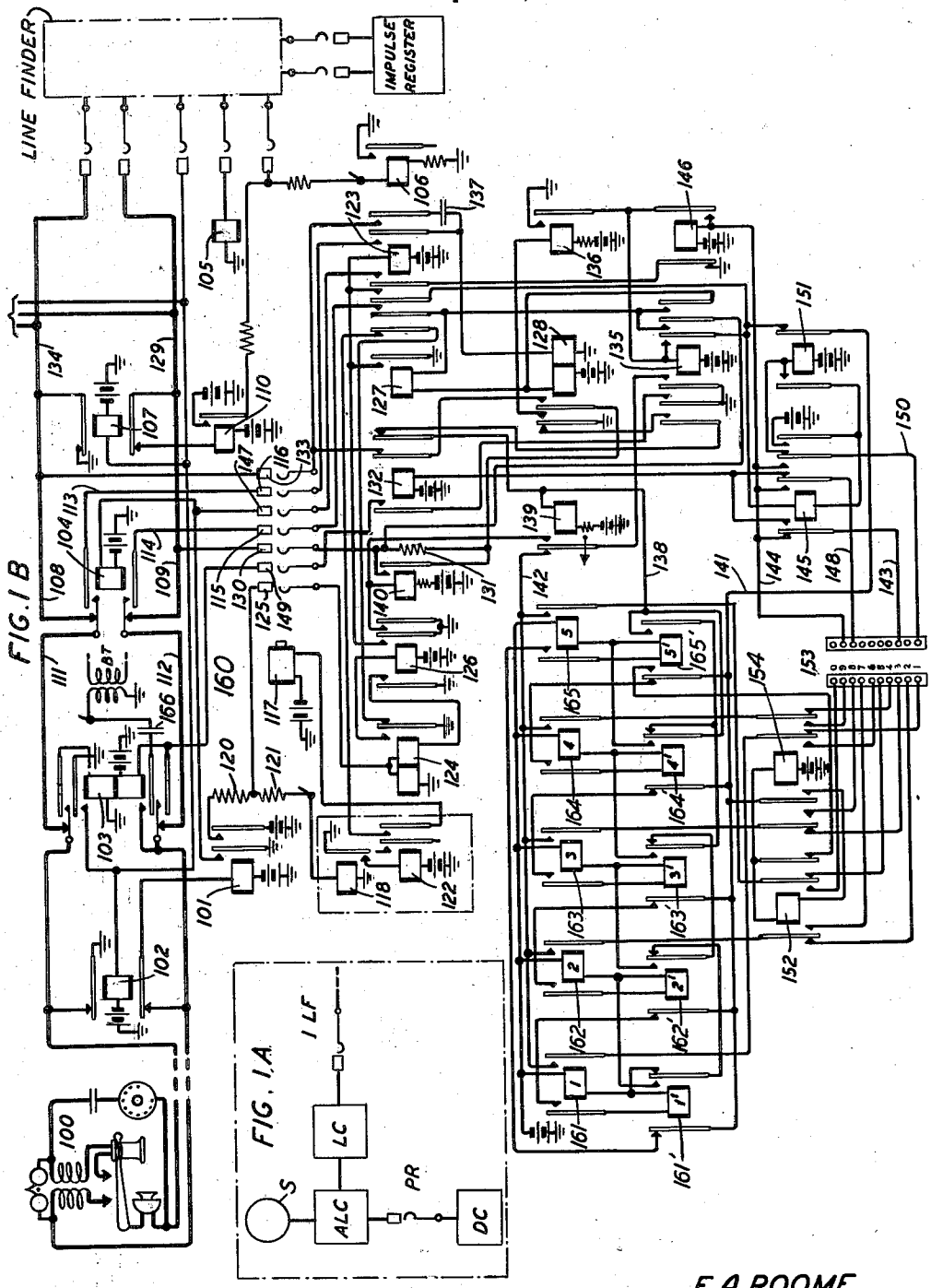
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TELEPHONE SYSTEM

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TELEPHONE SYSTEM

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This invention relates to automatic or semi-automatic telephone systems and particularly to central offices in which subscribers' lines are arranged in groups or classes according to the character of service to which the lines in each of said classes are entitled. The object of the invention is to provide improved means for discriminating between different classes of subscribers for the purpose of restricting, blocking or passing calls initiated by calling subscribers in each of the several classes, all in accordance with the character of service allotted to each of the calling line classes.

