

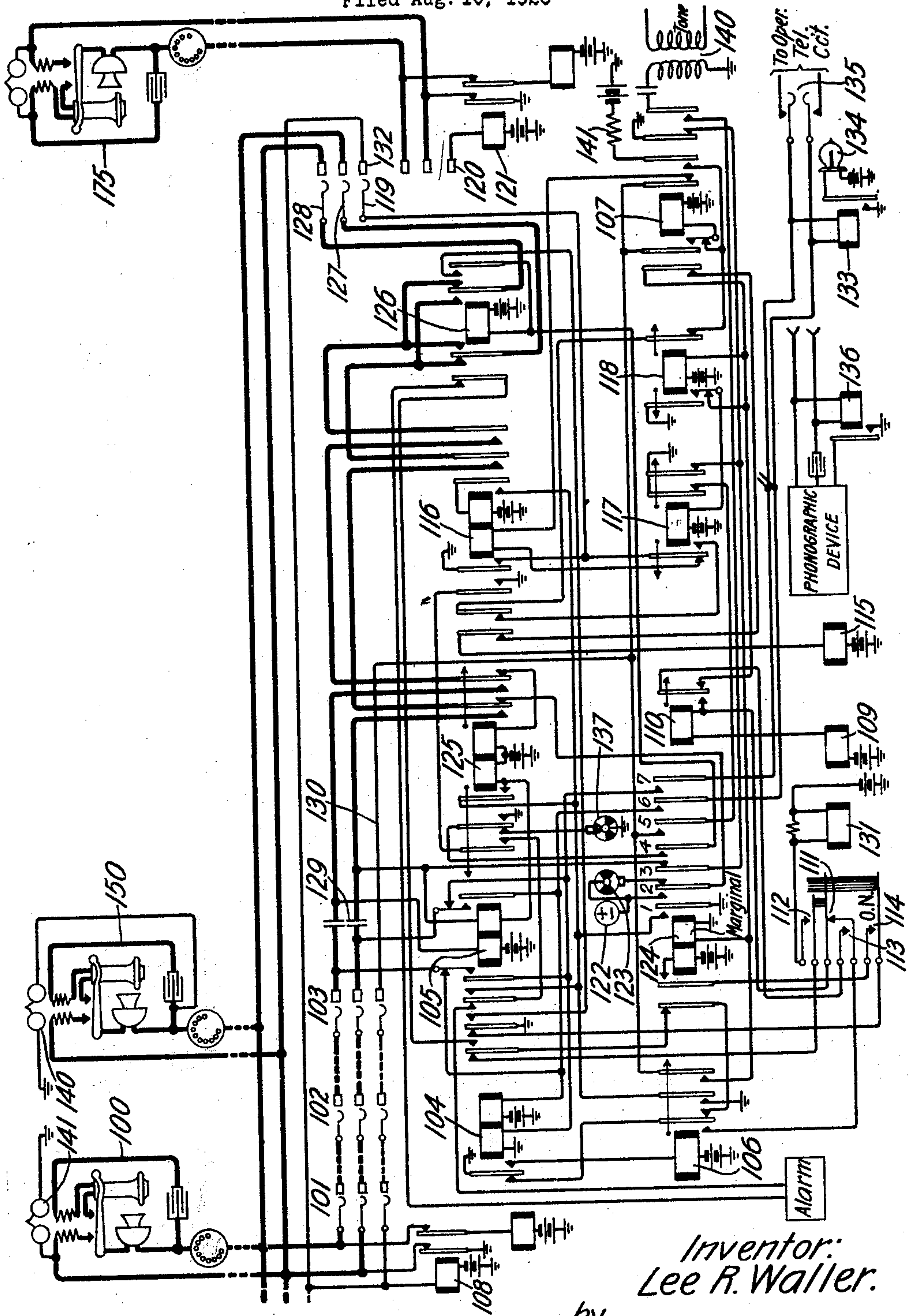
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PARTY LINE TELEPHONE SYSTEM

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UNITED STATES PATENT OFFICE.

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PARTY-LINE TELEPHONE SYSTEM.

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This invention relates to telephone exchange systems and more particularly to party-line automatic telephone systems.

It is the object of the invention to improve revertive calling and particularly to economize in the use of equipment and to simplify the procedure on the part of the subscriber.

