by the operation of PR until switch PON is moved to its normal position. In a previously filed application of mine, Serial No. 610,652, it is possible to cause such a reënergization of the release relay as just referred to, which stops the release movement of the switch. It is apparent, that in the present application if such a reënergization of relay MR were possible during the step-ahead release movement of the wipers, that the circuit of relay TR would be interrupted at normal contact 46 and its winding would be connected through alternate contact 46 and alternate contact 45 to test wiper 17, whereby relay TR would continue energized until an idle second selector were seized. To this end I have worked out my present invention to prevent any such interference with the release operation of the switch, preferably in the manner disclosed.

Now as soon as normal contact 35 of switch PON is interrupted as stated, the locking circuit for relay R of line switch C is interrupted, as it will be remembered that relay R has been maintained energized by current flowing over the test conductor to this grounded alternate contact 35. Therefore relay R restores opening its alternate contact 29, thus interrupting the circuit for relay CO which is deënergized and switch C is again available for use in establishing other connections.

Now as to the restoration of second selector E. This is effected when relay TR of first selector D was energized in releasing as previously described. Upon the said energization of TR its normal contact 45 is interrupted, thereby interrupting the circuit for release relay RR′ of second selector E which restores to normal, closing a circuit for TR′ traced from ground at normal contact 60 of relay SR′, alternate contact 61 to conductor 119, normal contact 66 and the winding of relay TR′ to battery. The ensuing energization of relay TR′ effects the closing of alternate contact 64 whereby a circuit for secondary magnet SM′ is established and said magnet steps wipers 54, 55 and 56 beyond the last contact in the bank whereby they are automatically restored similar to the restoration of the wipers of the first selector D as described. It will be noted that upon deënergization of relay RR′ its normal contact 66^2 closes and connects ground to test conductor 49 thus holding switch E busy during its release. Upon the restoration of switch PON′, its alternate contacts 61 are interrupted, whereby the circuit for relay TR′ is interrupted, causing its restoration and interruption of the circuit of magnet SM′.

To release connector switch F, the subscriber at substation B restores his receiver

whereby the circuit for ringing control relay RC is interrupted, causing its deënergization. Its contact 110 is therefore interrupted, disconnecting ground from the conductor 111 thereby interrupting the circuits for relays 100, LT and *co'*, causing their restoration, the restoration of cut-off relay *co'* restoring the substation control of line switch C'. Also upon deënergization of relay RC its alternate contact 112 is interrupted allowing the restoration of relay 113, whereby a circuit for release relay RR^2 is established, from battery at normal contact 114 of relay 113, alternate contact 120, the winding of relay RR^2 to ground at PON^2. Upon energization of said relay RR^2 its normal contact 71 is interrupted allowing 70 to restore, while the closing of its alternate contacts 86, 87, establishes a circuit for secondary magnet SM^2 from grounded alternate contact 86, the winding of magnet SM^2, alternate contact 87 to the alternating current generator, whereby magnet SM^2 is operated by current impulses from said generator to advance wipers 77, 78 and 79 beyond the last contact in the row whereby they are automatically restored by spring tension as in the case of the first, and second selectors. Upon restoration of primary off normal switch PON^2 the circuits for relays 92, RR^2 and SW are interrupted causing their restoration. Switch F now being at normal is available for use in establishing other connections.

Called line busy.

Assuming now that the called line is busy, the operation of the system will proceed as previously described up to the final deënergization of the secondary relay SR^2 of connector F. It will be remembered that at the final deënergization of relay SR^2 after the wipers have connected with the terminals of line L', relays SW and 70 are in an energized condition. Therefore upon said deënergization of relay SR^2 the upper winding of relay LT is connected in circuit with the test wiper 77 and test contact 80 of the called line as before.

Assuming that line L' is busy as a calling line, its test contacts 80 are on open circuit, as relay R' is energized. Now if line L' is busy as a called line its test contacts are connected to ground back over the test conductor 121 as previously described. Therefore when the upper winding of relay LT is connected in circuit with the test contacts 80, there will be no energizing circuit for the said winding, as its left hand terminal is connected to ground at normal contact 91 as previously described, and there will be no flow of battery, so relay LT does not energize.

