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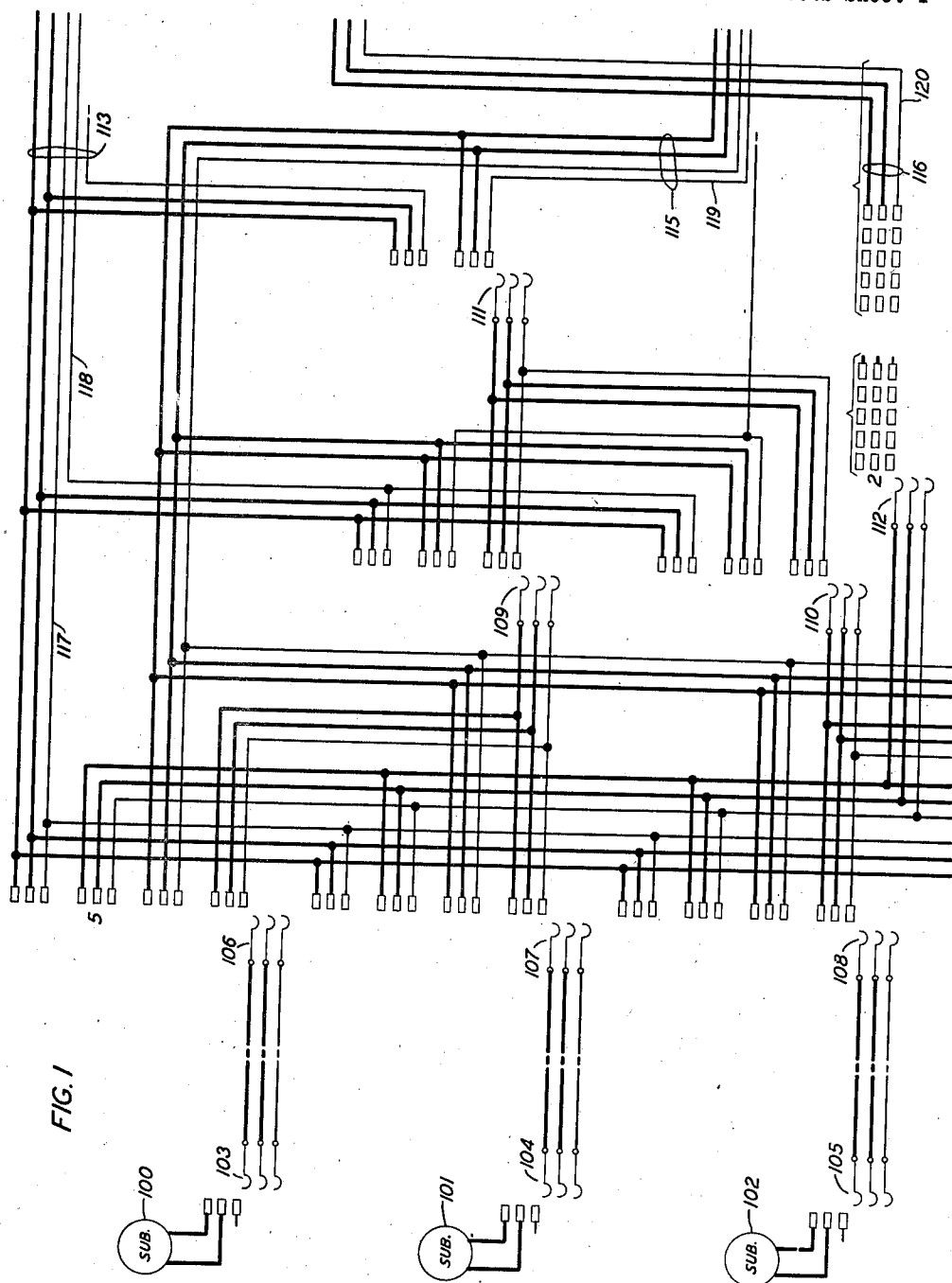
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2,337,642