As is well known in present day telephone systems, there is considerable diversity in the lines of an office with respect to their class or character and the kind of service each of said classes is to be accorded. Some of the lines, for instance, may be provided with coin boxes at the subscribers' stations and, in serving each of such lines, the central office automatic equipment must be provided with means for collecting the coin if the connection is completed or to return the coin if the connection is not completed. Another class of lines may involve the writing of a charge ticket by the operator to whose position said line is routed by the automatic apparatus before the call is completed; yet another class may require the automatic operation of the subscriber's message register a plurality of times on a toll call requiring no ticket and completed by automatic switches, and still another class of lines may be given a so-called flat rate and in that case the switching selectors which complete the call are not required to operate the message register at all if one is provided.

At the present time the most prevalent practice in an automatic office is to group all lines requiring different treatment in accordance with their respective classes and to assign a separate group of line-extending switches to each class, each of said groups of switches containing necessary means for extending, blocking or rerouting calls originated by lines in each of said groups as called for by the character of the service to which the group is entitled.

Now one of the features of this invention is a circuit arrangement for an automatic or semi-automatic or like telephone system comprising different classes of subscribers in which a call discriminating circuit is directly associated with line circuits of subscribers of a particular class so as to permit the use of the same kind of line-extending equipment for all classes thereby facilitating maintenance routines and otherwise improving the efficiency of the central office.

Another feature of the invention comprises a circuit arrangement for an automatic telephone or semi-automatic telephone system comprising subscribers entitled to restricted service and unrestricted service respectively in which the subscribers of the different classes are served by the same connecting equipment and in which discrimination for calls initiated by restricted subscribers and unrestricted subscribers is determined by a digit or digits dialed.

A further feature comprises a circuit arrangement for an automatic or semi-automatic telephone system in which the class of service desired by a calling subscriber is determined by means of a discriminating circuit directly associated with his line circuit.

Another feature of the invention comprises a circuit arrangement for an automatic or semi-automatic telephone system in which subscribers' line circuits are directly associated with a discriminating circuit which determines the type of call being made by the value of a digit or digits dialed.

Yet another feature comprises a circuit arrangement for an automatic or semi-automatic telephone system in which certain subscribers are provided with an auxiliary line circuit and a normal line circuit in series, the former being associated with a discriminating circuit which determines the type of call being made by the value of a digit or digits dialed and the latter being associated with the usual line-extending switches.

A clearer conception of the scope and purpose of the invention will be obtained from a consideration of the following description taken in connection with the attached drawing in which:

Fig. 1—A shows schematically the equipment used; and

Fig. 1—B shows a discriminating circuit associated with the line circuit of a subscriber's line such as that shown in Fig. 1—A.

Referring, now, to Fig. 1—A, when a restricted subscriber S initiates a call, an auxiliary line circuit ALC, individual to the subscriber's line, is connected by a switch PR to a discriminating circuit DC. At the same time, the subscriber's line is connected via the normal line circuit LC and a line finder LF to the normal connecting equipment. One or more of the digits dialed are received by the discriminating circuit DC and are also transmitted to the exchange equipment. If the call is one to which the subscriber is entitled,

the discriminating circuit is released. If, on the other hand, the call is one to which the subscriber is not entitled, the partly set up connection is broken down, the discriminating circuit is released, a special tone is transmitted to the subscriber and the subscriber's line circuit is locked out of action by a relay in the auxiliary line circuit which remains operated over the subscriber's loop.