Due to the failure of relay LT to attract its armature, neither relays 100 or FF are energized so that busy back BB remains in connection with the secondary conductor S through alternate contacts 122 and normal contact 101. Therefore a characteristic busy signal is transmitted to the calling substation traced from busy back BB through the said contacts 122, 101, to heavily marked secondary conductor S, back over the said conductor and out over the limb 5 of the line through the receiver of the substation, returning over limb 6 and along the heavily marked primary conductor P through the left hand winding of relay PR of first selector D to ground. The subscriber upon placing his receiver to his ear receives this signal and therefore replaces his receiver upon its switch-hook, causing the restoration of the apparatus used in establishing the connection in the following manner.

Due to the replacing of the receiver at substation A the circuit for relay PR is interrupted causing its deënergization followed by the deënergization of main release relay MR, thereby effecting the restoration of switch D, followed by the restoration of switch C as previously described. The second selector E is also restored upon restoration of first selector D, due to the interruption of the locking circuit of relay RR', which effects said restoration of switch E as previously described. It will be remembered in the previously described connection that connector F was restored by the subscriber at the called substation B, but in this instance its restoration is controlled by the calling subscriber. It will be remembered that relays 70 and SW are the only relays energized at switch F in this instance, being locked up over a circuit including test conductor 69 and the grounded normal contact 65 of relay TR' at selector E. Therefore, upon energization of relay TR' in the restoration of switch E as described, its normal contact 65 being interrupted relays 70 and SW are deënergized. Following the deënergization of relay 70 a circuit for release relay RR^2 is established from ground at alternate contact PON^2, the winding of said relay RR^2, normal contacts 120 and 95 to battery. Relay RR^2 therefore closes its contact 71, connecting ground to its test conductor 69 and contacts 57, preventing any other switch from making connection with connector F during its release. Although relay SW deënergized as just stated at the time its energizing circuit was interrupted at relay TR', it immediately energizes again upon the closing of its normal contact 84' due to the ground connection from PON^2, and is again locked up through its alternate contact 84 to ground at alternate contact 71, remaining so until the restoration of PON^2.

Returning now to relay RR^2, the closing of its alternate contacts 86, 87, causes the releasing operation of magnet SM^2 as pre-

viously described, whereby switch F is restored to normal, causing the restoration of primary off normal contact PON² and relays RR² and SW, switch F now being at normal and available for use in establishing other connections.

The circuits of my invention are so arranged that should a calling subscriber initiate a call and then not complete the connection to the called substation, or replace his receiver before a response has been secured from the called substation, all of the apparatus used and operated in such an incompleted connection is restored by the action of the calling subscriber replacing his receiver upon its switch-hook.

Should the calling subscriber simply remove his receiver from its switch-hook and after a short interval replaced it, the following occurs. Line switch C is first operated to select an idle first selector D whose primary relay PR and release relay MR are energized as previously described, while relays R and CO are also energized. The replacing of the receiver, as stated, therefore interrupts the circuits of relay PR which retracts its armature opening the circuit for relay MR which momentarily holds its armature attracted after its circuit is interrupted. Due to the deënergization of relay PR previous to restoration of MR, an impulse of current is transmitted through primary magnet PM and secondary relay SR from ground at normal contact 30 over the previously described path, magnet PM thereby stepping wipers 17, 18, 19, to the first row of bank contacts, causing the closure of primary off normal contact 35, and maintaining relays R and CO of switch C energized for the present. As soon as relay MR retracts its armature, the circuit for magnets PM and SR is interrupted, due to opening of alternate contact 37, causing them to restore, the restoration of SR thereby closing a release circuit from normal contact 41 over the previously described path through the winding of relay TR to battery, causing its energization whereby a circuit is closed through alternate contact 44 and magnet SM. Magnet SM therefore steps the wipers 17, 18, 19, beyond the last contact of the first row whereby the release pawls are automatically actuated to allow said wipers to be restored by spring tension as previously described. Upon restoration of switch PON, its alternate contact 35 is interrupted, thereby interrupting circuit for relay R at C, causing its restoration followed by the restoration of cut-off relay CO, and thus switch C is at normal as is also first selector D. From this it will be seen that when a subscriber simply takes off his receiver and restores it, an idle first selector is selected and caused to operate and restore to normal, as is also the operated line switch.

