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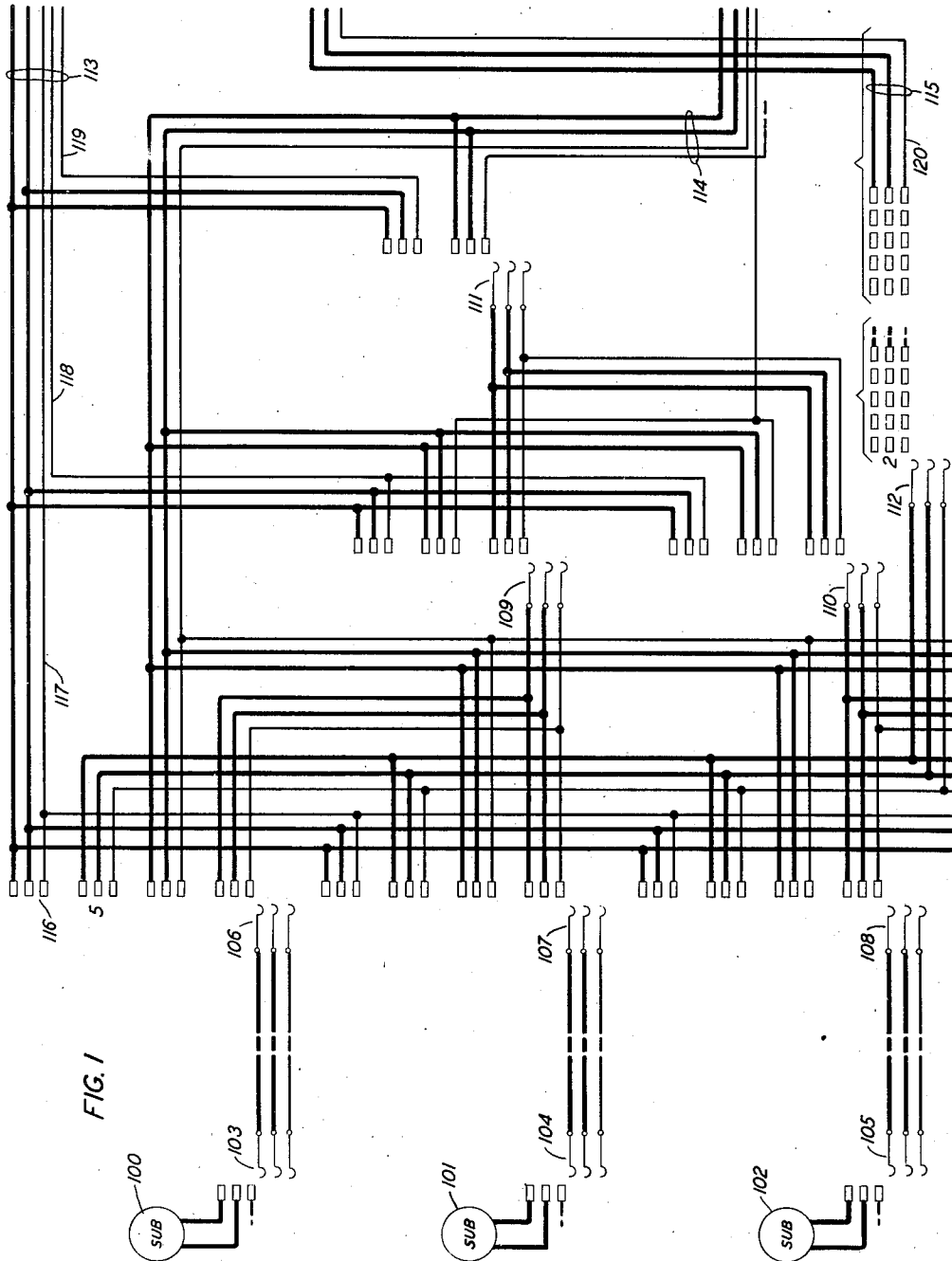
L. J. SCOTT