Referring, now, to Fig. 1—B, when the subscriber 100 initiates a call, the line relay 101 in the auxiliary line circuit operates over a circuit extending from ground on the top contacts of relay 102, subscriber's loop, bottom contacts of relay 102, winding of relay 101, battery and ground. Relay 101 closes an obvious circuit for relay 104 which, in operating, disconnects conductors 111 and 112 from conductors 108 and 109 respectively, which latter conductors extend to the regular line circuit, and connects the former to conductors 113 and 114 respectively, which, in turn, extend to terminals 115 and 116 of the switch 160 of the discriminating circuit. The operation of relay 101 also completes a circuit for relay 118 extending from ground and battery through the outer contacts of relay 101, resistances 120 and 121, winding of relay 118 to ground. Relay 118 operates, in turn operating relay 122 which closes the circuit of all switch magnets 117 of all idle discriminating switches, one of said circuits being from battery through the winding of switch magnet 117 of switch 160, outer contacts of relay 122, left outermost contacts of relay 123, back contacts of relay 124 to ground. When a switch, such as switch 117, reaches the terminals of the calling line, the corresponding test relay 124 operates over a circuit extending from ground and battery on the contacts of relay 101, resistance 120, bank terminal 125, left winding of relay 124 to ground. Relay 124 operates, opens the circuit of switch magnet 117 thus arresting the further movement of the switch, and closes an obvious circuit for relay 126. Relay 126 operates and closes a holding circuit for relay 124 through its right winding and previously traced circuit to battery through the contacts of relay 101. Relay 126 further closes an obvious circuit for relay 123 which latter relay, in operating, closes a circuit for relays 127 and 128 over the subscriber's loop as follows: ground and battery through the left winding of relay 128, winding of relay 127, left next-to-the-outer set of contacts of relay 123, bank terminal 115 and cooperating switch brush, conductor 114, bottom front contacts of relay 104, conductor 112, bottom normal contacts of relay 103, subscriber's loop, to ground on the top contacts of relay 102. Relays 127 and 128 operate in the above circuit, the former closing a locking circuit for relay 123 and the latter closing a circuit loop for the regular line relay 110 as follows: ground and battery through the winding of relay 110, bottom contacts of relay 107, bank terminal 130 and cooperating brush, resistance 131, inner contacts of relay 128, right inner contacts of relay 132, bank terminal 133 and cooperating brush to ground on the top contacts of cut-off relay 107. Relay 128 further closes an obvious circuit for relay 136, which, on operating, closes an obvious circuit for relay 135 which operates to perform functions noted hereinafter. The operation of relay 110 in turn energizes the common start relay 106 thereby initiating the operation of circuits which cause the connection of a line-finder and impulse register to the line in the well known manner, said line-finder and register being but schematically shown in the drawing. The connection of the line-finder switch to the line terminals then causes the operation of the regular cut-off relay 107 and auxiliary circuit cut-off relay 102 over a circuit from ground in the line-finder circuit (not shown), line-finder switch brush and cooperating bank terminal, winding of relay 107 to battery and ground and in parallel therewith, winding of relay 102 to battery and ground. Both of these relays operate, the former causing the release of the regular line relay 110 and the latter the release of auxiliary line relay 101. Dial tone is now transmitted to the subscriber's line from the register (not shown), through a line-finder brush and cooperating bank terminal, conductor 134, terminal and brush 133, right outer contacts of relay 123, condenser 137, right inner contacts of relay 123, terminal 116 and cooperating brush, top front contacts of relay 104, top normal contacts of relay 103, subscriber's loop bottom normal contacts of relay 103, bottom front contacts of relay 104, terminal 115 and cooperating brush, left next-to-the-outer set of contacts of relay 123, right middle contacts of relay 135, terminal 130 and cooperating brush, conductor 109, through a line-finder brush and bank terminal to the tone circuit in the register. The calling subscriber, upon receiving tone, dials the first digit and, at each impulse of said digit, relay 128 in the discriminating circuit releases. At each impulse, the loop to the regular exchange equipment is opened at the left inner contacts of relay 128, thus repeating the impulses forward in the well known manner. In addition, at each impulse, a circuit is completed from ground on the back contacts of relay 128, left outer contacts of relay 135, right outer contacts of relay 132, winding of slow-release relay 139 to battery and, in parallel therewith, through the right back contacts of counting relay 164', right back contacts of counting relay 163', right back contacts of counting relay 162', right back contacts of counting relay 161', winding of relay 161 to battery and ground. Relay 161 operates and closes its contacts the left set of which locks relay 161 through the winding of relay 161' and establishes a short circuit for relay 161' over the left contacts of relay 161, left back contacts of relay 162', conductor 141, right contacts of relay 151, left next-to-the-inner set of contacts on relay 123 to ground on the inner contacts of relay 127; this ground also providing a locking ground for all other sets of counting relays. Slow-release relay 139 operates in parallel with relay 161 so that a circuit is closed for relay 140 extending from ground and battery through the winding of said relay, front contacts of relay 139, to ground on the left inner contacts of relay 135. Relay 140 operates and closes its contacts to short circuit resistance 131 during the forward transmission of the repeated impulses. When relay 139 releases at the end of the impulse of the right digit if the digit dialed is a one, ground is connected from the left inner contacts of relay 135, back contacts of relay 139, right contacts of relay 161, right inner back contacts of relay 154 to the No. 1 terminal on cross-connecting block 153.

