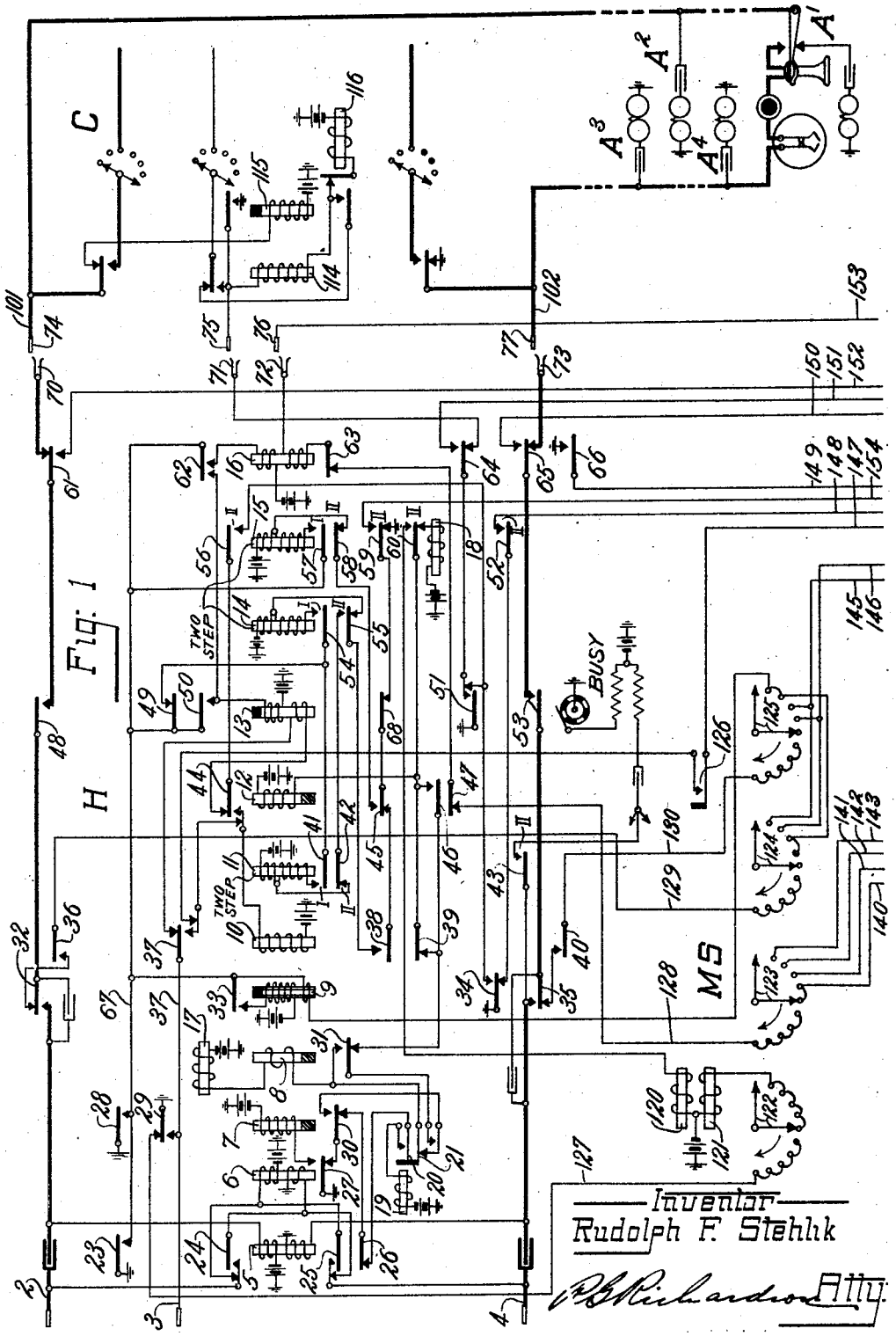
Sept. 3, 1929. R. F. STEHLIK 1,727,137

AUTOMATIC TELEPHONE SYSTEM

Filed Dec. 21, 1925 2 Sheets-Sheet 1



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AUTOMATIC TELEPHONE SYSTEM

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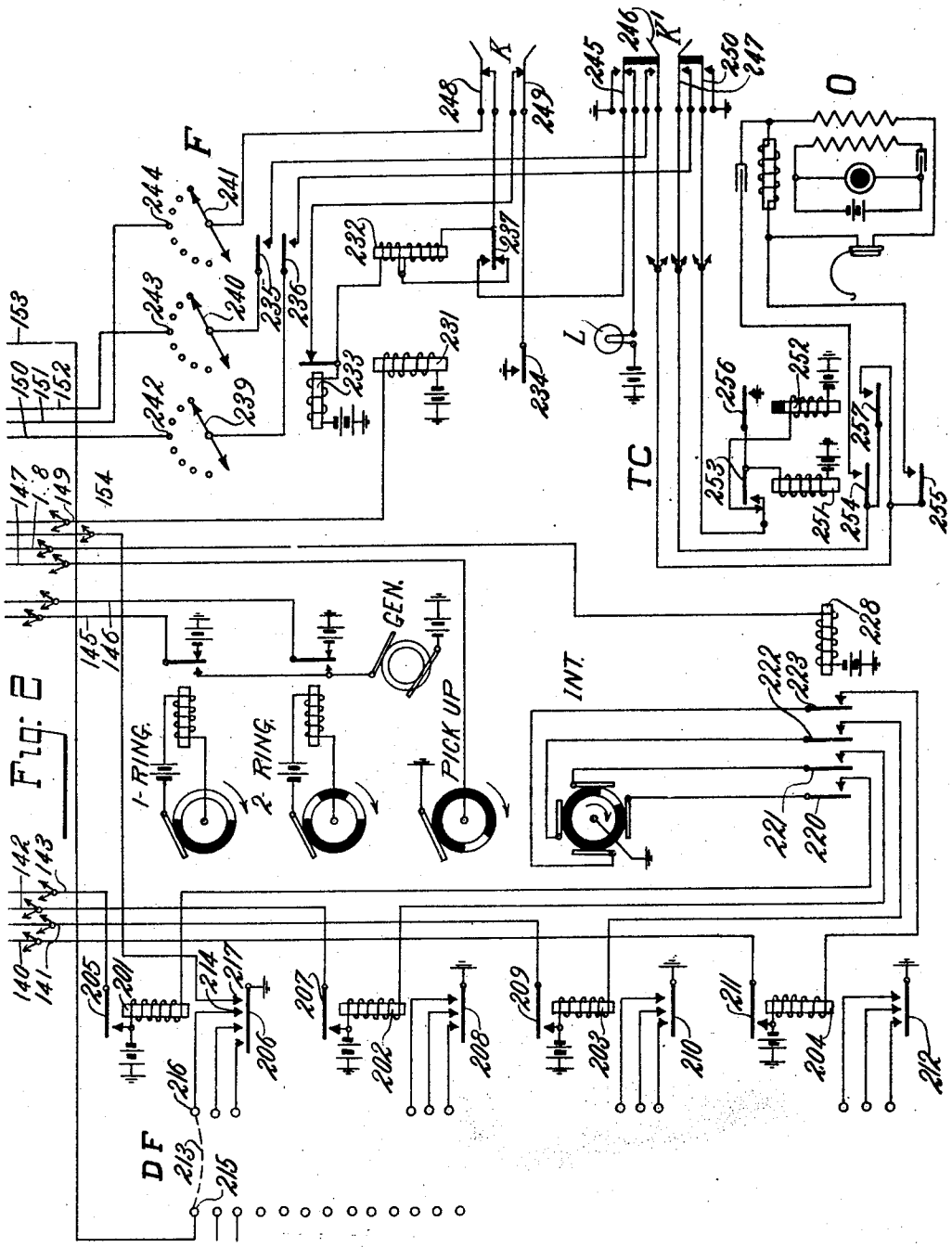


Fig. 2

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UNITED STATES PATENT OFFICE.

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AUTOMATIC TELEPHONE SYSTEM.

Application filed December 21, 1925. Serial No. 76,564.

This invention relates in general to automatic telephone systems, in which connections are established through the medium of subscriber controlled automatic switches, but is more particularly concerned with automatic systems including party lines and code ringing or similar connector switches, and the object of the invention is to provide a new and improved method of and apparatus for intercepting calls for substations disconnected from party lines.

The arrangement herein described is inexpensive and, briefly stated, consists of common apparatus for delivering synchronized impulses for controlling the operation of the intercepting relays of the connector switches.

The detailed means by which the foregoing object is accomplished will be fully set forth hereinafter, reference being had to the accompanying drawings, in which Figs. 1 and 2, with the former placed above the latter and the lines at the top and bottom thereof in alignment, represent diagrammatically sufficient of the apparatus in an automatic telephone system to enable the invention to be explained and understood.

Referring now to Fig. 1, the code ringing connector H is of the two directive type, has the usual vertical and rotary magnets for controlling its selective operation, and also has a release magnet for releasing the switch to normal position. The switch has, in addition to the usual relays, three two-step relays and an intercepting relay for controlling the busy tone and extending a connection to an intercepting operator and disconnecting the wiper circuits when a disconnected substation is called for. The switch also has associated with it the usual busy tone source, and has connected to it a minor switch MS. The switch shaft carries the usual line wipers and in this case two test wipers, the usual private wiper and a special wiper which is used for completing the circuit of said intercepting relay.