AUTOMATIC TOLL TICKETING SYSTEM

Filed June 27, 1942

4 Sheets-Sheet 1



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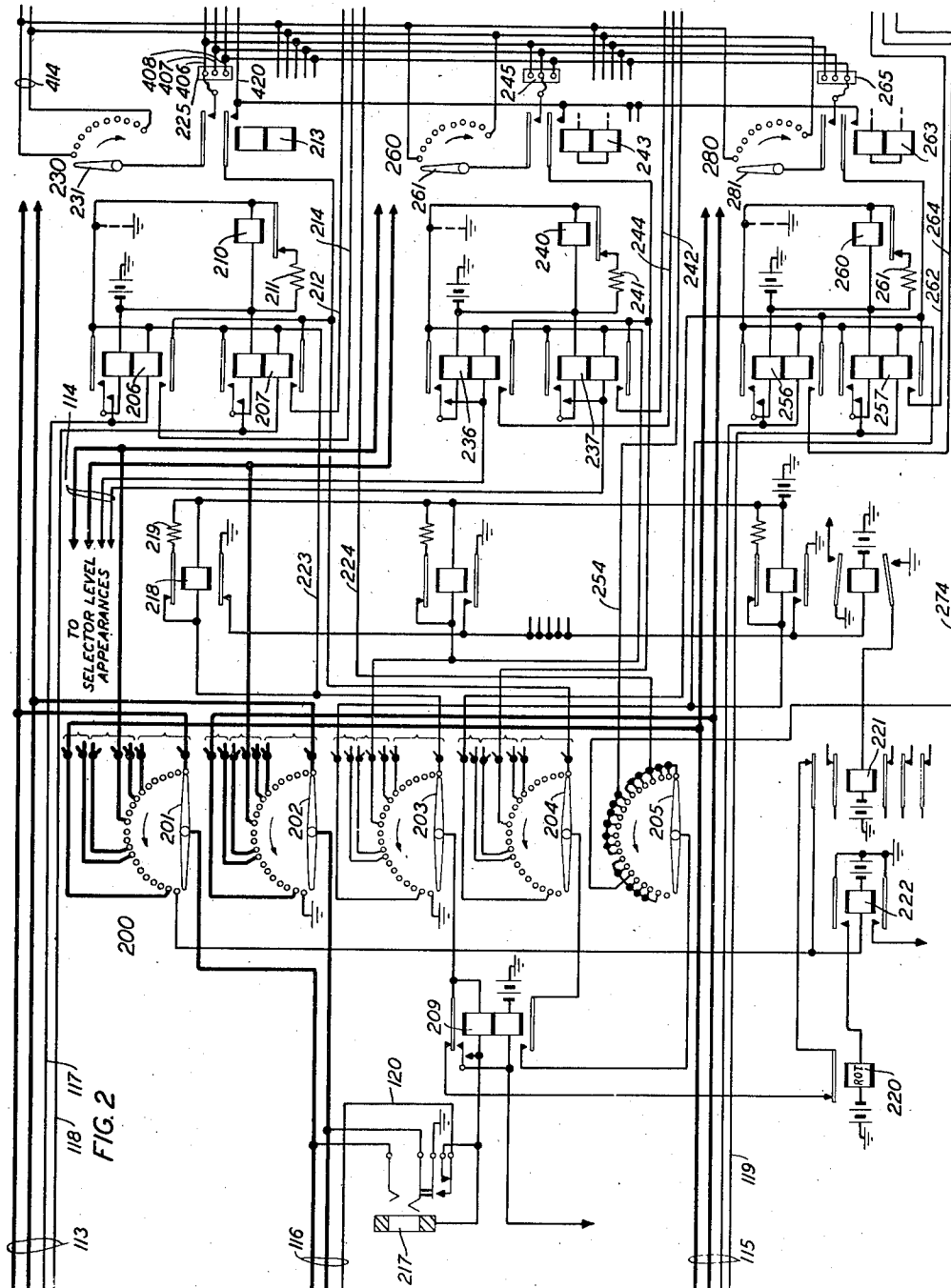
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4 Sheets-Sheet 2