Heretofore there have been two general methods of making such revertive connections. One of these methods employs means associated with the first selector of the train of switches used in establishing a connection for temporarily removing the busy condition from the multiple of the calling line, thereby enabling the connector switch to seize the called line and apply ringing current thereto in the same manner as though the desired station were on a separate line. In practicing this method all of the switches employed in the connection are held during the entire conversational period and, of course, it is necessary to supply special means in the first selector for removing the busy condition. In the second method a special ring-back switch is employed which is selected by the first selector when the calling subscriber dials a special code. In practicing this method it is necessary for the calling subscriber to dial a special code thereby digressing from the usual procedure in obtaining line connections.

In accordance with the present invention it is necessary merely to dial the directory number of the called subscriber, the connector being provided with a relay which operates only when the called line is the calling line to distinguish a revertive call from a direct call. According to another aspect of the invention means is provided for giving the calling subscriber oral instructions when making a revertive call.

In making a revertive call with the connector switch of the present invention, when the connector comes to rest on the line and tests it for busy condition, a circuit is completed from the connector, over the sleeve terminal of the called line which is also the calling line and thence over the release conductor, back to a relay in the connector. In response to the operation of this relay the subscriber is instructed to hang up his receiver, while ringing takes place. This relay also alters the ringing arrangement to cause the bells of both parties to be rung. The restoration of the receiver releases all the switches in the train

used in building up the connection, with the exception of the connector, which is held under the control of this same relay and serves to supply talking current to the line.

The operation of the connector switch embodying this invention will be more clearly understood from a consideration of the following description in connection with the drawing which shows such a connector switch in detail together with a diagrammatic showing of means for establishing both a direct and a revertive connection.

Let it be assumed that the subscriber at sub-station 100 which is one of two on a party line, desires to call a subscriber not on the same line, he will remove his receiver from the hook whereupon the line switch 101 will extend the line to a first selector 102. The subscriber will then dial the number of the wanted subscriber and selectors 102 and 103 will be positioned to connect the subscriber's line with the connector shown in detail.

When second selector 103 comes to rest on the terminals of the connector switch, a circuit is completed from battery, through the right winding of relay 104, left normal contact of relay 105, over the tip conductor of selectors 103 and 102 and line switch 101 through the sub-station 100 back over the ring conductor of line switch 101 and selectors 102 and 103, right normal contact of relay 105, left winding of relay 104 to ground. Relay 104 closes an obvious circuit for relay 106 which connects ground from the outer right back contact of relay 107 over the outer right front contact of relay 106 to release conductor holding the train of switches. Relay 106 also prepares a circuit for vertical magnet 109 extending from battery through the winding of the magnet, winding of slow to release relay 110, normal contact 111, inner right front contact of relay 106, to the back contact of relay 104.

When the subscriber dials the third digit of the called number, relay 104 releases and completes this circuit for magnet 109. The connector switch is moved upward in response to the operation of the vertical magnet 109 closing off-normal contacts 112, 113 and 114 and opening normal contact 111. Relay 110 operates in series with magnet 109 and closes a second circuit for itself and magnet 109 over its right front contact and contact 113 to the contact of relay 106. Contact 113 is closed

before contact 111 opens so that no dial pulses are lost. Magnet 109 advances the connector one vertical step for each dial pulse.

When the last pulse of the series has been received relay 104 remains operated for a sufficient length of time to permit relay 110 to release and prepare the circuit of rotary magnet 115. The circuit of magnet 115 extends over the outer left back contact of relay 116, outer left back contact of relay 107, back contact of relay 110, off-normal contact 113, front contact of relay 106 to ground at the back contact of relay 104.

When relay 104 releases in response to the first pulse of the last digit, the above traced circuit is closed and magnet 115 operates to give the connector one rotary step. At the same time two circuits are closed in parallel with magnet 115 from battery through the winding of relay 118 and a second circuit from battery through the winding of relay 117 and the left normal contact of relay 118. Relay 118 operates and being slow to release holds its armatures attracted throughout the dialing of the last digit. Relay 118 closes an obvious holding circuit for relay 117 which is also slow to release.