The minor switch or code selecting switch MS consists of four double wipers, each two wipers being spaced ninety degrees apart, and associated banks, rotary and release magnets and off-normal springs that close on the first step. It responds to the last digit of the party line call number and controls the selection and application of the code ringing, as well as controls the particular battery feed to the intercepting relay.

One of the lines to which the connector H has access is shown at the extreme right of the drawing. This line is a party line, and substations A^1–A^4, inclusive, only one of which is shown completely, are connected in bridge of the line with their bells connected to ground in the well known manner.

The line switch C is associated with the party line at the exchange, and is of the well known rotary type whose wipers have no normal position and move in a forward direction only.

Referring now to Fig. 2, the four relays shown vertically at the left of the drawing are so called fan type relays having a plurality of contacts which are closed when the relays operate. These contacts may be connected with the special bank contacts of the connector switches, such as H, by means of cross connections at the distributing frame DF. The improved circuit arrangement whereby these relays, in conjunction with the minor switch MS, deliver synchronized impulses to the intercepting relay of the connector, is the principal subject matter of the invention and will be described in detail hereinafter.

The interrupter labeled INT. has as many brushes as there are fan relays and generates ground impulses for said relays in sequence. The interrupter has associated with it a start relay for closing circuits to the fan relays.

The ringing generator labeled GEN., together with its associated one and two ring interrupters and pick-up equipment, is for delivering one or two interrupted rings, the latter in an unmutilated condition, to the called substation bells, by way of the minor switches and connectors, such as MS and H.

The finder switch F is associated with the trunks extending to the intercepting operator's headset O, and is similar to the line-switch C of Fig. 1.