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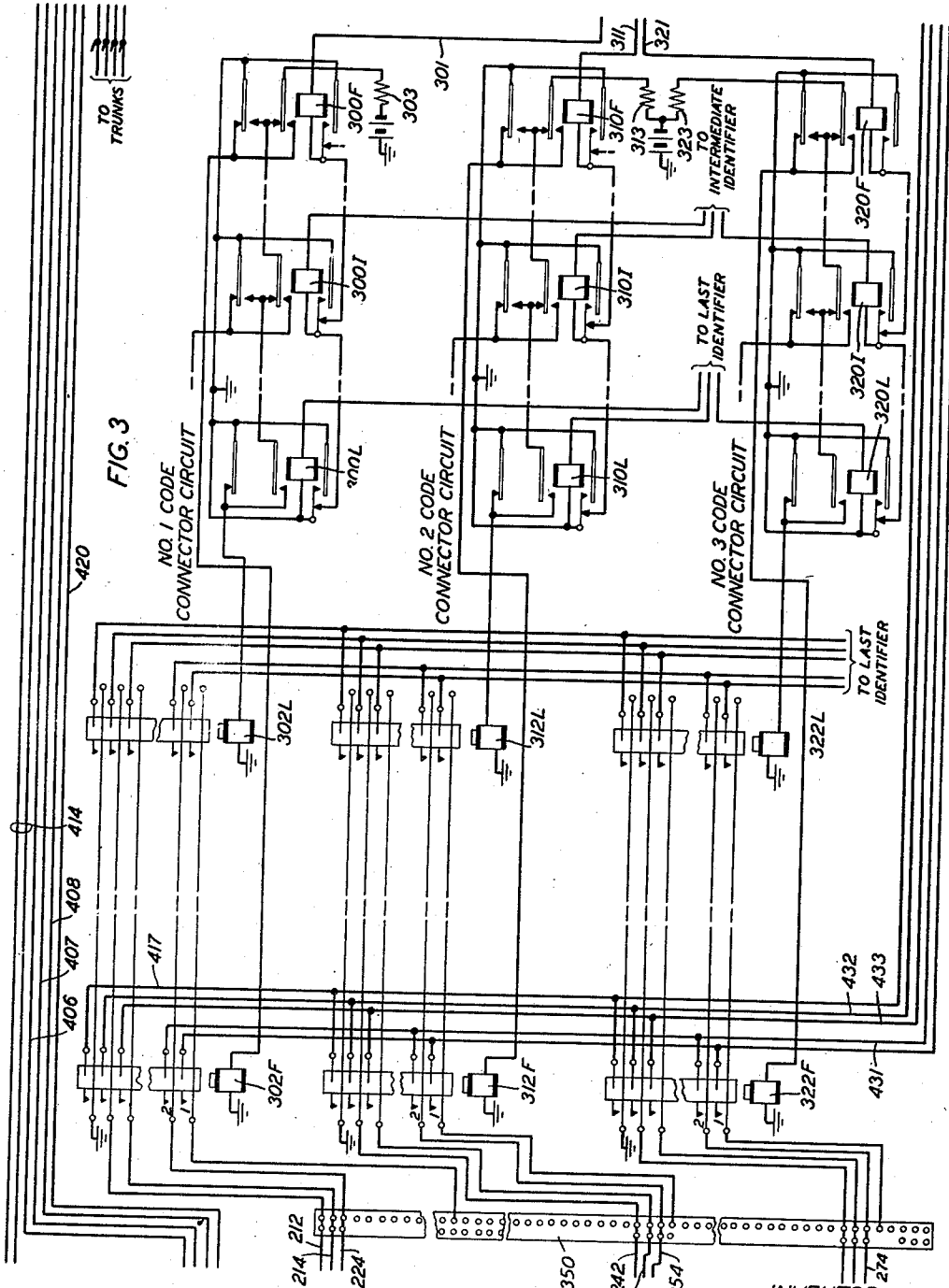
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4 Sheets-Sheet 3