Should the calling subscriber in initiating a call remove his receiver and thereafter operate his dial a single time to cause switch D to select an idle second selector E, and then restore his receiver to its switch-hook, relay PR is restored as before, causing the restoration of switches D and C as previously described in connection with the release of a completed connection.

Now in the present case, relay PR deënergizing before MR as before, connects ground momentarily from normal contact 30 to conductor P and secondary relay SR′ and primary magnet PM′ of second selector E, causing their energization. Magnet PM′ therefore steps wipers 54, 55 and 56 a single step and thereafter secondary relay SR′ deënergizes closing its normal contact 60, and as relay RR′ deënergized when its circuit was interrupted by the releasing energization of relay TR at switch D, this closing of normal contact 60 effects the energization of relay TR′ as previously described, which closes a circuit through magnet SM′, causing a releasing operation of switch E similar to that of first selector D last described.

Assuming now that the subscriber at A removes his receiver and thereafter operates his calling device two times, thus operating first selector D and second selector E, and thereafter replaces his receiver, this will cause the release of switches C, D and E as described in the completed connection. In this instance though, ground is momentarily connected to the primary conductor P from normal contact 30 of relay SR as before, but extending to primary magnet PM² and secondary relay SR² of connector F, causing their energization. Upon cessation of this momentary ground connection, and after switch E is restored, magnet PM² and relay SR² deënergize as does also relay 70 which, it will be remembered, was energized when the switch F was selected by ground over the test conductor 69. Now upon the release of relay 70, its normal contact 95 is closed, and as contacts PON² were closed when magnet PM² was operated, relay RR² is energized closing its alternate contacts 86, 87, thereby establishing a circuit for magnet SM² which steps the wipers 77, 78 and 79 beyond the last contact in the bank where they are restored by spring tension as previously described. The opening of contact PON² causes the restoration of relay RR², thus interrupting the circuit for magnet SM².

Should the calling subscriber extend connection to the called substation B and replace his receiver upon its switch-hook at A before the subscriber at B has responded, all of the switches will be restored. The restoration of switches C, D and E are brought about as previously described, but in this instance it will be remembered that

connector switch F is to be restored and that its relays SR², SW, 70, LT and 100 are energized.

Therefore, upon release of second selector E and the consequent disconnection of the ground from test conductor 69, relay 70 of switch F deënergizes, closing a circuit for RR² which, in turn operates and causes a releasing operation of magnet SM². The deënergization of relay 70 also disconnects ground and battery by the opening of alternate contacts 93 and 95, from relays 100 and LT respectively, causing their deënergization, while relay SW is deënergized when its locking circuit is interrupted at alternate contact 71 of relay RR² upon its deenergization when the switch is restored.

While I have illustrated and described a specific form of my invention, it is to be understood that many changes and modifications thereof may be made and I do not desire to be limited to the exact structure as disclosed, but aim to cover all such changes and modifications as come within the spirit and scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A selector switch comprising a primary relay, a relatively slow release relay, an initial energizing circuit for said release relay adapted to be closed upon an energization of the primary relay, and a substitute energizing circuit for said release relay including normally open contacts of said primary and release relays.

2. A selector switch comprising a primary relay, a relatively slow release relay, an initial energizing circuit for said release relay including off normal contacts and adapted to be closed upon an energization of the primary relay, a substitute energizing circuit for said release relay adapted to be closed while both said relays are energized through alternate contacts thereof, and means for operating said switch upon a subsequent operation of said primary relay, whereby the initial energizing circuit for the release relay is interrupted by said off-normal contacts.