The apparatus having been described more or less in general, a detailed description of the operation of the switches and mechanism shown in the drawings will now be given. For this purpose, it will be assumed that an automatic subscriber desires to obtain connection with a subscriber at substation A^1, whose telephone number ends with the digits 11—1; the last digit controlling the minor

switch, and the two previous digits controlling the connector switch. The customary calling subscriber's station, individual line switch, and the selector switches as used by an automatic subscriber in completing a connection are not shown but are well understood by those skilled in the art and form no part of the present invention. It will therefore suffice to say that in response to the removal of the receiver by the calling subscriber his individual lineswitch seizes an idle trunk line leading to an idle selector switch, and in response to the operation of the subscriber's calling device, the selector switches are operated to select an idle trunk line leading to a connector switch.

Let us assume that the calling subscriber has established his connection as far as the last selector, and that the selector has come to rest on bank contacts connected to the conductors 2, 3, and 4 of the connector switch H, this being the first idle connector accessible to the said selector. When the selector switch comes to rest on the contacts associated with conductors 2, 3, and 4, the switching relay of the selector completes an energizing circuit for the line relay 6 of the connector switch as follows: From ground by way of the lower winding of line relay 6, normally closed springs controlled by armature 25 of backbridge relay 5, conductor 4, over the intervening switches and the subscriber's loop back to conductor 2, normally closed springs controlled by armature 24 and through the upper winding of line relay 6 to battery. Relay 6 at armature 27 and its working contact completes an energizing circuit for the slow-to-release relay 7. Relay 7, upon energizing, connects ground to the release trunk conductor 3, at armature 29 and its working contact. This ground completes a holding circuit for the switches preceding the connector switch for maintaining these switches in an operated position, and in addition, maintains the trunk line leading to the connector busy to all other selectors having access thereto. Furthermore, relay 7, at armature 30 and its working contact, prepares a circuit for the vertical magnet 17 and at its resting contact opens a point in the release circuit; and at armature 28 and its working contact grounds holding conductor 67.

The calling subscriber may now manipulate his calling device in accordance with the third from the last digit in the number of the called subscriber, which in this case is 1. In response to the operation of the calling device by the calling subscriber, the circuit of the line relay 6 is interrupted in known manner and this relay therefore deenergizes for a short interval. A circuit may now be traced for the vertical magnet 17 as follows: From ground by way of armature 27 and its resting contact, armature 30 and its working contact, normally closed contact and off-normal springs 21, slow-to-release series relay 8, and vertical magnet 17 to battery. The vertical magnet 17 and relay 8 energize in series, and by the operation of the vertical magnet 17, the shaft and wipers are raised until the wipers 70–73, inclusive, stand opposite the first level. The relay 8 maintains its own circuit and that of the vertical magnet intact after the shifting of the off-normal springs which takes place on the first vertical step. After the first impulse, since there is only one in this case, the line relay 6 energizes again and opens the circuit for relay 8 and vertical magnet 17 at armature 27. Relay 8, upon deenergizing after a short interval, transfers the impulsing circuit from the vertical magnet to the rotary magnet at armature 31.

Upon the dialing of the next to the last digit of the called subscriber's number, in this case the digit 1, the circuit of the line relay 6 is again interrupted. Relay 6, upon deenergizing, completes a parallel circuit for the rotary magnet 18 and the stepping relay 12 as follows: From ground, armature 27 and its resting contact, armature 30 and its working contact, normally open contacts controlled by off-normal springs 21, armature 31 and its resting contact, resting contact and armature 39, through relay 12 to battery, and also continuing by way of armature 60 and its resting contact, through rotary magnet 18 to battery. The rotary magnet 18 and relay 12 energize and by the operation of the rotary magnet, the wipers 70–73, inclusive, are rotated into engagement with the bank contacts 74–77, inclusive, of the first line in the first level, which is the line including substation A^1. The slow-to-release relay 12 is energized in multiple with the rotary magnet and retains its armature attracted throughout the rotary movement of the switch. As a result of the energization of relay 12 a circuit is closed for two-step relay 15 at armature 45 which may be traced from ground, resting contact and armature 59, resting contact and armature 68, armature 45 and its working contact, armature 58 and its resting contact, and upper winding of relay 15 to battery. This relay only partially energizes at this time and armature 57 marked I is the only one attracted, it serving to close a locking circuit for relay 15 to the grounded holding conductor 67.

When the slow-to-release relay 12 deenergizes at the end of the rotary movement of the switch, it opens the shunt circuit of the lower winding of two-step relay 15 at armature 45 and allows it to fully energize. Relay 15, upon fully energizing, operates its second step armatures marked II, whereupon at armature 56 the test wiper 71 is connected with the switching relay 13, and at armature 60 the impulsing circuit is transferred from the rotary magnet 18 of the connector switch H to the rotary magnet 120

of the minor switch MS. As a further result of the full energization of relay 15 a circuit is closed at armature 52 for start relay 228 of Fig. 2 which may be traced from grounded armature 34 and its resting contact, armature 52 and its working contact, conductor 148, and the winding of the start relay 228 to battery. Relay 228, upon energizing, prepares or closes, depending upon the position of the interrupter labelled INT., circuits for fan relays 201–204, inclusive, at armatures 220—223, respectively, whereupon said relays are energized in sequence by the ground interrupter INT., but with no consequence at this time.

It will be assumed first that the called line is busy. Such being the case, when the test wiper 71 arrives at test contact 75, it will find a ground potential thereon, and switching relay 13 will not energize.