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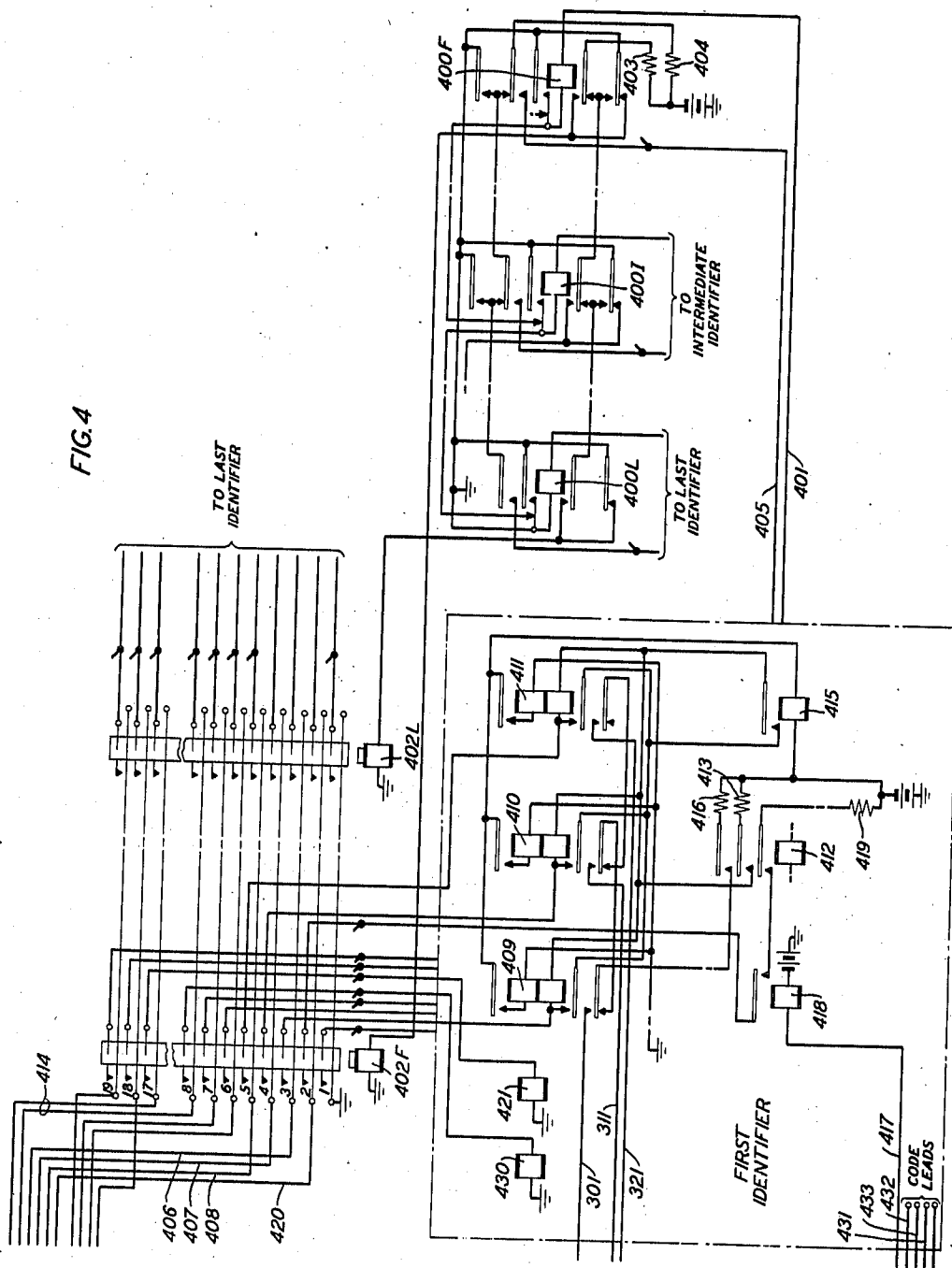
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AUTOMATIC TOLL TICKETING SYSTEM

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2,337,642

AUTOMATIC TOLL TICKETING SYSTEM

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Application June 27, 1942, Serial No. 448,759

6 Claims. (Cl. 179—27)

This invention relates to a telephone system and more particularly to a toll 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 in the nearby toll area and from which trunk a connection is extended by selector switch equipment. The selector switch equipment by which the connection is extended from a ticketing trunk 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 a 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 directly with the calling trunk over a trunk-identifier-connector circuit.

For giving automatic ticketing service, two main groups of 100 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 minor subgroups. To associate an identifier with a trunk in a main group of 100 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 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 terminates 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 which are extended 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. These code leads are employed to assist the identifier in reconstructing the office code digits of a wanted line number dialed by a subscriber to seize a ticketing trunk. As disclosed in the application of L. J. Scott, Serial No. 448,785, filed concurrently herewith, the twenty trunks accessible to an out-trunk secondary switch are divided into two or more minor subgroups each of which is associable with an identifier over a different trunk-identifier-connector by providing access to each subgroup of trunks over different portions of the bank 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 through different trunk-identifier-connectors. By this distribution of trunks, the danger of rendering an entire group of twenty trunks unavailable for completing a connection to a particular office is avoided.

It is the object of the present invention to increase the efficiency of a system of the above-described character by enabling the trunk to be reassigned from one trunk group to another with a minimum of maintenance effort and to be assigned to more than one trunk group to secure the trunk efficiency available through the use of the graded multiple; by increasing the trunk access of the out-trunk secondary switches and simplifying the cross-connection field involving the code leads outgoing therefrom and by the simplification of the trunk-identifier-connector circuits.

In accordance with the present invention this object is obtained by providing three code-connector circuits for each office building in addition to the maximum of ten trunk-identifier-connector circuits. A single cross-connection rack is associated with the three code-connector circuits

upon which all of the code leads from all of the trunks terminate. The code leads from one third of the trunks of each subgroup are associated with the No. 1 code-connector, the code leads from the second third of the trunks of each subgroup are associated with the No. 2 code-connector and the code leads from a third third of the trunks of each subgroup are associated with the No. 3 code-connector. This distribution of the code leads reduces the hazard of tying up ticketing service so that should a trouble condition arise on any code-connector not more than one third of the trunks of any subgroup will be affected. By the provision of the code-connectors for extending the code leads from the trunk to an identifier, the trunk-identifier-connectors are simplified in that no provision is necessary for extending code leads therethrough. To increase the trunking efficiency of the out-trunk secondary switches, the banks are arranged to have access to twenty-one trunks divided into three subgroups of seven trunks each and with the code leads thereof associated respectively with the three code-connectors rather than to have access to two subgroups of ten trunks as heretofore proposed.