When relay 104 remains operated for a sufficient length of time following the last pulse of the digit, relay 118 releases but relay 117 does not release for a further interval. At this time a circuit is closed from battery through the winding and over the left normal contact of relay 107, back contact of relay 118, inner left back contact of relay 116, front contact of relay 117, to sleeve brush 119. If the called line is busy, ground will be connected to the sleeve terminal from the apparatus with which that line is busy and relay 107 will operate, locking over its left front contact, outer right front contact of relay 106 to ground through the right winding of relay 124 and at the outer right back contact of relay 117 as soon as that relay releases. Relay 124 does not operate in series with relay 107.

With relay 107 operated, a tone is transmitted through repeating coil 140, outer right front contact of relay 107, back contact of armature No. 3 of relay 124, right winding of relay 105, left winding of relay 125 to battery. This tone is transmitted through condenser 129 to the receiver at the subscriber's substation notifying him that the called line is busy, whereupon he may hang up and release relays 104, 106 and 107 in turn operating release magnet 131 and restoring the connector and other switches to normal.

Should the called line be idle, relay 107 will not operate and when relays 117 and 118 release, a circuit will be closed from battery through the cut-off relay, for example relay 121, terminal 120, brush 119, left back contact of relay 117, left winding of relay 116, inner right back contact of relay 107, outer

right front contact of relay 106 to ground at the outer right back contact of relay 117. Relay 116 locks in a circuit from battery through its right winding and right front contact, middle right contact of relay 106 to ground. Relay 116 also connects ground over its inner left front contact directly to brush 119, holding the called line busy.

The operation of relay 116 completes the ringing circuit which extends from source of ringing current 122 through interrupter 123, back contact of the No. 2 armature of relay 124, inner right back contact of relay 125, middle right front contact of relay 116, inner left back contact of relay 126, brush 127, ring conductor of the subscriber's line through the bell of the called subscriber's sub-station back over the tip conductor to brush 128, right back contact of relay 126, outer right front contact of relay 116, outer right back contact of relay 125, right winding of relay 125 to battery. The bell is rung intermittently under the control of the interrupter 123 but relay 125 does not operate in series with the ringer.

Had the called line been one on a party line, the ringer would have been connected between either the tip or ring conductor and ground. The multiple terminals corresponding to the different parties appear before different connectors, which connectors are arranged to apply the ringing current to the proper side of the line.

When the called subscriber answers, relay 125 operates and locks in a circuit from battery through its left winding and inner left front contact to ground at the middle right contact of relay 106. Relay 125 in operating extends the called subscriber's line through the left winding of relay 105 to battery and through the right winding of relay 105 and the inner right front contact of relay 125 to ground at the middle right contact of relay 106. The calling subscriber receives talking battery through the windings of relay 104 and the called subscriber through the windings of relay 105.

If, following conversation, the calling subscriber hangs up first, he will release relay 104 closing the previously traced circuit for relays 117 and 118 which relays operate, ineffectively. However, the circuit of relay 106 now remains open for a sufficient length of time for relay 106 to release. In releasing, relay 106 removes ground from the release conductor 130 and permits line switch 101 and selectors 102 and 103 to release. After the proper interval, relays 117 and 118 release and the circuit remains in this condition until the called party hangs up. Relay 105 being held operated by the called subscriber provides a substitute ground for holding relays 125 and 116 operated which may be traced from the locking contacts of these relays over the next to the innermost left front

contact of relay 105, outer left front contact of relay 125, outer left front contact of relay 116 to ground.

When the called subscriber restores his receiver, relay 105 releases in turn releasing relays 125 and 116. With relay 105 released, the circuit of release magnet 131 is completed over off-normal contact 112, outer left back contact of relay 105, left back contact of relay 124, right back contact of relay 106, back contact of relay 104 to ground. The release magnet 131 operates and restores the connector switch to normal, opening the off-normal contacts and closing the normal contacts, in turn opening the circuit of the release magnet.

If the called party hangs up first, relay 105 alone is released since relays 125 and 116 are held operated under the control of relay 106 which is in turn held operated by relay 104. When now the calling subscriber hangs up, relay 104 releases, in turn releasing relay 106. Since relay 105 has already been released, the circuit of the release magnet is immediately closed and the switch restored. The release of relay 106 also releases relays 125 and 116.