The calling subscriber may now operate his calling device in accordance with the final digit in the number, which is the digit which selects the proper code of ringing current for signalling the particular station wanted. The substations A^1–A^4, inclusive, have been numbered for convenience in accordance with the digits to which they correspond, and since the substation A^1 is the wanted substation in this case the final digit to be called will be the digit 1. When the calling device is operated for this digit, the line relay 6 transmits one impulse of current to the stepping magnet 120 of the code selector MS over the following circuit: From grounded armature 27 and its resting contact, armature 30 and its working contact, normally open contacts controlled by off-normal spring 21, armature 31 and its resting contact, resting contact and armature 39, armature 60 and its working contact and the winding of the stepping magnet 120 to battery. By the operation of magnet 120, ninety degree wipers 122–125, inclusive, are stepped into engagement with the first contacts in their respective banks. The slow-to-release relay 12 is energized in multiple with the magnet 120 and closes a circuit for relay 10 at armature 44 which may be traced from ground at the busy called line, bank contact 75, test wiper 71, resting contact and armature 64, normally closed contacts controlled by armature 51, working contact and armature 56, armature 44 and its working contact, and the winding of relay 10 to battery. Relay 10, upon energizing, prepares a locking circuit for itself at armature 37, and prepares an energizing circuit for two-step relay 14 at armature 38. At the end of the impulse transmitted to magnet 120, relay 12 is deenergized and a locking circuit is completed for relay 10 by make before break contacts controlled by armature 44, and the impulsing circuit is opened at armature 46. As a further result of the deenergization of relay 12 a circuit is closed for two-step relay 14 at armature 45 which may be traced from grounded armature 206 and its working contact 217, when fan relay 201 energizes as previously explained, conductor 154, working contact and armature 59, resting contact and armature 68, armature 45 and its resting contact, armature 38 and its working contact, armature 55 and its resting contact, and the upper winding of relay 14 to battery. Relay 14, being a two-step relay, only energizes partially to attract its armature 54 marked I. Upon armature 54 being attracted a locking circuit is completed for relay 14 by way of armature 49 and grounded holding conductor 67. As soon as fan relay 201 deenergizes, as a result of the interrupter INT. opening its circuit, the shunt circuit of the lower winding of relay 14 is opened at armature 206 and the relay fully energizes to attract its armature marked II. Relay 14, upon fully energizing, prepares a circuit for two-step relay 11 at armature 55, and when fan relay 201 is again energized by the interrupter INT., the circuit is closed and may be traced from grounded armature 206 and working contact 217, conductor 154, working contact and armature 59, resting contact and armature 68, armature 45 and its resting contact, armature 38 and its working contact, armature 55 and its working contact, armature 42 and its resting contact, and through the upper winding of relay 11 to battery. Relay 11, being a two-step relay, only energizes partially to attract its armature 41 marked I. Upon armature 41 being attracted a locking circuit is completed for relay 11 by way of armature 49 and grounded holding conductor 67. As soon as fan relay 201 deenergizes, as a result of the interrupter INT. opening its circuit, the shunt circuit of the lower winding of relay 11 is opened at armature 206 and the relay fully energizes to attract its armatures marked II. Relay 11, upon fully energizing, further opens the shunt circuit of its lower winding at armature 42, and at armature 43 connects a lead from the busy signalling machine labelled BUSY to the lower heavy talking conductor. By this latter operation, an audible signal is transferred to the calling subscriber, and, being advised thereby that the called line is inaccessible for the time being, he will hang up his receiver.

Having explained the operation which takes place when the called line is busy, it will now be assumed that the line is idle when called. Under these circumstances, when the test wiper 71 arrives at test contact 75, it will find no ground potential and as soon as stepping relay 12 becomes deenergized and two-step relay 15 becomes fully energized, as previously explained, a circuit is closed for switching relay 13 at armatures 56 and 44 which may be traced from grounded release trunk conductor 3, armature 37 and its rest-

ing contact, lower winding of switching relay 13, resting contact and armature 44, armature 56 and its working contact normally closed contacts controlled by armature 51, armature 64 and its resting contact, test wiper 71, bank contact 75, winding of the switching relay 114, and the winding of the stepping magnet 116 to battery. The relays 13 and 114 are energized in series over the above circuit, and the latter relay is operated to clear the called line of its normal battery and ground connections at the line switch C. It should be noted that the relay 114 is not fully operated at this time. Due to a mechanical interlocking arrangement between the armature of this relay and the armature of the slow acting line relay 115, the wipers of the line switch C are not connected up. In the connector H, when the switching relay 13 is energized, it establishes a locking circuit for itself at its armature 50; grounds the test wiper 71 at armature 51; further opens the circuit of two-step relay 14 at armature 68; and at armatures 48 and 53 connects through the line wipers 70 and 73.