As illustrated herein, a subscriber desiring a connection to a line terminating in an office of a nearby toll area first removes his receiver from the switchhook whereby an idle line finder, paired with a first selector, is started in search of the calling line and as soon as the line is found, the usual dial tone is transmitted. Upon hearing the dial tone, the subscriber then proceeds to dial the office code and numerical digits of the wanted line number. In response to the dialing of one or more of the office code digits, the selectors of a switching train, including the first selector, are operated to extend a connection from the calling line to an idle tandem or automatic ticketing trunk accessible from all lines of the office in which the calling line terminates, over which trunk a connection may be further extended to the office in which the wanted line terminates.

Immediately following the seizure of the trunk, an idle sender common to a plurality of such trunks is associated with the seized trunk over a trunk finder. The sender is provided with registers for registering the remaining digits of the called line number dialed by a calling subscriber. Since, however, a digit dialed by a calling subscriber might be lost during the time elapsing between the seizure of the trunk and the seizure of an idle sender, the trunk is provided with a digit register for registering the digit dialed following the last code digit dialed to reach the trunk. On calls to certain offices the trunk may be seized by a first selector in response to the dialing of a first code digit. On calls to other offices the trunk may be seized by a second selector in response to the dialing of two office code digits. On calls to still other offices the trunk may be seized by a third selector in response to the dialing of three office code digits. In other cases a trunk may be seized in response to the setting of a selector switch, primary trunks from a bank level of which terminate in rotary out-trunk secondary switches which in turn have access to ticketing trunks and which normally stand on the terminals of an idle preselected trunk. Since a trunk may be seized in response to the dialing of one, two or three code digits, the trunk register may register either the second or third code digit or the thousands numerical digit and the first dial impulse responsive register of

the sender may register either the third code digit, the thousands numerical digit or the hundreds numerical digit.

As soon as the first digit has been registered in the sender, an idle identifier for identifying the calling line and for reconstructing the called office code digits dialed by the calling subscriber is associated with the sender over an identifier-connector and the identifier is associated directly with the calling trunk over that one of a plurality of trunk-identifier-connector circuits which has access to the calling trunk. Each of the trunk-identifier-connector circuits has access to a subgroup of twenty trunks and each trunk has a cross-connection field associated therewith over which cross-connections may be made from each trunk of the subgroup to a control conductor extending through the associated trunk-identifier-connector to give the identifier seized for serving the connection, information concerning which one of the three code-connectors is to be employed to extend code leads from the calling trunk to the identifier. The identifier then proceeds to operate the proper one of such code-connector circuits. Thereupon office code identifying equipment associated with the trunk and selectively operated in accordance with whether the trunk was seized over a first, second or third selector bank level, establishes a record in the identifier from which the office code digits dialed to reach the trunk may be reconstructed and if other code digits have been registered by the trunk register or by the first register of the sender, such registration or registrations are also transferred to the identifier whereby from all such data registered in the identifier, a route relay is operated which is instrumental in furnishing all of the information required by the sender and the ticketing equipment of the trunk concerning the called office and the manner in which the call should be ticketed.

The invention having been described in a general manner, reference may now 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, three 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 accessible from a trunk incoming from a divided bank level switch and having access to three minor groups of automatic ticketing trunks and some of the apparatus of three ticketing trunks located respectively in the three minor groups of trunks;

Fig. 3 shows the three code-connector circuits for extending code leads from the trunks to that one of a plurality of identifiers which has been seized by a sender in response to the seizure of a ticketing trunk; and

Fig. 4 shows one of the trunk-identifier-connector circuits over which control conductors from 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 a ticketing trunk and a portion of the apparatus of an identifier by which the code-connector circuits of Fig. 3 are controlled.

For a full disclosure of the present invention, Fig. 2 should be placed to the right of Fig. 1;

Fig. 3 should be placed to the right of Fig. 2 and Fig. 4 should be placed to the right of Fig. 3.