2,327,466

AUTOMATIC TOLL TICKETING SYSTEM

Filed June 27, 1942

3 Sheets-Sheet 1



INVENTOR
L. J. SCOTT
BY
P. C. Smith
ATTORNEY

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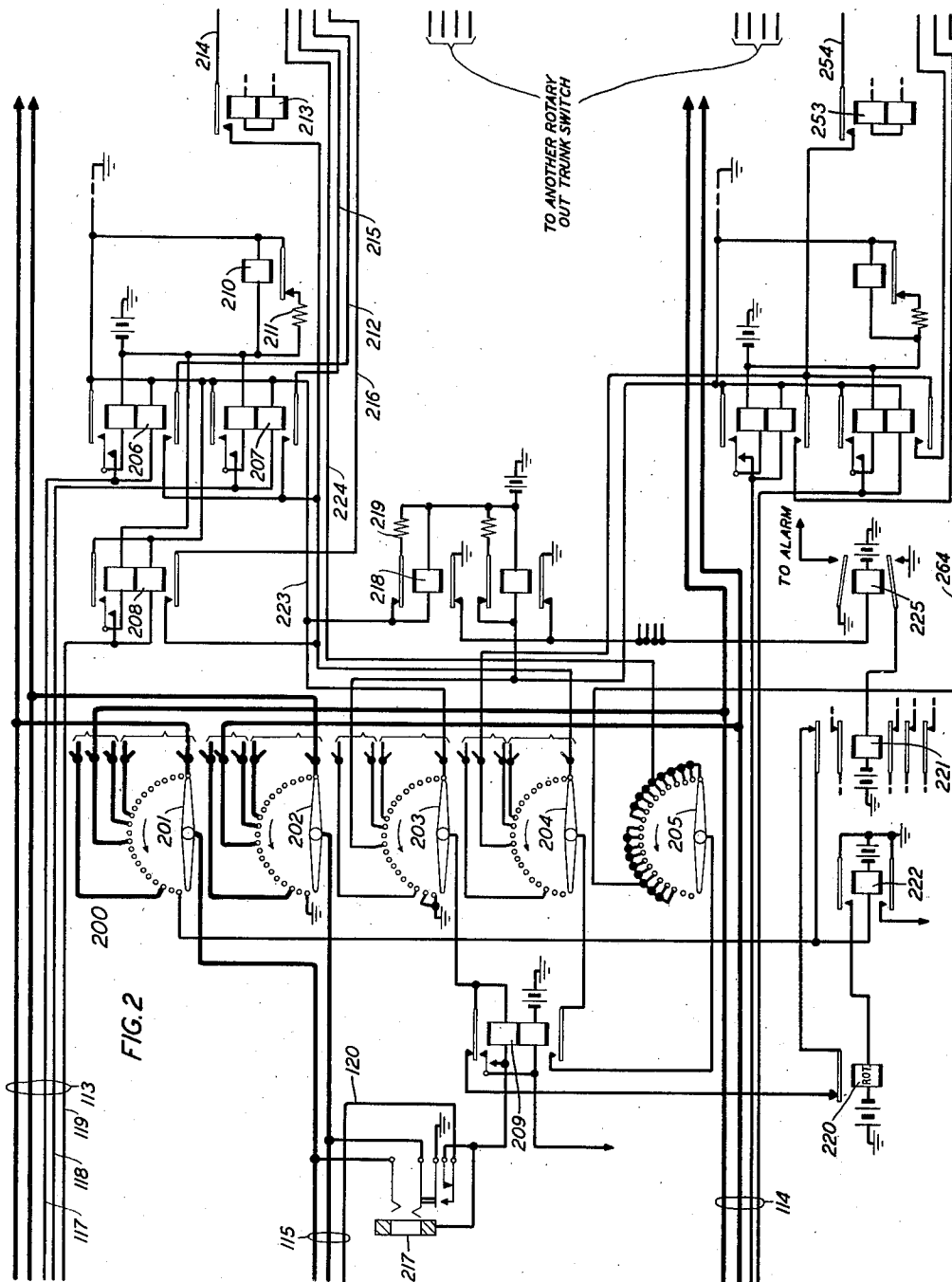
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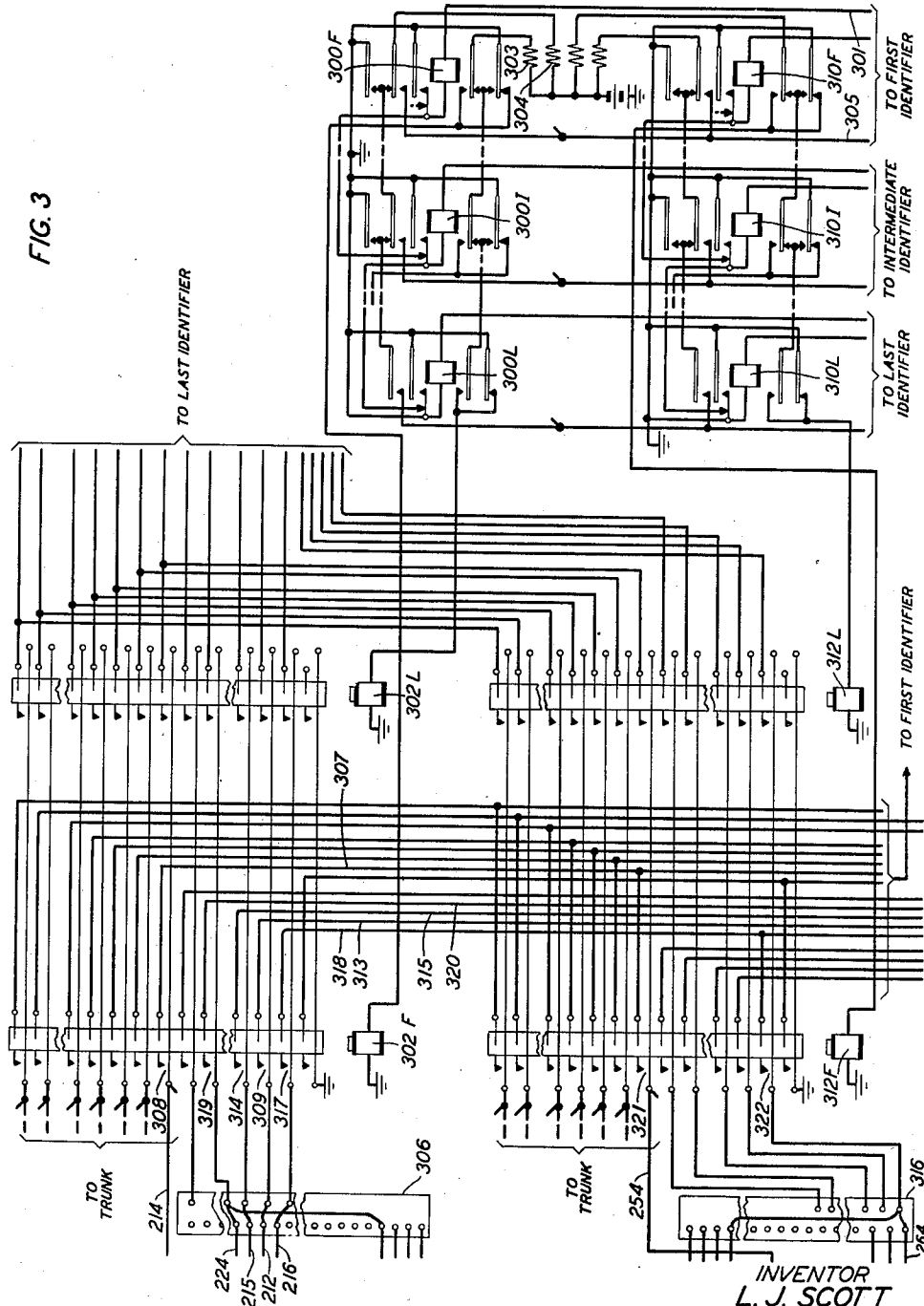
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INVENTOR
L. J. SCOTT