The calling subscriber may now operate his calling device in accordance with the final digit 1 in the number, which as previously explained, steps the code selector MS wipers into engagement with the first set of bank contacts; the slow-to-release relay 12 being again energized in multiple with the stepping magnet 120. At the end of the impulse transmitted to the magnet 120, relay 12 is deenergized and a circuit is completed for relay 10 as follows: Grounded brush in the pick-up interrupter, conductor 147, off-normal spring 126 and its working contact, which close on the first rotary step of the code selector, normally closed contacts controlled by armature 37, normally closed contacts closed by armature 44, and the winding of test relay 10, now acting as a code switch control relay, to battery. Relay 10, upon energizing, closes a locking circuit for itself at armature 37, opens the circuit of the stepping magnet 120 at armature 39, and at armature 36 completes the signalling circuit as follows: From generator GEN., connected to ground through battery, the contacts of the one-ring interrupter, conductor 145, first contact in the bank associated with ninety-degree wiper 124 and said wiper, contacts 6–10, inclusive, associated with wiper 124, conductor 129, armature 36 and its working contact, resting contact of armature 32 and said armature, armature 48 and its working contact, armature 61 and its resting contact, line wiper 70, bank contact 74, line conductor 101, the normally closed switchhook contact at the substation A^1, and the ringer at said substation to ground. The above circuit is intermittently opened and closed by the operation of the ringing interrupter and the ringer at substation A^1 is thus operated at intervals to signal the called subscriber. The calling subscriber is given the well known ringing tone, when ringing current is applied to the wanted line, through the small capacity condenser which is connected across armature 32 and its working contact. It is understood, of course, that ringing current also flows through the ringer at substation A^2, to ground at the same time, but the subscriber at this substation knows that the call is not for him and will not respond to the ringing code which is now in use. When the called subscriber at substation A^1 removes his receiver to answer the call, the ringer thereat is disconnected and the ringing circuit is completed over a metallic circuit including the other line conductor 102 and the lower winding of the ring-cut-off relay 9 at the connector H, which may be traced as follows: Grounded armature 28 and its working contact, conductor 67, lower winding of ring-cut-off relay 9, first bank contact associated with ninety-degree wiper 125 and said wiper, contacts 6–10, inclusive, conductor 130, armature 40 and its working contact, resting contact and armature 35, armature 53 and its working contact, armature 65 and its resting contact, line wiper 73, bank contact 77, line conductor 102, substation talking equipment, line conductor 101, bank contact 74, line wiper 70, resting contact and armature 61, working contact and armature 48, armature 32 and its resting contact, working contact and armature 36, conductor 129, contacts 6–10, inclusive, associated with ninety-degree wiper 124 and said wiper, contact 1, associated with said wiper, conductor 145, and through the contact of the one ring interrupter to battery. The ring-cut-off relay 9 now energizing and establishes a locking circuit for itself at armature 33, removes ground from the start conductor 148 at armature 34, opens the ringing circuit at its armature 32, and at the working contacts of this same armature and armature 35 and its working contact, finally completes the talking circuit.

The required connection has now been established and the calling and called subscribers may now converse as desired. Current for the transmitter at the calling substation is supplied through the windings of the double wound line relay 6, while current for the transmitter at substation A^1 is supplied through the windings of the back bridge or reversing relay 5. The latter relay is of course energized and places ground on the holding trunk 67 at armature 23 and further opens the circuit of the release magnet at armature 26, to place the releasing of the switch under the control of the party hanging up last, and also reverses the direction of the current flow in the calling line during conversation. This latter operation is a standard operation for use in controlling measured service equipment and is well known to those skilled in the art.

When the conversation is finished, both subscribers will hang up their receivers.

When the receivers are replaced, the back bridge, line and release relays 5, 6, and 7 are deenergized and these relays close a circuit for the release magnet 19, which operates to restore the connector H to normal position in the usual manner. Relay 7 also disconnects ground from the release trunk conductor 3, thereby breaking the holding circuit of the preceding switches, and they are accordingly restored to normal also. At the same time the circuit of release magnet 19 is closed, relay 7 closes a circuit at armature 29, by way of conductor 127, which includes the release magnet 121 of the minor switch MS. By the operation of the release magnet 121, the wipers 122–125, inclusive, are restored to normal position. Thus all the apparatus in use has been freed and made ready for use in another connection.

A brief explanation will now be given of the manner in which the other stations of the line are signalled. Substation A^2 may be signalled by calling digit 2, as the final digit, and the operations are exactly the same as when substation A^1 is called, except that a different code of ringing current is selected. It will be understood in this connection that conductors 145 and 146 extend to separate ringing current interrupters, and these interrupters are of different ringing codes. The ringers at the two substations just referred to, are connected from the line conductor 101 to ground. In order to operate the ringers at the remaining substations A^3 and A^4, which are connected from the line conductor 102 to ground, digits 3 and 4, respectively, must be called as the final digits. Suppose, for example, that it is desired to call the substation A^3, the final digit to be called in this case is the digit 3, and the ninety-degree wipers of the minor switch MS are advanced three steps into engagement with the third and eighth contacts in their respective banks. When the ninety-degree wiper 125 comes to rest on the third contact, the one ring interrupter is selected. When the relay 12 deenergizes at the end of the operation of the code selecting switch, a circuit is closed for the relay 10 the same as before and when said relay energizes, a ringing circuit is completed substantially the same as previously described, except that in the present case, the ringing current is supplied to the line by way of connector wiper 73 instead of by way of connector wiper 70, and hence flows over the line conductor 102 and through the ringers at substations A^3 and A^4 to ground. The ringers at substations A^3 and A^4 are accordingly operated, and the subscriber at substation A^3 responds to the one ring code call. The substation A^4 may be called in the same manner by using the final digit which corresponds to that substation.

It will now be assumed that the subscriber at substation A^1 has had his telephone taken out. Now in order to trunk calls which may be extended to the line terminating in the line switch C for disconnected substation A^1 to a special "A" or intercepting operator's position, it is only necessary that the cross connection 213 be run between terminals 215 and 216 at the distributing frame DF to connect the conductor 153 to a working contact such as 214 of armature 206 of relay 201. When the connector H seizes the line switch C, and assuming that the line is idle, the test wiper 71 finds battery and the slow-acting switching relay 13 energizes as before. Then when the slow-to-release relay 12 deenergizes at the end of the stepping of the minor switch MS and the fan relay 201 energizes, as previously explained, an energizing circuit is closed for intercepting relay 16 at armature 47 and armatures 205 and 206, respectively, which may be traced from grounded armature 206 and working contact 214, terminal 216, cross connection 213, terminal 215, conductor 153, bank contact 76, special wiper 72, lower winding of relay 16, armature 63 and its resting contact, armature 47 and its resting contact, conductor 128, contacts 6–10, inclusive, associated with wiper 123 and said wiper, contact 1, conductor 143, armature 205 and its working contact, to battery. Relay 16, upon energizing, closes a locking circuit for itself to holding conductor 67 at armature 62; disconnects the wiper circuits at armatures 61, 63, 64, and 65, thus making the line available for other calls; connects ground to conductor 151 by way of armature 51 and its working contact, at armature 64; and at the working contacts of armatures 61 and 65, transfers the ringing connection to the finder switch F. As a further result of the energization of relay 16, a circuit is closed for start relay 231 of finder switch F, which may be traced from ground, working contact and armature 66, conductor 149, and the winding of relay 231 to battery.