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 trunk 113, 114, or 115 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 115 are disclosed, as having bank level appearances in first, second and third selectors and these same trunks may have appearances in more than one level of the same switch, whereby the trunks may be seized in response to the dialing of the first code digit of certain distant office designations, in response to the dialing of the first and second code digits of other office designations and in response to the dialing of the three code digits of still other office designations. The trunk 114 might be similarly terminated in the bank levels of first, second and third selectors. In the commercial use of the system, however, a plurality of subgroups of trunks would be required to handle the toll traffic, for example, 200 trunks divided into ten groups and each subgroup divided into minor subgroups. The trunks of each subgroup may be distributed according to traffic requirements in the bank terminals of first, second or third selectors and in the banks of the out-trunk secondary switches.

The selector switch 112 of Fig. 1 may be of the divided level step-by-step type disclosed for example in Patent 2,249,067 to P. W. Wadsworth hereinbefore referred to 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 at 116 terminating in the out-trunk secondary switch 200 of Fig. 2. Switch 200 is of the general type disclosed in Patent 1,472,425, granted October 30, 1923, to Forsberg et al., but is of the non-normalizing type. The switch 200 is disclosed as having access to branches of the three trunk groups including ticketing trunks 113, 114 and 115.

Each of the code-connector circuits of Fig. 3, comprises a multicontact relay such as 302F for each identifier and a lock-out relay for each identifier and the code leads from a third of the trunks, terminating in the cross-connecting rack 353, are arranged for extension to any identifier through the operation of the multicontact relay allotted to such identifier.

One of the ten trunk-identifier-connector circuits which are required to connect any one of the 200 trunks to the identifier seized to serve a connection, are disclosed in Fig. 4. Each connector circuit serves twenty trunks and is provided with a multicontact relay for each identifier 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, brushes of switch 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 the seventh 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 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 primary trunk terminating in the second group of such bank level. It will be assumed that the trunk 116 is found to be idle and is therefore seized. Each of the trunks of this 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 116 is seized by the switch 112, a circuit is established from ground at switch 112 over sleeve conductor 120 of trunk 116, 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 windings of the line relay (not shown) of trunk 113. In response to the operation of such line relay, an idle sender becomes associated with the trunk by a trunk finder individual to such sender 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 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 129 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 every other switch of the same group as switch 209, the brushes of which 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.

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 230 associated with the seized trunk 113 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 designation is associated with the sender over an identifier-conductor 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 100 trunks and in which twenty trunk subgroup of such main group, the calling trunk is located.

It will be assumed that the first identifier, a portion of which is represented by the dot-dash rectangle in Fig. 4, has been taken for use and that therefore a circuit is established which may be traced in part from such identifier over conductor 401, through the winding of lock-out relay 400F allocated to the first identifier and to the trunk-identifier-conductor circuit having access to the subgroup of twenty trunks in which the calling trunk is located, over the inner upper normal contacts of similar lock-out relays allocated to the same trunk-identifier-conductor circuit and to other identifiers, to ground. Relay 400F operates, if the trunk-identifier-conductor circuit has not been taken for use by some other identifier on another call, locks over its inner upper alternate contacts to ground, establishes an operating circuit for the multicontact relay 402F from ground through the winding of such relay, over the inner lower front contact of relay 400F and through resistance 403 to battery and establishes a circuit from battery through resistance 404, over its middle upper front con-

tact, conductor 405 and thence over a circuit not disclosed but fully described in the Gooderham application hereinbefore referred to, which extends over contacts of the identifier-conductor and through the trunk finder to ground through the winding of connector relay 213 of the calling trunk. With multicontact relay 402F of the trunk-identifier-conductor 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 100 trunks, five trunk-identifier-conductor circuits, of which only one is disclosed in Fig. 4, are provided.

Of the several control circuits which are established by the operation of the multicontact relay 402F, there are three including conductors 406, 407 and 408, which extend from terminals on the twenty cross-connecting racks, such as 225, 245 and 265 allocated to the 20 trunks of the group, to the Nos. 3, 4 and 5 multiple contacts on the multicontact relays 402F to 402L and are extended over such contacts of relay 402F upon its operation through the lower windings of relays 409, 410 and 411 of the identifier and, after the operation of relay 412 of the identifier, over the middle contacts thereof and through resistance 413 to battery. The terminals of racks such as 225, 245 and 265 are cross-connected to front contacts of the connector relays of the trunks of the 20-trunk subgroup which have access to an identifier over the trunk-identifier-conductor circuit of Fig. 4, and are connectable by such relays to the brushes of the registers associated with such trunks in accordance with the allocation of the trunks of the subgroup to the three code-connectors of Fig. 3. Thus the brush 231 of register 230 of trunk 113 is connected over the upper contacts of connector relay 213 of such trunk to a terminal on rack 235 connected to conductor 406 and thence over the No. 3 contacts of relay 402F, through the lower winding of relay 409 to inform the identifier that trunk 113 is one of a minor group the code leads of which appear in the multiple contacts of multicontact relays 302F to 302L of the first code-conductor. Brush 231 of register 230 of trunk 114 is connected over the upper contacts of connector relay 243 of such trunk to a terminal of rack 245 connected to conductor 407 and thence over the No. 4 contacts of relay 402F through the lower winding of relay 410 to inform the identifier that the trunk 114 is one of a minor group the code leads of which appear in the multiple contacts of relays 312F to 312L of the second code-conductor, and brush 231 of register 230 of trunk 115 is connected over the upper contacts of connector relay 263 of such trunk to a terminal of rack 265 connected to conductor 408 and thence over the No. 5 contacts of relay 402F, through the lower winding of relay 411 to inform the identifier that trunk 115 is one of a minor group, the code leads of which appear in the multiple contacts of relays 322F to 322L of the third code-conductor.