3. A step-ahead-release selector switch comprising a primary relay, a release relay energized responsive to energization of said primary relay, means for energizing and thereafter operating said primary relay to cause operation of the switch, means for deenergizing said release relay responsive to a prolonged deënergization of said primary relay, to cause the release of said switch, and means to prevent a reënergization of said release relay responsive to a reënergization of the primary relay previous to restoration of the switch.

4. A telephone system comprising a step-ahead-release selector switch, a primary relay, a calling substation connected thereto, means for energizing said relay by current over the calling line and substation, a relatively slow release relay energized responsive to the energization of said primary relay and adapted to maintain its armature attracted during the operations of said primary relay to operate said switch, means for causing a prolonged deënergization of said primary relay by the restoration of the receiver at the calling substation whereby said release relay causes a step-ahead-release of said switch, and means to prevent a reenergization of said release relay during such step-ahead-release operation.

5. A telephone system comprising a selector switch, a calling line and substation connected thereto, a primary relay energized by current over said line and station, a relatively slow release relay for said selector, means for energizing said release relay responsive to the initial energization of said primary relay, a calling device for rapidly interrupting the circuit of said primary relay to cause operation of said selector, means for causing a prolonged deënergization of said primary relay whereby said release relay is restored to cause a restoring movement of said selector, means controlled at the calling substation for reënergizing said primary relay, and means to prevent a reenergization of the release relay responsive to such reënergization of the primary relay during said restoring movement of the selector.

6. A telephone system comprising a selector switch, a primary relay, a calling line and substation connected to said relay, means for energizing said relay by current over the calling line and substation, a relatively slow release relay operated responsive to said energization of the primary relay, means for causing relatively short periodic deënergizations of said primary relay to cause operation of said selector switch, said release relay having its energizing circuit interrupted responsive to such periodic operations but maintaining its armature attracted, means for causing a prolonged deënergization of said primary relay whereby said release relay retracts its armature, means for releasing said switch responsive to such deënergization of the release relay, and means to prevent a reënergization of said release relay responsive to a reënergization of the primary relay until said release means have operated.

7. A telephone system including a line switch having contacts and coöperating wipers, trunk lines leading from said contacts, a calling telephone line, means controlled over the two sides of said line in series for operating said wipers to select an idle one of said trunk lines upon initiation of a call over said line, a cut-off relay and a release relay, energizing circuits for said relays effective upon said connection made to

the trunk line, and means controlled at the calling telephone to cause restoration of said release and cut-off relays only, whereby said line switch is then at normal.

8. A telephone system including a line switch having contacts and coöperating wipers, trunk lines leading from said contacts, a calling telephone line, a line relay energized responsive to initiation of a call over said line, means responsive to said line relay for operating said wipers to select an idle one of said trunk lines, means for deenergizing said line relay upon such selection, a release relay energized responsive to the initial energization of the line relay, a cut-off relay operated responsive to deënergization of the line relay, and means controlled at the calling telephone for restoring said release and cut-off relays only, whereby said line switch is then at normal.

9. A telephone system including a line switch having contacts and coöperating wipers, trunk lines leading from said contacts, a calling telephone line, a line relay energized responsive to initiation of a call over said line, step by step mechanism responsive to said line relay for operating said wipers to select an idle one of said trunk lines, a release relay also energized responsive to the line relay, a cut-off relay, means for deënergizing said line relay upon said selection and energizing said cut-off relay, and means controlled by the calling subscriber to deënergize said release and cut-off relays only, whereby said switch is then at normal.

10. A telephone system comprising a line switch and telephone line connected thereto, contacts and coöperating wipers for said line switch, means effective upon initiation of a call over said line to advance said wipers to select a set of said contacts, a release relay and means for energizing it upon initiation of a call, a cut-off relay, a maintaining circuit for said release relay and an energizing circuit for said cut-off relay effective responsive to such selection, whereby said relays are placed under the control of the calling line, whereby they may be restored by the calling subscriber opening his line circuit and said wipers rendered inert until another call is initiated.

11. A non-restoring wiper line switch for telephone systems including only contacts and coöperating wipers, motor mechanism including a step-by-step-driving magnet individual to said line switch for rotating said wipers, simple relays including a slow-acting single wound release relay, each of said relays having individually controlled contacts, circuit connections controlled by the contacts of said relays for operating said motor mechanism and wipers, a holding circuit for said slow acting single wound release relay adapted to be held closed while said switch is in use, and means for opening said holding circuit thereby restoring said switch.