When the line is transferred as above described, the start relay 231 of the finder switch F is energized over the start circuit to close a circuit for the stepping magnet 233 by way of kick-off key K, at armature 234. The stepping magnet 233 energizes and deenergizes over this circuit to step the wipers 239, 240 and 241 until they find the extended line. When the wiper 241 reaches the bank contact 244, a circuit is closed for relay 232 which may be traced as follows: Grounded armature 51 and its working contact, armature 64 and its working contact, conductor 151, bank contact 244, wiper 241, spring 248 and its resting contact of key K, armature 237 and its resting contact, upper winding of relay 232, and through the winding of magnet 233 to battery. Magnet 233 holds energized over this circuit to stop the stepping of the wipers, and relay 232 energizes to extend the ringing conductors to the listening key K^1 at armatures 235 and 236. As a further result of the

energization of relay 232, the shunt around its lower winding is removed and a multiple circuit is closed for lamp L at armature 237, which may be traced from battery, lamp L, resting contact and spring 245, working contact and armature 237, and thence over a circuit previously traced to ground at armature 51, in multiple with relay 232.

The operation which takes place at the intercepting operator's position will now be described. The intercepting operator, upon observing the lighted condition of lamp L, operates the key K^1, thereby closing a holding circuit for relay 232 and magnet 233, and opening the circuit of lamp L at spring 245, to extinguish said lamp; and extend the ringing conductors to the intercepting operator's trunk circuit TC at springs 246 and 247. As a further result of the operation of the key K^1, a circuit is closed for slow-acting relay 252 which may be traced from ground, working contact and spring 250, normally closed contacts controlled by armature 253, and the winding of relay 252 to battery. Relay 252, upon energizing, closes a circuit for relay 251 at armature 256, and at armature 257 closes a bridge across the ringing circuit to energize the ring-cut-off relay 9 in the connector switch H, which circuit may be traced from grounded holding conductor 67, lower winding of relay 9, contact 1, associated with ninety-degree wiper 125 and said wiper, contacts 6–10, inclusive, conductor 130, armature 40 and its working contact, resting contact and armature 35, armature 53 and its working contact, armature 65 and its working contact, conductor 150, bank contact 242, wiper 239, armature 236 and its working contact, working contact and spring 247, armature 254 and its resting contact, armature 257 and its working contact, spring 246 and its working contact, working contact and armature 235, wiper 240, bank contact 243, conductor 152, working contact and armature 61, working contact and armature 48, armature 32 and its resting contact, working contact and armature 36, conductor 129, contacts 6–10, inclusive, associated with ninety-degree wiper 124 and said wiper, contact 1, conductor 145, and to battery at the one-ring interrupter springs or at the generator GEN., depending upon whether the circuit is closed during the ringing or silent period. In the connector H, when relay 9 energizes, it establishes a locking circuit for itself, breaks the ringing circuit, and finally completes the talking connection as already described.

Relay 251, upon energizing, opens the circuit of relay 252 and closes a locking circuit to ground at key K^1 for itself at armature 253 and its make-before-break springs and at armatures 254 and 255, and their working contacts extends the connection through to the operator's headset O. Relay 252 falls back after an interval and at armature 257 removes the short circuit from the talking conductors.

The operator may now converse with the calling subscriber advising him that the called party's telephone has been disconnected. When the conversation is completed the calling subscriber replaces his receiver, resulting in the release of the connector H, the minor switch MS, and all previously operated switches as already described. The operator upon releasing the key K^1, releases the finder switch F and trunk circuit TC and renders them available for further use.

A brief explanation will now be given of the manner in which calls for the other substations of the line are routed to the intercepting operator when said substations are disconnected and the line is idle. Calls for substations A^2, A^3, and A^4, may be routed to the intercepting operator by merely running a cross connection at the distributing frame DF between the terminal corresponding to the called line and a terminal corresponding to the disconnected substation, i. e. a terminal associated with fan relay 202 for the substation A^2, whose final digit is 2, a terminal associated with fan relay 203 for substation A^3, etc. The operations are exactly the same as when the call for disconnected substation A^1 is made, except that the minor switch MS is stepped to a different set of bank contacts and the operating circuit for the intercepting relay is controlled by a different fan relay.

If a call is initiated for a disconnected substation and the line is busy, the switching relay 13 will not energize when the two-step relay 15 energizes after the connector H seizes the line switch C, as already explained. Relay 13 will, however, be energized by the intercepting relay 16 over a multiple circuit closed by armature 62 which may be traced from grounded holding conductor 67, armature 62 and its left hand working contact, and through the upper winding of relay 13 to battery. From this it will be seen that the two-step relays 14 and 11 are prevented from being operated, the same as when an idle line is called for, and the busy tone is prevented from being given to the calling subscriber. The calling line is routed to the intercepting operator by the intercepting relay as previously explained.