It has been assumed that trunk 113 has been taken for use and therefore upon the operation of relay 412 of the identifier a circuit is established from battery through resistance 413, over the middle contacts of relay 412, through the lower winding of relay 409, over the No. 3 contacts of relay 402F, conductor 406, the upper contacts of relay 213 of trunk 113, brush 231 of trunk register 230 and the terminal of its arc to which it has been advanced in response to the

digit dialed following the seizure of the trunk, over one of the ten conductors of the cable 414, over one of the Nos. 8 to 17 contacts of operated relay 402F, to ground through the winding of one of the relays of the trunk code register, such as relays 421 and 430, of the identifier. Relay 409 operates over this circuit but due to the resistance of its winding, the register relay is not operated at this time. Relay 409, upon operating, closes a locking circuit for itself from ground through its upper winding and over its upper contacts to battery through the winding of relay 415 and establishes a circuit from battery through resistance 416, over the upper contacts of relay 412, the lower front contact of relay 409, conductor 301 through the winding of lock-out relay 300F allocated to the first identifier and to the No. 1 code-connector circuit, over the lower normal contacts of the lock-out relays of the No. 1 code-connector circuit allocated to other identifiers, to ground. Relay 300F operates if the code-connector circuit is not at the time being used on another call by another identifier, locks directly to ground over its lower alternate contacts and establishes a circuit from battery through resistance 303 over its inner upper front contact and through the winding of multicontact relay 302F to ground. When relay 415 operated, in the locking circuit of relay 409, it established a shunt around the lower winding of relay 409 over its contacts and the inner lower contacts of relay 409 thereby reducing the resistance of the circuit previously traced through the winding of a selected relay of the register group 421 to 430 thereby permitting the operation of such relay to register the digit previously registered in the register 230 of the calling trunk.

With relay 302F operated, the code leads of the first third of the ticketing trunks in which the calling trunk is located, and which are terminated on the cross-connecting rack 350, are extended over the contacts of such relay to the first identifier, assumed to be taken for use. As many code leads extend to the identifier as there are different office route appearances of all of the ticketing trunks in bank levels of selector switches. By means of the cross-connecting rack 350 the code leads of the trunks may be cross-connected for extension to the code leads extending to the identifier whereby code leads of different trunks which appertain to the same office route may be concentrated for connection to the proper code lead terminating in the identifier.

Multicontact relay 302F also establishes a circuit from ground over its upper contacts and conductor 417 to battery through the winding of relay 418 at the identifier which, upon operating, establishes a circuit from battery through resistance 419 over the inner contacts of relay 412, the contacts of relay 418, the No. 2 contacts of multicontact relay 402F of the trunk-identifier-connector circuit, over conductor 420, over the inner contacts of connector relay 213 of the trunk, over the terminal of the bank of switch 200 with which brush 204 is engaged, the lower contacts of sieve relay 209, brush 205 and the terminal of the bank with which it is engaged, code lead 224, the No. 2 contacts of multicontact relay 302F and code lead 431 extending to the identifier. Battery potential thus connected to the code lead 431 results, as fully described in the application of J. W. Gooderham hereinbefore referred to, in causing the identifier to recon-

struct the three office code digits assumed to have been dialed by the calling subscriber.

Had the ticketing trunk 113 been seized over some other selector bank level appearance in response to the dialing of some other called office designation, a sleeve relay such as 203 or 207 would have been operated and when battery potential was applied from the identifier through the operation of relay 418 to conductor 420, such battery potential would have been connected to another code lead individual to the trunk, such as lead 212 or lead 214, terminating in the cross-connecting rack 350 and extended through the operation of multicontact relay 302F to a code lead, such as 432 and 433, extending to the identifier.