BY
P. C. Smith

ATTORNEY

UNITED STATES PATENT OFFICE

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AUTOMATIC TOLL TICKETING SYSTEM

Lyle J. Scott, Chatham, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application June 27, 1942, Serial No. 448,785

3 Claims. (Cl. 179-18)

This invention relates to a telephone system and more particularly to an out-trunk secondary switch circuit for distributing calls to a group of outgoing trunks. The invention is more specifically applicable to an automatic ticketing system of the type disclosed in the application of J. W. Gooderham, Serial No. 448,782, filed concurrently herewith.

In the system disclosed therein provisions are made whereby subscribers may secure connections to the nearby toll area by dialing. This is accomplished by the provision of a group of automatic ticketing trunks each provided with a ticket printer, to an idle one of which a calling subscriber may secure a connection by dialing one, two or three digits or letters of the office designation of a subscriber's line which terminates in an office of the nearby toll area and from which trunk a connection is extended by selector switch equipment. The selector switch equipment by which connections are extended from ticketing trunks is controlled by senders, an idle one of which is associated with a trunk by a trunk finder individual to the sender when the trunk is taken for use. The sender is also equipped to control the ticket printer to print the office code and numerical digits of the calling line number, the office code and numerical digits of the called line number and to print other information required on the toll ticket. It is therefore essential to reconstruct the office code digits which a subscriber dials to extend a connection to a ticketing trunk and to identify the calling line. For this purpose a plurality of identifiers is provided, an idle one of which is associated with a sender over an identifier-connector following the seizure of the sender and which identifier is then connected with the calling trunk over a trunk-identifier-connector circuit.