Should the subscriber of sub-station 100 wish to call another subscriber on his own line, he will dial the directory number of that subscriber in response to which selectors 102 and 103 will be positioned and the connector will direct its brushes to the multiple terminals of the calling line appearing in its bank. Relays 118 and 117 are operated on the first pulse of the last digit as previously described. When relay 118 releases due to relay 104 remaining operated following the last digit, the previously traced circuit for relay 107 is completed. Since the called line is also the calling line, the sleeve terminal 132 will be grounded over back contact of relay 107 and through the winding of relay 124 by way of the release conductor 130 and the release conductor extending through selectors 103 and 102 and finder 101. Relay 107, will therefore, operate and lock as previously described. The operation of relay 107 will connect battery through low resistance 141, inner right front contact of relay 107, back contact of relay 118, inner left back contact of relay 116, front contact of relay 117 to sleeve brush 119, whence the circuit will be extended over terminal 132 back through the line finder and selectors 102 and 103, outer right front contact of relay 106 to the right winding of relay 124. Relays 107 and 117 being operated, the direct ground over their back contacts is removed and relay 124 operates. Relay 124 locks in a circuit from battery through its right winding, right front contact, off-normal contact 114, middle left back contact of relay 105 to ground. As soon as relay 117 closes its back contact, direct ground is again connected to the release conductor.

The operation of relay 124 completes a

circuit from battery through the right winding of relay 104, contact of No. 6 armature of relay 124 through the winding of relay 133, contact of armature No. 7 of relay 124, left winding of relay 104 to ground. Relay 133 operates in this circuit and lights lamp 134 to notify an operator that a revertive connection has been attempted. The operator then closes key 135 and informs the calling subscriber that he is attempting a call to another subscriber on his own line and must hang up his receiver in order to permit the bells to be rung. In an office where a large number of party lines are used, a phonographic device may be substituted for the operator's telephone circuit and a relay such as relay 136 which corresponds to relay 133 may start the phonographic device to give to the calling subscriber the same instructions as the operator would give. In some instances it might be possible to merely apply the busy tone to the calling line, the subscriber being informed by printed instructions the numbers for which the busy tone is a signal to restore the receiver to the switchhook temporarily to permit the bells to be rung.

When the calling subscriber restores his receiver in response to instructions, relay 104 releases closing the previously described circuit for relays 118 and 117. After an interval relay 106 releases opening the locking circuit of relay 107. With relay 106 released and relay 117 operated, ground is removed from the release conductor 130 and the switches 101, 102 and 103 permitted to release. After an interval relays 118 and 117 release. A circuit is closed from battery through the cut-off relay 108 of the subscriber's sub-station, sleeve terminal 132 and brush 119, left back contact of relay 117, left winding of relay 116, inner right back contact of relay 107, front contact of No. 5 armature of relay 124, inner left back contact of relay 117 to ground. Relay 116 operates in this circuit and locks to ground at the front contact of the No. 1 armature of relay 124. Relay 116 connects direct ground to terminal 119 holding the line busy.

As soon as relay 124 operated, it closed a circuit from battery through the winding of relay 126, front contact of the No. 4 armature of relay 124, left back contact of relay 125, interrupter 137 to ground. Relay 126 is, therefore, intermittently operated under the control of interrupter 137. When relay 116 operated, it completed a ringing circuit from ringing source 122, front contact of the No. 2 armature of relay 124, inner right back contact of relay 125, middle right front contact of relay 116 to contacts of relay 126, whence it extends alternately over the tip and ring conductors of the subscriber's line through the ringers 140 and 141, respectively, to ground. As soon as relay 126 operates, this ringing current is effective to ring the bells of

stations 150 and 100 alternately. A circuit is also prepared for relay 125 extending from battery, through the right winding and outer right back contact of relay 125, outer right
5 front contact of relay 116, over contacts of relay 126 to the opposite conductor to that to which ringing current is being applied.