If the digit dialed comprises two impulses, then two sets of counting relays will be successively operated, namely the 161—161' set and the 162—162' set, whereupon, at the termination of the impulses, the counting relays 161 and 161' will release because their locking circuit is opened

at the left contacts of relay 162' and the ground previously traced to the right contacts of relay 161 is now extended to the right contacts of relay 162, left back contacts of relay 152, to the No. 2 terminal of cross-connecting block 153. Similarly if the digit dialed comprises three impulses, the counting relay sets 161—161', 162—162', 163—163' are successively operated, the sets of relays 161—161', 162—162' are released and the ground is extended over the front contacts of relay 163, left outer back contacts of relay 154 to the No. 3 terminal of cross-connecting block 153. A digit of four impulses causes counting relay sets 161—161', 162—162', 163—163', 164—164' to be successively operated and relay sets 161—161', 162—162' and 163—163' to be released, and the ground to be extended over the front contacts of relay 164, right outer back contacts of relay 154, to the No. 4 terminal of the above mentioned cross-connecting block while a digit of five impulses causes the successive operation of relay sets 161—161' to 165—165', inclusive, the release of relay sets 161—161' to 164—164' inclusive, and the connection of ground over the front contacts of relay 165, right inner back contacts of relay 152, to the No. 5 terminal of the cross-connecting block.

If the first digit consists of more than five impulses, then the sixth impulse will cause the second operation of relay 161 in a circuit extending over the right contacts of relay 165', right back contacts of relay 163', right back contacts of relay 162', right back contacts of relay 161', winding of relay 161 to battery and ground. At the same time a circuit is closed from ground and battery through the winding of relay 154, right outer back contacts of relay 152, left front contacts of relay 165' to ground on conductor 141. Relay 154 operates and closes a locking circuit through the winding of relay 152, left inner contacts of relay 154 to ground on conductor 141. Relay 152 is prevented from operating at this time, however, by virtue of a short-circuiting ground through its right outer contacts and left front contacts of relay 165'. When, however, the impulse is terminated, relay 161' operates, relay 165' releases since the locking ground of relays 165 and 165' is controlled through the left contacts of relay 161', and relay 152 operates in series with relay 154. The conductors from each of the set of counting relays are now switched over the front contacts of relays 154 and 152 from the terminals 1 to 5 to the terminals 6 to 0 on the cross-connecting block. Thus, for each digit from 1 to 0, a corresponding terminal is grounded on the left terminals of the cross-connecting block 153 and which may be suitably extended to the right terminals of said block in accordance with the character of the service characterized by said digit to the appropriate terminal on the right side of cross-connecting block 153.

If the first digit has a value which determines that the call is of the non-restricted type, the grounded terminal on the left side of connecting block 153 representing this digit is strapped to conductor 143 which, over the left back contacts of relay 145, extends to the winding of relay 146, or is strapped to conductor 144 which is connected directly to the winding of relay 146.

It will be observed that relay 104 has been maintained operated over a circuit extending through terminal 147 and cooperating brush, left inner contacts of relay 123, to ground on the back contacts of relay 146. The operation of relay 146 as a result of the dialing of a digit indicating non-restricted service, releases relay 104 so that the loop to the discriminating circuit is opened and the discriminating circuit is released in the manner described hereinafter. The line circuit is now connected through the normal contacts of relay 104 direct to the exchange equipment and the remaining digits are transmitted thereto in the normal manner.