For giving automatic ticketing service two main groups of one hundred trunks each may be provided, each main group being divided into five subgroups of twenty trunks each and each of said subgroups being further divided into two or more smaller subgroups. To associate an identifier with a trunk in a main group of one hundred trunks five trunk-identifier-connector circuits are provided, each circuit serving to connect twenty trunks with an identifier. Each of the trunks may be terminated in a bank level of a first selector or a bank level of a second selector or a bank level of a third selector, or may have branches terminating in bank levels of first, second and third selectors.

In some cases where the traffic to a particular office in the toll area is not great, a full selector bank level having access to ten trunks may not be necessary. It is then possible through the use of a divided level selector of the type disclosed in Patent No. 2,249,067, granted July 15, 1941 to P. W. Wadsworth to provide access to two groups of trunks over which connections may be secured to different terminating offices. In order, however, that on such calls a wider choice of automatic ticketing trunks may be secured, the trunks of each group outgoing from the divided bank level terminate in rotary out-trunk secondary switches, one group of such switches having access to a maximum of twenty of the automatic ticketing trunks and the other group of such switches having access to a maximum of twenty other ticketing trunks.

Each ticketing trunk is provided with a sleeve relay connected to the sleeve conductor of each bank level appearance of the trunk in first, second or third selector banks or in the bank of a divided level selector and these relays control the establishment of signaling circuits over code leads extending from the trunk to the identifier over contacts of the operated trunk-identifier-connector, there being one such code lead for each office route which may be completed over the trunk. Those code leads are employed to assist the identifier in reconstructing the office code digits of a wanted line dialed by a subscriber to seize a ticketing trunk. If one such code lead were provided for all twenty of the ticketing trunks accessible to a rotary out-trunk switch for a particular route and all twenty of such trunks were connectable to an identifier over the same trunk-identifier-connector, it would be impossible to complete the connection to such route should the single trunk-identifier-connector fail to operate.

It is the object of the present invention to guard against this possible failure by dividing the twenty trunks accessible to an out-trunk secondary switch into two or more smaller subgroups each subgroup of trunks being associable with an identifier over a different trunk-identifier-connector, by providing access to each subgroup of trunks over different portions of the banks of the out-trunk switch and by providing an additional bank on the out-trunk switch over the separate portions of which code leads, each relating to the same office route, may be extended to the identifier over different trunk-identifier-connectors.

As illustrated, a subscriber desiring a connec-

tion to a line terminating in an office of a nearby toll area which may be reached over a ticketing trunk by setting a first selector, a divided level second selector and a rotary out-trunk switch by dialing the three code letters of the office designation of the calling line, first removes his receiver from the switchhook whereupon an idle line finder, paired with a first selector, is started in search of the calling line. When the line has been found the usual dial tone is transmitted to the calling line and the subscriber hearing the tone then proceeds to dial the office code digits or letters and numerical digits of the wanted line number. In response to the dialing of the first code digit, a first selector is operated to select an idle trunk extending to an idle selector of the divided level type which has access to a ticketing trunk through a rotary out-trunk secondary switch and, in response to the dialing of the second or the second and third code digits of the office designation this selector is operated to select an idle trunk terminating in an out-trunk secondary switch. The out-trunk secondary switch normally stands in engagement with the terminals of an idle ticketing trunk and therefore when the out-trunk switch is seized a connection is extended from the calling line to the idle ticketing trunk.

Upon the seizure of the ticketing trunk an idle sender is associated with the trunk and the sleeve relay of the trunk, which is allocated to the out-trunk switch and to the bank level appearance of the trunk incoming thereto from the preceding selector, is operated preparatory to establishing a code signaling circuit to the identifier. The sender following its seizure establishes a connection with an idle identifier which, in turn, becomes associated with the seized ticketing trunk over a trunk-identifier-connector through the operation of a multicontact relay of the connector which has access to the subgroup of trunks in which the calling trunk is located and by the operation of a connecting relay in the trunk. The code signaling circuit prepared by the sleeve relay of the trunk is then completed over two banks of the out-trunk secondary switch and is extended to the identifier to give the identifier information regarding the office code digits which the calling subscriber has dialed to reach the trunk. If all three office code digits were dialed to reach the trunk all of the required information may be given to the identifier over the code leads but if but two office code digits were dialed to reach the trunk and the third code digit was registered in the register associated with the trunk, then information concerning the first two code digits is given to the identifier over the code lead and the setting of the trunk register which is transferred to the identifier over circuits established through the trunk-identifier-connector supplies the identifier with information concerning the third code digit dialed. The combination of this information may then be employed to inform the sender as to the complete office designation of the called line.