When the called party answers, the ringing circuit is connected to the circuit of relay
10 125 and that relay operates and locks to ground over the No. 1 armature of relay 124. It also disconnects ringing current from the line and transfers the circuit of relay 126 from interrupter 137 to direct ground. The
15 operation of relay 125 applies talking battery to the line, the circuit extending from battery through the left winding of relay 105, outer right front contacts of relay 125 and relay 116, left front contact of relay 126, brush
20 127 to the ring conductor, back over the tip conductor to brush 128, inner right front contacts of relays 126, 116 and 125, right winding of relay 105, inner left front contact of relay 125, to ground at the front contact of
25 armature No. 1 of relay 124. Relay 105 operates in this circuit and completes a substitute holding circuit for relays 116 and 125 which may be traced from ground at the outer left front contacts of relay 116 and re-
30 lay 125, next to the inner left front contact of relay 105, to the armatures of relays 125 and 116. It also closes a locking circuit for relay 126 which holds that relay operated during the conversation. In addition it
35 opens the locking circuit of relay 124 and that relay releases disconnecting relay 133 from relay 104, opening one ground connection to the release conductor 130, the operating circuit of relay 126, the ringing circuit and the
40 first locking circuit for relays 125 and 116. Ground is still connected to release conductor 130 to mark the connector busy to other second selectors, over the inner right back contact of relay 107, left winding of relay
45 116, left back contact of relay 117, to ground at the inner left front contact of relay 116.

The subscriber at sub-station 100 hearing the cessation of ringing knows that the called subscriber has answered and also removes his
50 receiver and conversation proceeds. As long as either receiver is off the switchhook relay 105 will remain operated. When both receivers have been restored, relay 105 releases, in turn releasing relays 116, 125 and
55 126. As soon as relay 105 releases, the circuit of release magnet 131 is closed and that magnet causes the restoration of the switch to normal, opening the off-normal contacts and the circuit of the release magnet.

60 If the called subscriber fails to answer, the calling subscriber removes his receiver from the switchhook and replaces it, permitting the above described operations to take place to stop the ringing and release the connector.

65 Two supervisory circuits are provided

which operate an alarm provided they remain closed an unusual length of time. One of these circuits is used to indicate that the calling subscriber has not restored his re-
70 ceiver to the switchhook within a reasonable length of time following the restoration of the receiver by the called party. The other circuit indicates that the called party has not hung up within a reasonable length of time following the hanging up of the calling sub-
75 scriber. It will be remembered that the calling line holds relays 104 and 106 operated, in turn holding relays 125 and 116 operated and that the called line holds relay 105 operated. Therefore when the called subscriber fails
80 to hang up, a circuit is completed from the alarm over the outer left contact of relay 126, outer left front contact of relay 105, left back contact of relay 124, back contact of relay 106, back contact of relay 104 to ground.
85 When the called subscriber hangs up, releasing relay 105, this circuit is opened.

When the calling subscriber fails to hang up, a circuit will be closed from the alarm over inner left back contact of relay 105, outer
90 left front contact of relay 125, outer left front contact of relay 116 to ground. When the calling party hangs up, releasing relay 104, relay 106 will be released opening the locking circuit of relays 125 and 116 and this
95 supervisory circuit will be opened.

What is claimed is:

1. In a telephone system, subscribers' lines including party lines, a connector switch, means for extending a connection from a call-
100 ing one of said party lines to said connector, means in said connector for completing said connection to a called line, means for testing whether said line is busy or idle, and means in said connector operated in conjunction
105 with said testing means when the calling and called parties are both on the same line to permit the release of said connection extending means while maintaining said connector in connection with said line.
110

2. In a telephone system, subscribers' lines including party lines, a connector switch, means for extending a connection from a
115 calling one of said party lines to said connector, means in said connector for completing said connection to a called line, means for giving instructions to the calling subscriber, and means in said connector operated when the calling and called parties are both on the
120 same line to associate with said line said means for giving instructions to the calling subscriber.

3. In a telephone system, subscribers' lines including party lines, a connector switch, means for extending a connection from a call-
125 ing one of said party lines to said connector, means in said connector for completing said connection to a called line, an operator's telephone circuit, and means in said connector operated when the calling and called
130

parties are both on the same line to associate said operator's telephone circuit with said line for instructing the calling subscriber how to proceed to permit the completion of the connection.

4. In a telephone system, subscribers' lines including party lines, a connector switch, means for extending a connection from a calling one of said party lines to said connector, means in said connector for completing said connection to called subscriber's line, means for giving instructions, means in said connector operated when the calling and called subscribers are both on the same line to associate said instructing means with said line to instruct the calling subscriber to restore his receiver to permit signaling to take place, and means operated following the restoration of the receiver to the switchhook to release said connection extending means and to retain said connector in connection with said line.