If the digit dialed is one which characterizes a restricted service call, then the grounded terminal on the left side of connecting block 153 representing this digit is strapped to conductor 148 which, over the right inner back contact of relay 145, extends to the winding of relay 132. Relay 132 operates and on its right inner contacts, opens the loop to the exchange equipment while ground is connected through the left middle contacts of relay 135, left contacts of relay 132, terminal 149 and cooperating brush, bottom winding of relay 103 to battery and ground. Relay 103 operates, locks in a circuit extending from ground through its top winding and top outer front contacts, subscriber's loop, bottom outer front contacts of relay 103, lower winding of relay 103 to battery and ground; operates cut-off relays 102 and 107 and transmits busy tone to the subscriber in a parallel circuit to that of relay 103 extending from ground through the left winding of the source of tone coil BT, condenser 166, bottom inner contacts of relay 103, subscriber's loop and thence as traced to ground through the top winding of relay 103. By the operation of relay 103, the subscriber's loop is disconnected from the discriminating circuit which now releases as described hereinafter, busy tone is connected to the subscriber's loop and the cut-off relays 102 and 107 are held operated. The discriminating circuit and the exchange equipment already taken into use are released.

If the value of the first digit is such that the type of service is not determined until the second digit is dialed and received, then the grounded terminal on the left side of connecting block 153 denoting this class of service is strapped to conductor 150 which, over the right middle back contacts of relay 145, extends to the winding of relay 151, causing this relay to operate. Relay 151 opens the locking circuit of the counting relays through its right contacts while the counting relays, in releasing, open the operating circuit of relay 151. This relay, however, does not release because it is now held in series with relay 145 over a circuit from ground and battery through the winding of relay 151 and left contacts, winding of relay 145, left next-to-the-inner contacts of relay 123 to ground on the contacts of relay 127, relay 145 being held short circuited in the meanwhile by the operating ground for relay 151 so long as the counting relays remain operated. When the counting relays release, relay 145 also energizes and locks. Relay 145, in operating disconnects conductor 143 from relay 146, connects it to the winding of relay 132, disconnects conductor 148 from the winding of relay 132, connects it to the winding of relay 146, further disconnects conductor 150 from the winding of relay 151 and connects it to the winding of relay 146, and short circuits relay 151 which now releases. The impulses of the digit are now received on the counting relays. When relay 139 again releases at the end of the series of impulses of the second digit, the ground on the cross-connecting terminal either causes the operation of relay 132 or relay 146 according to the type of call which the subscriber is making. If relay 146 is operated,

indicating thereby that the subscriber is entitled to make the call, relay 104 is released, permitting the call to be completed in the normal manner. If, on the other hand, service is to be denied, relay 132 is operated, the connection is broken down, busy tone is transmitted to the calling subscriber and the line circuit is locked out of action until the receiver is restored.

If service is denied to a subscriber as is evidenced by the operation of relay 103 and the consequent operation of cut-off relays 102 and 107, relay 107 releases relay 110 in turn releasing relay 106, the release of which then causes the disconnections of the exchange equipment in the normal manner. The release of relay 101 releases relays 118, 122 and 124. Relay 124 releases relay 126, which, in turn, releases relay 140. When the subscriber restores his receiver, the loop holding relays 127 and 128 is opened causing these relays to release. The release of relay 127 causes the release of relay 123, opens the locking ground to the counting relays causing them as well as all other relays holding to conductor 141 to release. The release of relay 128 causes the release of relay 136 and the consequent release of relays 135 and 146 thereby restoring the discriminating circuit to normal. The restoration by the subscriber also unlocks relay 103, removes busy tone from the line and releases the cut-off relays 102 and 107.

If the call is to be completed in the normal manner, the release of relay 101 causes the release of that portion of the circuit which depends on the operated condition of this relay as already described while the release of relays 104 opens the loop of relays 127 and 128 causing the disconnection of the remainder of the circuit also as already described.

What is claimed is:

1. In an automatic or semi-automatic telephone system, subscribers' lines entitled to different classes of service, and a discriminating circuit for said lines comprising means responsive to the initiation of a call by one of said lines for connection with said line, and means for determining the class of service to which said calling line is entitled.

2. In an automatic or semi-automatic telephone system, a group of subscribers' lines entitled to restricted service, another group of subscribers' lines entitled to unrestricted service, a discriminating circuit for both of said groups of lines comprising means responsive to the initiation of a call by a line in the associated group for operatively connecting said discriminating circuit to said line, line-extending switches common to both of said groups and responsive to said connection between said calling line and said discriminating circuit for extending said line to one of said line-extending switches, and means in said discriminating circuit responsive to the value of a discriminating digit or digits for disconnecting said discriminating circuit from said calling line without impairing the connection between said line and said line-extending switch.