The invention having been described in a general manner, reference may be had to the following detailed description thereof taken in connection with the accompanying drawings, in which:

Fig. 1 shows schematically calling lines, line finders, and trains of first, second and third selectors for extending connections from a calling line to automatic ticketing trunks two of which are illustrated, and a selector switch of the type

having access over a divided bank level to two groups of outgoing trunks;

Fig. 2 shows a rotary out-trunk secondary switch in accordance with the present invention accessible from a trunk incoming from the divided bank level switch and having access to two subgroups of ticketing trunks; and

Fig. 3 shows trunk-identifier-connectors over which control conductors from two groups of automatic ticketing trunks may be extended to that one of a plurality of identifiers which has been seized by a sender in response to the seizure of the trunk.

To completely visualize the invention, Fig. 2 should be placed to the right of Fig. 1 and Fig. 3 should be placed to the right of Fig. 2.

The line finders 103, 104 and 105, the first selectors 106, 107 and 108, and the third selector 111 may be of the well-known step-by-step type and the selectors may be controlled directly by a subscriber's dial to establish local connections or to establish a connection to an idle ticketing trunk such as 113 or 114 should the subscriber desire a connection to a subscriber's line which terminates in the toll area adjacent to the exchange area in which the calling line terminates. The ticketing trunks 113 and 114 are disclosed as having bank level appearances in first, second and third selectors and these same trunks may have appearances in more than one bank level of the same switch whereby the trunks may be seized in response to the dialing of the first code digit of certain distant offices, in response to the dialing of the first and second code digits of other offices and in response to the dialing of the three code digits of still other offices. To simplify the disclosure, but two groups of ticketing trunks are shown for serving connections to all offices of the toll area. In the commercial use of the system, however, a plurality of groups of trunks would be required to handle the toll traffic, for example, two hundred trunks divided into ten groups and each group divided into two or more subgroups. Some of the subgroups would be made accessible only from bank levels of first selectors, other subgroups would be made accessible only from bank levels of second selectors and still other subgroups would be made accessible only from bank levels of third selectors. The trunking scheme may therefore be made quite flexible for allocating the trunk groups in accordance with the density of the traffic.

The selector switch 112 of Fig. 1 may be of the divided level step-by-step type disclosed, for example, in Patent No. 2,249,067, granted July 15, 1941 to P. W. Wadsworth and having access over the same bank level thereof to two groups of trunks terminating in rotary out-trunk secondary switches. One such trunk is schematically shown as 115 terminating in the out-trunk secondary switch 200 of Fig. 2. The switch 200 is of the general type disclosed in Patent No. 1,472,425, granted October 30, 1923 to Forsberg et al, but is of the non-normaling type. The switch 200 is disclosed as having access to branches of the two trunk groups including ticketing trunks 113 and 114 but it is to be understood that it could have access to more than two trunk groups.

Two of the ten trunk-identifier-connector circuits which are required to connect any one of the two hundred trunks to the identifier seized to serve a connection are disclosed in Fig. 3. Each connector circuit serves twenty trunks and is provided with a multicontact relay for each iden-

tifier and with a lock-out relay for each identifier.

To more clearly set forth the novel features of the invention, it will be assumed that the calling subscriber whose substation is indicated by the numeral 100 initiates a call for a toll connection to a subscriber's line terminating in an office of the toll area to which the calling subscriber is permitted access by dialing. Upon the removal of the receiver from the switchhook an idle line finder, such as 103, is started in search of the calling line in the well-known manner. When the line finder has found the calling line the usual dial tone is transmitted over the calling line to inform the subscriber that his line has been connected with a first selector 106, paired with the line finder 103, and that he may therefore commence dialing the digits of the wanted line number.

It will be assumed that the subscriber desires a connection with a line whose directory number is KRA-1345 and that a ticketing trunk over which a connection to that line may be extended, may be reached from the second level of the divided level selector 112 and through the rotary out-trunk secondary switch 200. The calling subscriber upon hearing the dial tone therefore proceeds to dial the office code letters K, R, A and the numerical digits 1, 3, 4, 5. In response to the dialing of the first office code letter K, which has a numerical equivalent 5, the brushes of the first selector 106 are raised to a position opposite the fifth level of its bank whereupon they rotate to select an idle selector 112 of the divided level type. In response to the dialing of the second office code letter R, which has a numerical equivalent 7, the brushes of selector 112 are raised to a position opposite the seventh level of its bank. It will be assumed that the switch is arranged to operate its shaft contacts when the brushes are raised to this level whereupon the switch shaft is released into its normal position whereby the second dialed code letter R is absorbed and a brush selection is made as fully disclosed in the Wadsworth patent hereinbefore referred to. In response to the dialing of the third office code letter A, which has the numerical equivalent 2, the brushes are again raised to a position opposite the second bank level and are then rotated to select an idle trunk terminating in the second group of such bank level. It will be assumed that the trunk 115 is found to be idle and is therefore seized. Each of the trunks of the group terminates in a rotary out-trunk secondary switch 200 of the type which normally stands upon the terminals of an idle outgoing or ticketing trunk. It will be assumed that the switch 200 and other similar switches of the same group are at the time standing on terminals allocated to the ticketing trunk 113.