5. In a telephone system, subscribers' lines including party lines, a connector switch, means for extending a connection from a calling one of said party lines to said connector, means in said connector for completing said connection to a called subscriber's line, means for giving instructions, means in said connector operated when the calling and called subscribers are both on the same line to associate said instructing means with said line to instruct the calling subscriber to restore his receiver to permit signaling to take place, means operated following the restoration of the receiver to the switchhook to release said connection extending means and to retain said connector in connection with said line, and means to apply ringing current alternately to the tip and ring of said line over the brushes of said connector to ring the bells of both parties on said line.

6. In a telephone system, subscribers' lines including party lines, a connector switch, means for extending a connection from a calling one of said party lines to said connector, means in said connector for completing said connection to a called line, means to test whether said line is busy or idle, a relay in said connector operated in conjunction with said testing means when the calling and called subscribers are both on the same line, and means under the control of said relay to permit the release of said connection extending means while maintaining said connector in connection with said line.

7. In a telephone system, a party line, a connector switch, other switching means for extending a connection from said line to said connector, multiple terminals for said line appearing before said connector, a third terminal associated with said line terminals, a release conductor connected with said third terminal and extending through said switching means to said connector, means to position the brushes of said connector on the terminals of said line, a relay in said connector operated over said release conductor in a circuit completed over said third terminal by said connector, means for giving instructions, means under the control of said relay to associate said instructing device with said line to instruct the calling subscriber to restore his receiver to permit signaling to take place, and means operated following the restoration of the receiver to the switchhook to release said connection extending means

tion the brushes of said connector on the terminals of said line, a relay in said connector operated over said release conductor in a circuit completed over said third terminal by said connector, and means under the control of said relay to release said switching means while maintaining the brushes of said connector in position on the terminals of said line.

8. In a telephone system, a party line, a connector switch, other switching means for extending a connection from said line to said connector, multiple terminals for said line appearing before said connector, a third terminal associated with said line terminals, a release conductor connected with said third terminal and extending through said switching means to said connector, means to position the brushes of said connector on the terminals of said line, a relay in said connector operated over said release conductor in a circuit completed over said third terminal by said connector, means for giving instructions to a subscriber, and means under the control of said relay to associate with said line said means for giving instructions.

9. In a telephone system, a party line, a connector switch, other switching means for extending a connection from said line to said connector, multiple terminals for said line appearing before said connector, a third terminal associated with said line terminals, a release conductor connected with said third terminal and extending through said switching means to said connector, means to position the brushes of said connector on the terminals of said line, a relay in said connector operated over said release conductor in a circuit completed over said third terminal by said connector, an operator's telephone circuit, and means under the control of said relay to associate said telephone circuit with said line for giving instructions to the calling subscriber.

10. In a telephone system, a party line, a connector switch, other switching means for extending a connection from said line to said connector multiple, terminals for said line appearing before said connector, a third terminal associated with said line terminals, a release conductor connected with said third terminal and extending through said switching means to said connector, means to position the brushes of said connector on the terminals of said line, a relay in said connector operated over said release conductor in a circuit completed over said third terminal by said connector, means for giving instructions, means under the control of said relay to associate said instructing device with said line to instruct the calling subscriber to restore his receiver to permit signaling to take place, and means operated following the restoration of the receiver to the switchhook to release said connection extending means

without releasing the brushes of said connector from the multiple terminals of said line.

11. In a telephone system, a party line, a
5 connector switch, other switching means for
extending a connection from said line to said
connector, multiple terminals for said line
appearing before said connector, a third ter-
10 minal associated with said line terminals, a
release conductor connected with said third
terminal and extending through said switch-
ing means to said connector, means to posi-
tion the brushes of said connector on the ter-
15 minals of said line, a relay in said connector
operated over said release conductor in a cir-
cuit completed over said third terminal by
said connector, means for giving instruc-

tions, means under the control of said relay
to associate said instructing means with said
line to instruct the calling subscriber to re- 20
store his receiver to permit signaling to take
place, means operated following the restora-
tion of the receiver to the switchhook to re-
lease said connection extending means and to
retain the brushes of said connector on the 25
multiple terminals of said line, and means
to apply ringing current alternately to the
tip and ring of said line over the brushes of
said connector to ring the bells of both par-
ties on said line. 30

In witness whereof, I hereunto subscribe
my name this 4th day of August, A. D. 1926.

LEE R. WALLER.