3. In an automatic telephone system, subscribers' lines entitled to different classes of service, each of said lines being equipped with an impulse sender, a line circuit associated with each of said lines, and a discriminating circuit operably associable with each of said line circuits when the associated line is calling, said discriminating circuit containing impulse responsive means for determining the class of service to which said line is entitled by the predetermined value of an impulse series or a plurality of impulse series transmitted from said calling line.

4. In an automatic telephone system, a subscriber's line having a dial, said line being entitled to one class of service, an auxiliary line circuit for said line, and a discriminating circuit operably associable with said auxiliary line circuit containing impulse responsive means for determining the class of service to which said line is entitled by the value of a digit or digits dialed.

5. In an automatic or semi-automatic telephone system, a calling line having impulse sending means, a line-extending switch, a discriminating circuit, means responsive to the initiation of a call by said line for operatively connecting said discriminating circuit to said line, means in said discriminating circuit responsive to said connection for operatively connecting said line to said line-extending switch, and means in said discriminating circuit responsive to impulses initiated from said calling line whereby said impulses are registered in said discriminating circuit and repeated to said line-extending switch.

6. In an automatic or semi-automatic telephone system, a calling line equipped with an impulse sender, a line-extending switch, a discriminating circuit, means responsive to the initiation of a call by said line for operatively connecting said discriminating circuit to said line, means in said discriminating circuit responsive to said connection for operatively connecting said line-extending switch to said line, means in said discriminating circuit responsive to impulses transmitted from said calling line for registering said impulses and repeating them forward to said line-extending switch, and means in said discriminating circuit responsive to a predetermined series of impulses of a digit or digits for releasing said discriminating circuit without disturbing the extension of said calling line to said line extending switch.

7. In an automatic or semi-automatic telephone system, a calling line equipped with an impulse sender, a line-extending switch, a discriminating circuit, means responsive to the initiation of a call by said line for operatively connecting said discriminating circuit to said line, means in said discriminating circuit responsive to said connection for operatively connecting said line-extending switch to said line, means in said discriminating circuit responsive to impulses transmitted from said calling line for registering said impulses and repeating them forward to said line-extending switch, and means in said discriminating circuit responsive to a predetermined series of impulses for a digit or digits indicative of a connection to which the calling line is not entitled for transmitting a distinctive signal to said calling line.

8. In an automatic or semi-automatic telephone system, a calling line equipped with an impulse sender, a line-extending switch, a discriminating circuit, means responsive to the initiation of a call by said line for operatively connecting said discriminating circuit to said line, means in said discriminating circuit responsive to said connection for operatively connecting said line-extending switch to said line, means in said discriminating circuit responsive to impulses transmitted from said calling line for registering said impulses and repeating them forward to said line-extending switch, means in said discriminating circuit responsive to a predetermined series of impulses for a digit or digits indicative of a connection to which the calling line is not en-

titled for transmitting a distinctive signal to said calling line, and means in said discriminating circuit responsive to the registration of said impulse series for initiating a breakdown of the partially set-up connection between said calling line and said line-extending switch.

9. In an automatic or semi-automatic telephone system, a calling line circuit equipped with an impulse sender, a relay in said line circuit, a line-extending switch, a discriminating circuit, means responsive to the initiation of a call by said line for operatively connecting said discriminating circuit to said line, means in said discriminating circuit responsive to said connection for operatively connecting said line-extending switch to said line, means in said discriminating circuit responsive to impulses transmitted from said calling line for registering said impulses in said discriminating circuit and repeating them forward to said line-extending switch, and means responsive to a predetermined series of impulses for a digit or digits indicative of a connection to which the calling line is not entitled for operating said relay to lock said calling line out of service so long as the receiver of said line is off the switchhook.

10. In an automatic or semi-automatic telephone system comprising different classes of lines, a line circuit for each of said lines, and a discriminating circuit for all of said classes capable of operable connection with any line circuit in any of said classes when an associated line initiates a call for automatically extending said line if entitled to make the call and for automatically signaling said line if not entitled to make the call.

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