When therefore the trunk 115 is seized by the switch 112, a circuit is established from ground at switch 112 over sleeve conductor 120 of trunk 115, over normal contacts of test jack 217, through the upper low resistance winding of sleeve relay 209, over brush 203 to battery through the winding of relay 218 and in parallel therewith over the upper back contact of relay 218 and through resistance 219 to battery. A circuit in parallel with the winding of relay 218 and resistance 219 is also established over the upper back contact of relay 209, over the interrupter contacts of stepping magnet 220 and back contacts of relay 221 to battery through the winding of stepping relay 222. Relay 209 operates but the winding of relay 222 being shunted by the winding of relay 218 and resistance 219, relay 222 does not operate.

The brushes of switch 200 therefore remain in engagement with the terminals of trunk 113 and a dialing loop is extended from the calling line over the connection established therefrom, over the brushes 201 and 202 of switch 200 and through the winding of the line relay (not shown) of trunk 113. In response to the operation of such line relay a sender becomes associated with the trunk and ground is connected to conductor 223 to mark the trunk as busy. With direct ground connected to conductor 223 relay 218 now operates, if it has not previously operated, and sleeve relay 209 is held operated from such ground on conductor 223, over brush 203 and over the upper front contacts and through the lower winding of relay 209 to battery. This busy ground is also connected to sleeve conductor 120 to hold the previously operated line finder 103 and selectors 106 and 112 from releasing.

With direct ground connected to conductor 223, a circuit is established over brush 203 of other switches of the same group as switch 200 whose brushes may be in engagement with the multiple terminals of the same trunk 113, thence over the upper back contact of the associated sleeve relay corresponding to relay 209, over the interrupter contacts of the stepping magnet 220 of such switch, contacts of relay 221 and to battery through the winding of the stepping relay 222 of such switch. Relay 222 thereupon operates in turn causing the operation of the associated stepping magnet 220 which upon operating opens the circuit of relay 222. Relay 222 then releases, in turn releasing magnet 220. Thus relay 222 and magnet 220 reciprocally control each other to cause magnet 220 to advance the switch brushes step by step until an idle outgoing trunk is encountered at which time the brush 203 will find no busy ground and the switch brushes will be arrested in engagement with the terminals of such idle trunk. In this manner all out-trunk switches whose brushes are engaged with the multiple terminals of trunk 113 are advanced to preselect other idle ticketing trunks.

To guard against the unnecessary step-by-step advance of out-trunk secondary switches in search of an idle ticketing trunk should all ticketing trunks become busy and their associated relays 218 all be operated, relays 221 and 225 are provided. Relay 225 is maintained operated over the paralleled back contacts of relays 218 of all trunks to which the group of switches including switch 200 have access, but should all such trunks become busy relay 225 releases to close an alarm circuit and to cause the operation of relay 221. Relay 221 upon operating opens the circuits for the stepping relays 222 of all of the out-trunk switches of the group thereby preventing the stepping of such switches.

Following the seizure of an idle trunk the next digit dialed by the calling subscriber subsequent to the dialing of the code digit which resulted in the seizure of the trunk, in the case assumed, the thousands digit 1 is registered in the register associated with the trunk and thereafter the remaining numerical digits dialed by the subscriber are registered in registers of the sender which has become associated with the trunk. As soon as a digit has been registered in the sender, an idle identifier for identifying the calling line and for reconstructing the called office code designation is associated with the sender over an identifier-connector as described in the application of J. W. Gooderham hereinbefore referred to and the identifier is informed, through the prior

operation of the trunk finder, in which main group of one hundred trunks and in which of two ten-trunk subgroups of such main group the calling trunk is located.