The key K serves as a kick-off key should the conductor 151 for any reason become permanently grounded. When key K is depressed, with the listening key K^1 in normal position, the circuit including magnet 233, relay 232 and grounded conductor 151 is opened at spring 248, whereupon the magnet and relay deenergize. Magnet 233, upon deenergizing, steps the wipers of finder switch F to the next set of bank contacts, whereupon the finder switch is made ready for additional service upon the restoration of the key K.

Having described the invention, what is

considered new and desired to have protected by Letters Patent will be pointed out in the appended claims.

What is claimed is:

1. In a telephone system, a party line, a connector for extending a connection to said line, means for selecting the desired station after the line is connected with, and means effective in case the desired station is out of service for transferring the connection to an intercepting trunk regardless of whether the party line is busy or idle.

2. In a telephone system, a party line, a connector for extending a connection to said line, means for selecting the desired station after the line is connected with, means for preventing the establishment of a talking connection to said line if the line is busy and the desired station is in service, and means for transferring the connection to an intercepting trunk if the desired station is out of service, regardless of whether the line is busy or not.

3. In a telephone system, a party line, a connector for extending a connection to said line, means for testing the line to determine if it is busy or idle, means for selecting the desired station on said line, testing means for determining whether or not the desired station is in service, busy signalling means for indicating to a calling subscriber a busy condition of the line, and means for delaying the busy signal in case the busy test indicates the line is busy until after it is determined that the desired station is in service.

4. In a telephone system, a party line, a connector for extending a connection to said line, means for testing the line to determine if it is busy or idle, means for selecting the desired station on said line, testing means for determining whether or not the desired station is in service, and means for applying a busy signal to the calling line only in case the busy test indicates that the line is busy and the said testing means indicates that the desired station is in service.

5. In a telephone system, a party line, a connector for extending a connection to said line, means in said connector for selecting the desired station on said line after the line is connected with, and testing means in the connector for determining whether or not the desired station is out of service.

6. In a telephone system, a party line, a connector for extending a connection to said line, selecting means responsive to an extra digit for selecting the proper ringing circuit to signal the desired station, and testing means controlled by said selecting means for determining whether or not the desired station is out of service.

7. In a telephone system, a party line, a connector for extending a connection to said line, means in said connector for selecting the desired station on said line after the line is connected with, testing means for determining whether or not the desired station is out of service, and circuit arrangements for transferring the connection to an operator if the desired station proves to be out of service.

8. In an impulse controlled connector switch for setting up a connection to a desired line, a wiper connecting relay, a test wiper, means responsive to the cessation of the impulses for setting said switch for connecting said relay between said wiper and one pole of a source of voltage regardless of whether the line is in the idle or busy condition, said relay being inoperative if the line is in one of said conditions and operative if the line is in the other of said conditions.

9. In a connector switch, a wiper connecting relay, a test wiper, and a two-step relay, means for partially energizing the two step relay at the beginning of a series of setting impulses and fully energizing the two step relay at the end of such series for connecting said first named relay to said wiper.

10. In a connector switch, a wiper connecting relay, a test relay, a test wiper, means for connecting said connecting relay to said test wiper at the end of the setting operation of the switch, and means for subsequently connecting said test relay to said wiper in case the connecting relay does not operate.

11. In a connector switch, a wiper connecting relay, a test relay, a test wiper, means for connecting said connecting relay to said test wiper at the end of the setting operation of said switch, and means for connecting said test relay to said wiper responsive to an additional series of impulses received after the impulses which control the setting operation.

12. In a connector switch, a test relay for testing a called line and for controlling the transmission of a busy signal to the calling line, a test wiper, and means for connecting said relay to said wiper only in case the called line is busy.

13. In a telephone system, party lines, a connector switch for extending connections to said lines, an operator's position, an intercepting relay in said switch for transferring the connection to said operator's position when a disconnected substation is called for, a minor switch associated with said connector switch for controlling the operation of said relay, and common apparatus associated with said connector switch and other similar switches for delivering synchronized impulses by way of said minor switch for operating said relay.

14. In a telephone system, a plurality of party lines, an operator's switchboard, means for extending calls to any of said lines, step-by-step mechanism common to said lines for

extending calls to the operator's switchboard, and means effective when certain stations on said party lines are called for extending the call to said step-by-step mechanism over a path exclusive of the party line.

15. In a telephone system, a plurality of party lines, subscriber controlled means for selecting a desired line, subscriber controlled means effective to call a desired party on said line, a device common to a plurality of said first named lines for extending calls to an operator over paths exclusive of the lines, and means in said device for rendering it operative depending upon which party on the selected line is called.

16. In combination with a plurality of party line connectors each of which is provided with means for selectively signalling a desired party on a party line, means common to said connectors for extending calls for some parties on certain party lines to an operator, but not extending calls for other parties on those same party lines to the operator, the call to the operator being extended over a path exclusive of the party lines.

17. In a telephone system, a party line connector having accessible thereto a plurality of party lines, means for operating the connector to select a desired station on a desired party line, an operator's switchboard, and means for conditioning the connector so that if any predetermined station on any line is selected the call will be extended to the operator's switchboard.

18. In a telephone system, a party line connector having an incoming talking conductor, an outgoing wiper, and a conductor leading to an operator's position, a plurality of lines accessible to the connector, means for operating the connector to select any line, means for selecting any station on the line, means for classifying the individual stations on any line in either of two classes, and means dependent upon whether the station selected is of one or the other class, for extending the incoming talking conductor to the outgoing wiper or to the conductor leading to the operator's position.