12. A non-restoring wiper line switch for telephone systems comprising only contacts and coöperating wipers, motor mechanism including a step-by-step motor magnet individual to said line circuit for operating said wipers, simple relays including a single wound slow-acting release relay and a line relay, each of said relays having individually controlled contacts, circuit connections controlled by said line relay for operating said motor mechanism and wipers to select a set of contacts, a holding circuit for said single wound slow-acting relay adapted to be maintained closed while said switch is in use, and means for opening said holding circuit thereby restoring said switch by a conjoint operation of said relays.

13. A telephone system including a calling telephone line, a line switch therefor having contacts and coöperating wipers, a line relay energizable over the two sides of said calling telephone line in series, motor mechanism controlled by said line relay for operating said wipers to select a set of contacts, simple relays including a single wound release relay, each relay being provided with individually controlled contacts, a holding circuit for said release relay adapted to be held closed while said switch is in use, and substation controlled means for opening said holding circuit to render said switch available for another selecting operation without moving said wipers.

14. A telephone exchange system including a telephone line and an associated automatic line switch for extending the circuit of said line, said switch including only passive and active contacts, an individual driving magnet and connected mechanism for operating said active contacts, simple relays including a single wound release relay, each of said simple relays including individually controlled contacts and suitable electrical connections controllable over the two sides of the connected line in series for operating said switch to select a set of contacts for closing a maintaining circuit for said single wound release relay and for thereafter opening said maintaining circuit, thereby rendering said switch available for another selecting operation without moving the active contacts.

15. A non-numerical, non-restoring wiper line switch for telephone systems including bank contacts and coöperating wipers, electromagnetically controlled motor mechanism including a step-by-step motor magnet individual to said switch for rotating said wipers, simple relays including a cut-off relay and a release relay, each provided with only individually controlled contacts, circuit connections controlled by said relays for oper-

ating said motor mechanism and wipers to select a set of said bank contacts and to close a holding circuit for said cut-off and release relay, and means for restoring said cut-off and release relay, thereby restoring said switch without altering its antecedent progressive position.

16. A telephone system including a calling telephone line, a line switch individual thereto provided with bank contacts and cooperating wipers, motor mechanism individual to said switch for operating said wipers, simple electromagnets including a cut-off magnet and a release magnet, each of said simple electromagnets being provided with only individually controlled contacts, circuit connections controlled by said electromagnets for operating said motor mechanism and wipers to select a set of said bank contacts and to close a maintaining circuit for said cut-off and release magnets, and means controlled over the two sides of said calling line in series for opening said maintaining circuit thereby restoring said magnets and said switch without altering its antecedent progressive position.

17. A non-numerical, non-restoring wiper line switch provided with bank contacts and coöperating wipers, quick acting relays and a slow acting single wound release relay for said switch, contacts for said relays, said contacts being individually controlled by their respective relays, motor mechanism for operating said wipers, and circuit connections controlled by the contacts of said relays for operating said motor mechanism and wipers to select a set of bank contacts and to close a holding circuit for said slow acting single wound release relay, and means controlled over the two sides of a calling subscriber's line in series for opening said holding circuit thereby restoring said switch.

18. A telephone system including a calling telephone line, a non-numerical line switch individual thereto provided with contact wipers, quick acting electromagnets and a single wound slow acting release electromagnet for said switch, spring contacts individually controlled by said electromagnets, motor mechanism for operating said wipers, circuit connections controlled by the contacts of said electromagnets for operating said motor mechanism and wipers, a holding circuit for said single wound slow acting release magnet controlled by said contacts, and means controlled over the two sides of said calling telephone line in series for opening the said holding circuit thereby restoring said switch without altering its selective position.