It will be assumed that the first identifier has been taken for use and that therefore a circuit is established which may be traced in part over conductor 331, through the winding of lock-out relay 300F, allocated to the first identifier and to the trunk-identifier-connector circuit having access to the Nos. 0 and 9 ten-trunk subgroups of the main group of trunks in which the calling trunk is assumed to be located, over the inner upper normal contacts of similar lock-out relays allocated to other identifiers to ground. Relay 300F operates if the trunk-identifier-connector circuit is not at the time being used by another identifier on another call, locks over its upper inner alternate contacts to ground; establishes an operating circuit for the multicontact relay 302F from ground through the winding of such relay over the inner lower front contact of relay 300F and through resistance 323 to battery, and establishes a circuit from battery through resistance 334, over its middle upper front contacts, conductor 305, and thence over a circuit not disclosed but fully described in the Gooderham application hereinbefore referred to which extends over contacts of the identifier-connector and through the trunk finder to ground through the winding of connector relay 213 of the calling trunk 113. With multicontact relay 302F of the trunk-identifier-connector circuit and relay 213 of the trunk both operated, a plurality of control conductors are extended from the calling trunk to the identifier.

It is to be noted that to serve each main group of one hundred trunks, five trunk-identifier-connector circuits, of which two are disclosed in Fig. 3, are provided, the connector circuit comprising the lock-out relays 300F to 300L and the multicontact relays 302F to 302L serving the Nos. 0 and 9 ten-trunk subgroups or twenty trunks, the connector circuit comprising the lock-out relays 310F to 310L and the multicontact relays 312F to 312L serving the Nos. 1 and 4 ten-trunk subgroups or twenty trunks, and the three other connector circuits (not shown) serving respectively subgroups 2 and 5, 3 and 6, and 7 and 8. A similar group of five connector circuits would serve the second main group of one hundred trunks.

In addition to the sleeve relay 203 the trunk 113 is provided with a sleeve relay, such as relays 206, 207, 208, etc. for each bank level appearance of the trunk and each of these relays controls the continuity of a circuit over a separate code lead. The code leads controlled by these relays, such as leads 212, 215, 218, etc. are, together with the code lead 224 extending from the bank associated with brush 205 of the rotary out-trunk secondary switch 200, terminated on the cross-connecting rack 306 associated with the trunk-identifier-connector circuit which has access to the subgroup of trunks in which trunk 113 is located. Similarly, the code leads associated with other trunks of the same subgroup are also terminated on the rack 306. Thus the code leads of twenty trunks terminate on rack 306. In the same manner the code leads from the twenty trunks including trunk 114 are connected to terminals on the cross-connecting rack 316 associated with the other trunk-identifier-connector circuit disclosed in Fig. 3.

The code leads which terminate in the rack

306 may be cross-connected thereover to terminals which are connected to the multiple contacts of multicontact relays 302F to 302L and connected through the operation of one of such relays to a plurality of code leads extending to the identifier. Similarly, the code leads which terminate in the rack 316 may be cross-connected thereover to terminals which are connected to the multiple contacts of multicontact relays 312F to 312L and connected through the operation of such relays to a plurality of code leads extending to the identifier. The number of code leads extending to the identifier will depend upon the number of possible route appearances of the trunks at the banks of selectors. For example, if eight of the levels of the first selectors were involved in ticketing traffic there would be a maximum of eight code leads corresponding to the eight appearances through the first selectors. In a like manner the number of route appearances that might occur from the bank levels of the second selectors available for ticketing traffic would be eight times eight or sixty-four appearances or code leads if all two-digit codes were involved in outgoing ticketing traffic. The number of route appearances from the banks of third selectors and from the levels of divided level selectors is an indeterminate number depending upon the number of routes involved and therefore the number of code leads required for such three-digit codes is also indeterminate. By means of the cross-connection racks 306 and 316, the code leads from the sleeve relays of trunks, such as lead 212, which are associated with the same route appearance, can be connected together, the only code leads brought through the trunk-identifier-connector circuit being those required for distinct route appearances. In the identifier, the code leads may be cross-connected to control the reconstruction of the office code letters dialed by a calling subscriber as fully disclosed in the application of M. B. McDavitt, Serial No. 448,789, filed concurrently herewith.

Referring again to the out-trunk secondary switch 200, it is to be noted that the terminals of its banks are divided into two groups, the terminals of the first group being connected to the ten trunks of one subgroup of trunks including trunk 113, which it will be assumed may be associated with an identifier over the trunk-identifier-connector circuit disclosed in the upper portion of Fig. 3 and with which the cross-connection rack 306 is associated. Consequently, the trunk terminals appearing in the first half of the bank of switch 200 with which brush 205 is associated are multiplied together and connect to code lead 224 which terminates on the cross-connecting rack 306. The terminals of the other group of the banks of switch 200 are connected to the ten trunks of a second subgroup of trunks including trunk 114, which it will be assumed may be associated with an identifier over the trunk-identifier-connector circuit disposed in the lower portion of Fig. 3 and with which the cross-connection rack 316 is associated. Consequently, the trunk terminals appearing in the second half of the bank of switch 200 with which brush 205 is associated are strapped together and connected to code lead 264. Thus, if any one of the first ten trunks is selected by switch 200, code lead 224 which is common to all of such trunks and appertains to the same appearance in the bank level of switch 112 will be employed and if any one of the second ten trunks is selected by switch 200, code lead 264 which is common to all

of such trunks and appertains to the same appearance in the same bank level of switch 112 will be employed.