19. In a telephone system, a party line connector having an incoming talking conductor, an outgoing wiper, and a conductor leading to an operator's position, a plurality of lines accessible to the connector, means for operating the connector to select any line, means for selecting any station on the line, means for classifying the individual stations on any line in either of two classes, and means dependent upon whether the station selected is of one or the other class, for extending the incoming talking conductor to the outgoing wiper or to the conductor leading to the operator's position, said last named means being effective to extend the incoming conductor to the outgoing wiper only if the line is idle and effective to extend the incoming conductor to the conductor leading to the operator's position regardless of the busy or idle condition of the party line.

20. In a telephone system, a party line connector having an incoming talking conductor, an outgoing wiper, and a conductor leading to an operator's position, a relay for connecting the incoming conductor to either the outgoing wiper or to the second named conductor, a plurality of lines accessible to the connector, means for operating the connector to select any line, means for selecting any station on the line, means for classifying the individual stations on any line in either of two classes, and means dependent upon whether the station selected is of one or the other class for actuating said relay.

21. In a telephone system wherein a party line is accessible to a plurality of connectors over a single pair of bank contacts in each connector, and means is provided for selecting a desired station on the line and for signalling the station or an operator depending upon the station selected, means for rendering the line busy if the station is signalled and idle if the operator is signalled.

22. In a telephone system wherein a party line is accessible to a plurality of connectors over a single pair of bank contacts in each connector, and means is provided for selecting a desired station on the line and for signalling the station or an operator depending upon the station selected, means for rendering the line busy if the station is signalled and idle if the operator is signalled, and means for preventing the station from being signalled if at the time the line is selected the line is busy, while permitting the operator to be signalled at that time.

23. In a telephone system, a party line, a plurality of connectors each having access to the line, means for operating any of the connectors to select the line, means for selecting a desired station on the line, all of the stations on the line being reached over the same pair of connector bank contacts, means for classifying the individual stations in either of two classes, and means effective if the desired station is of one class to signal the station on the line and to render the line busy to the other connectors, whereas if the station is of another class to signal an operator and to render the line available to the other connectors.

24. In a telephone system, a plurality of party lines, means for selecting a desired line and a desired station on the line, means for testing the line to determine if it is busy, means dependent upon the station selected and effective if the line is idle to signal the station and to render the line busy, and dependent upon the station selected and independent of whether the line is busy or idle to signal an operator, without changing the busy or idle condition of the line.

25. In a telephone system, a party line, a

connector for extending a connection to said line, means in said connector for selecting the desired station on said line after the line is connected with, all of the stations being reached over the same pair of connector bank contacts, testing means for determining whether or not the desired station is out of service, and means effective if the line is idle and the desired station is in service for rendering the line busy and signalling the station, and if the station is out of service for signalling an operator without changing the busy or idle condition of the line.

26. In an automatic telephone system, the method of giving intercepting service to stations on party lines, which consists, in extending a connection to the desired line, in testing the line to determine if the line is busy, in selecting the desired station on the line, in then testing to determine if the station is in service, and if the station is in service in extending the call to the line if the line is idle but not extending the call if the line is busy, while if the station is out of service in extending the call to an operator regardless of the busy or idle condition of the line.

27. In an automatic telephone system, the method of giving intercepting service to stations on party lines which consists in extending a connection to the desired line, in testing the line to determine if it is busy or idle, in selecting the desired station on said line, in testing to determine if the station is or is not in service, and in applying a busy signal to the calling line only in case the busy test indicates that the called line is busy and the other test indicates that the desired station is in service.

28. In a connector switch, means for operating the switch in accordance with two digits of a telephone number to select a desired line, means for testing the line to determine if the same is busy, means operative in accordance with another digit in the desired number to select a particular station on the selected line, means effective responsive to the last named selection for again testing said line if the first test indicated that the line was busy, and means effective if the last named test indicates that the line is still busy for transmitting a busy signal over the incoming talking conductors of the switch.

29. In a telephone system wherein a connector is operated to select a desired party line, and is then operated to select a particular station on the selected line, the combination of means responsive to the selection of the line for testing said line to determine if the same is busy or idle, and means effective upon the selection of the particular station on the line if the first test indicated that the line was busy for again testing said line to determine if the line is still busy.

30. In a telephone system wherein a connector is operated to select a desired party line, and is then operated to select a particular station on the selected line, the combination of means responsive to the selection of the line for testing said line to determine if the same is busy or idle, and means effective if either test indicates an idle condition of the selected line for seizing the line and if both tests indicate a busy condition of the line for transmitting a busy signal over at least one of the incoming talking conductors of the connector.

31. In a telephone system, a connector, a plurality of party lines accessible to said connector, means for operating the connector to select any desired line of said group of lines, means for testing the selected line to determine if the same is idle and if idle for placing a guarding potential thereon, means for operating the connector to select a desired station on the selected line, and means effective if the first test indicated that the selected line was busy for again testing for the busy condition of the selected line upon the selection of the desired station on the selected line, and means effective if both of said tests indicate that the line is busy for transmitting a busy signal over the incoming talking conductor of the connector.

32. In a telephone system, a connector, a plurality of party lines accessible to said connector, means for operating the connector to select any desired line of said group of lines, means for testing the selected line to determine if the same is idle and if idle for placing a guarding potential thereon, means for operating the connector to select a desired station on the selected line, means effective if the first test indicated that the selected line was busy for again testing for the busy condition of the selected line upon the selection of the desired station, and means effective if the second test indicates that the line is idle for reoperating the second named means.

In witness whereof, I hereunto subscribe my name this 18th day of December, A. D. 1925.

RUDOLPH F. STEHLIK.