19. In a telephone system, a non-numerical trunking switch, trunk lines for talking purposes leading therefrom, said switch having line wipers always in electrical engagement with some one of said trunk lines, which selected trunk line is always the one last employed by said switch for extending a call, an automatic selector switch at the other end of each of said trunk lines, means controlled over the two sides of a line in series for operating said non-numerical trunking switch to select an idle one of said trunk lines, a single wound release relay for said switch, a holding circuit for said release relay including a conductor of the selected trunk line, and subscriber controlled means for opening said holding circuit thereby restoring said non-numerical trunking switch.

20. In a telephone system, an automatic trunking switch provided with a single wound cut-off relay, trunk lines for talking purposes leading from said switch, terminals for said trunk lines, each switch having line wipers always in electrical engagement with the terminals of the trunk last employed by said switch for extending a call, an automatic selector switch at the other end of each of said trunk lines, means controlled over the two sides of a subscriber's line in series for operating said trunking switch to select an idle one of said automatic selector switches, a maintaining circuit for said cut-off relay including a conductor extending from said trunking switch to said automatic selector switch, and subscriber controlled means for opening said maintaining circuit.

21. A telephone system including a non-numerical trunking switch provided with a cut-off relay and a release relay, trunk lines for talking purposes extending from said trunking switch, said switch having line wipers always in electrical engagement with some one of said trunk lines, which connected trunk line is always the one last employed by said switch for extending a call, an automatic selector switch at the other end of each of said trunk lines, a holding circuit for said relays including contacts of a relay of said selector switch, subscriber controlled means for operating said switches over two sides of a metallic line circuit in series and for opening said holding circuit.

22. In a telephone system, a non-numerical trunking switch, trunk lines for talking purposes leading therefrom, a single wound release relay for said trunking switch, said switch having line wipers always in electrical engagement with some one of said trunk lines, which connected trunk line is always the one last employed by said switch for extending a call, a telephone line to which said switch is individual, a holding circuit for said relay including a conductor of the selected trunk line, and means controlled over the two sides of said telephone line in series for opening said holding circuit when disconnection is desired.

23. In a telephone system, a subscriber's telephone line, a non-numerical trunking switch provided with a single wound cut-off relay, trunk lines for talking purposes extending from said trunking switch, said switch having line wipers always in electrical engagement with some one of said trunk lines, which connected trunk line is always the one last employed by said switch for extending a call, an automatic selector switch at the other end of each of said trunk lines, means controlled over the two sides of the said subscriber's line in series for operating said trunking switch to select an idle one of said selector switches and to close a maintaining circuit for said cut-off relay, and means for opening said maintaining circuit to restore said trunking switch.

24. A telephone system including a subscriber's telephone line, an individual trunking switch for said line, trunk lines for talking purposes leading therefrom, said switch having line wipers always in electrical engagement with some one of said trunk lines, which trunk line is always the one last employed by said switch for extending a call, an automatic switch at the other end of each of said trunk lines, means controlled over the two sides of said subscriber's line in series for operating said trunking switch to cause said switch to connect said subscriber's line to an idle one of said automatic switches, a single-wound relay for said individual switch, a holding circuit for said relay including a conductor of the trunk extending to the selected automatic switch, and means controlled over said telephone line for opening said holding circuit to restore said relay, thereby rendering said trunking switch available for extending other calls.

25. A telephone system including a subscriber's telephone line, a non-numerical trunking switch individual thereto and provided with a single-wound relay, trunk lines for talking purposes leading from said switch, line wipers for said switch always in electrical engagement with some one of said trunk lines, which trunk line is always the one last employed by said switch for extending a call, an automatic selector switch at the other end of each of said trunk lines, a line relay for said individual switch controlled over the two sides of said telephone line in series for operating said non-numerical trunking switch to connect said telephone line to an idle one of said selector switches, a holding circuit for said first relay including a conductor of the selected trunk line, and subscriber controlled means for opening said holding circuit, thereby releasing said single wound relay and rendering said non-numerical switch available for calling purposes.

Signed at Chicago, county of Cook, and State of Illinois, in the presence of two witnesses.

CHARLES S. WINSTON.

Witnesses:
GEORGE E. MUELLER,
CARRIE E. ANDERSON.