Following the operation of multicontact relay 302F and trunk relay 213 as previously described, battery connected to conductor 307 at the identifier is connected over contacts 308 of relay 302F, conductor 214, contacts of relay 213, the terminal engaged by brush 204 of switch 200, the lower contacts of operated sleeve relay 209, the contact of the bank engaged by brush 205, code lead 224, across strapped terminals of cross-connecting rack 306, contacts 317 of relay 302F and over code lead 313 to the identifier. Had another trunk of the same subgroup as trunk 113 been seized, then upon the operation of relay 302F and the connector relay of such trunk corresponding to relay 213, a circuit would have been established as just traced over contacts 308 of relay 302F, contacts of relay 213 of such trunk, the individual terminal of such trunk engaged by brush 204, over the lower contacts of relay 209, brush 205 and the terminal of such trunk engaged by brush 205, code lead 224 and thence as traced to code lead 313. Similarly, had trunk 114 of the other subgroup of ten trunks been seized, then multicontact relay 312F and connector relay 253 of the trunk would have been operated and thereafter upon the connection of battery to conductor 307 such battery would have been extended over contacts 321 of relay 312F, conductor 254, contacts of relay 253, the individual terminal of such trunk engaged by brush 264, over the lower contacts of relay 209, brush 205 and the individual terminal of the trunk engaged thereby, over code lead 264 and strapped terminals of cross-connecting rack 316, contacts 322 of relay 312F to code lead 318. By dividing a group of trunks between two trunk-identifier-connector circuits and enabling the out-trunk secondary switch to extend the code lead over either connector circuit depending upon the location of a trunk in the group with respect to the connector circuit, it is possible to obviate tying up an entire group of twenty trunks should a trouble condition occur in one of the trunk-identifier-connectors serving such group.

While a twenty-trunk group has been shown as served by two trunk-identifier-connector circuits and the code lead bank of the rotary out-trunk secondary switch 200 with which brush 205 cooperates, has therefore been divided into two corresponding strapped sections, it is to be understood that the twenty-trunk group could be divided to be served by a larger number of the trunk-identifier-connector circuits and the bank of switch 200 with which brush 205 cooperates could be divided into a similar number of strapped terminal sections connectable by sepa-

rate code leads to the several trunk-identifier-connector circuits.

What is claimed is:

1. In a telephone system, an incoming trunk, a plurality of outgoing trunks divided into subgroups, a switch operable upon the seizure of said incoming trunk to extend said incoming trunk to an idle one of said outgoing trunks, apparatus common to said outgoing trunks, a control circuit, a plurality of means equal in number to said subgroups of outgoing trunks for extending said control circuit from any one of said trunks to said apparatus, means in said switch for extending said control circuit to that one of said control circuit extending means allocated to the subgroup of trunks in which said selected trunk is located, and a relay operable upon the seizure of an idle outgoing trunk for completing said control circuit.
2. In a telephone system, an incoming trunk, a plurality of outgoing trunks divided into subgroups, a switch operable upon the seizure of said incoming trunk to extend said incoming trunk to an idle one of said outgoing trunks, apparatus common to said outgoing trunks, a control circuit, means equal in number to said subgroups of trunks for extending said circuit from any one of said trunks to said apparatus, said control circuit being individualized to each outgoing trunk over one bank of said switch and individualized to the control circuit extending means over another bank of said switch and a relay operable upon the seizure of an idle outgoing trunk for joining the two sections of said control circuit over the switch brushes cooperating with said banks.
3. In a telephone system, an incoming trunk, a plurality of outgoing trunks divided into a plurality of subgroups, a selector switch operable upon the seizure of said incoming trunk to extend said incoming trunk to an idle one of said outgoing trunks, apparatus common to said outgoing trunks, a control circuit, a plurality of means equal in number to said subgroups of outgoing trunks for extending said control circuit from any one of said outgoing trunks to said apparatus, branches of said control circuit individual respectively to said outgoing trunks and terminating in individual terminals of one bank of said switch, other branches of said control circuit individual respectively to said control circuit extending means and terminating in terminals of another bank of said switch which are multipled together in accordance with the subgrouping of said outgoing trunks and a relay operable upon the seizure of an idle outgoing trunk for uniting a first branch with a second branch over said banks and their associated brushes.

LYLE J. SCOTT.