In the previous discussion of the invention it was assumed that in response to the call, a trunk 116 terminating in the out-trunk secondary switch 200 was seized and that the switch 200 was standing in the position shown with its brushes engaged with the terminals of the pre-selected idle ticketing trunk 113. It will now be assumed that when the trunk 116 is seized, the brushes of switch 200 are engaged with the terminals of ticketing trunk 114. As before described, when the trunk 114 is seized over the brushes of switch 200 on the seizure of the trunk 116 by selector 112, an idle sender is associated with the trunk following which an idle identifier is associated with the sender. It will be assumed that the first identifier is idle and is associated with the sender and that the identifier is associated with the calling trunk 114 through the operation of the multicontact relay 402F of the trunk-identifier-connector circuit disclosed in Fig. 4 following which relay 243 of the calling trunk is operated.

It will be assumed that trunk 114 is one the code leads of which may be extended to the identifier through the operation of the No. 2 code-connector circuit and that therefore to transmit that information to the identifier the outer front contact of the connector relay 243 of the trunk is cross-connected at rack 245 to conductor 407. When relay 412 at the identifier operates, a circuit is established from battery through resistance 413, over the middle contacts of relay 412, the lower winding of relay 410, the No. 4 contacts of relay 402F, conductor 407, the outer contacts of relay 243, brush 261 of digit register 260 of trunk 114 and the terminal of its arc to which it has been advanced in response to the digit dialed following the seizure of the trunk, over one of the conductors of cable 414, over one of the Nos. 8 to 17 contacts of relay 402F, to ground through the winding of one of the relays of the trunk-code register, such as relays 421 and 430. Relay 410 operates over this circuit but the register relay does not operate at this time. Relay 410 upon operating closes a locking circuit through its upper winding and through the winding of relay 415 whereupon relay 415 operates as previously described to shunt the lower winding of relay 410 and to thereby permit the operation of the trunk code register relay and establishes a circuit which may be traced from battery, through resistance 416, over the upper contacts of relay 412, the lower back contact of relay 409, the lower front contact of relay 410, conductor 311 through the winding of lock-out relay 310F, allocated to the first identifier and to the No. 2 code-connector circuit and over the lower alternate contacts of lock-out relays of the No. 2 code-connector cir-

cuit allocated to other identifiers, to ground. Relay 310F operates if the code-conductor circuit is not at the time being used on another call by another identifier, locks directly to ground over its lower alternate contacts and establishes a connection from battery through resistance 313 over its inner upper front contacts and through the winding of multicontact relay 312F to ground.

With relay 312F operated, the code leads of the second third of the ticketing trunks in which the calling trunk 114 is assumed to be located, are extended over its contacts to the identifier. Relay 312F also completes over its upper contacts the previously traced circuit for relay 418 whereupon a circuit is established from battery through resistance 419, over the inner contacts of relay 412, the contacts of relay 418, the No. 2 contacts of relay 402F, conductor 420, the inner contacts of relay 243 of the trunk 114, over the terminal of the bank of switch 200 with which brush 204 is engaged, the lower contacts of sleeve relay 209, brush 205 and the terminal of the bank with which it is engaged, code lead 254, the No. 2 contacts of multicontact relay 312F and code lead 431 extending to the identifier. The code leads extending from the trunk 114 and controlled by the sleeve relays 236 and 237 thereof would in a similar manner be extended over contacts of relay 312F to code leads such as 432 and 433 extending to the identifier.

In a similar manner, if the out-trunk switch 200 were engaged with trunk 115 at the time it was seized by the selector 112, then since the trunk is assumed to be one, the code leads of which may be extended to the identifier through the operation of the No. 3 code-conductor circuit, the connection from the brush 281 of register 200 of the trunk is connected upon the operation of trunk connector relay 263 with a terminal on cross-connecting rack 265 which is connected to conductor 406. Therefore, assuming that the first identifier is taken to serve the call and consequently multicontact relay 402F is operated, the circuit of relay 411 in the identifier is established following the operation of relay 412 from battery through resistance 413, through the lower winding of relay 411, the No. 5 contacts of relay 402F, conductor 406, the outer contacts of relay 263, brush 281 of register 200 and the terminal of its arc to which it was advanced in response to the digit dialed following the seizure of the trunk, over a conductor of cable 414, over one of the contacts 8 to 17 of relay 402F, to ground through the winding of one of the trunk code register relays. Relay 411 thereupon operates, locks and establishes a circuit from battery through resistance 416 over the outer contacts of relay 412, the lower back contacts of relays 409 and 410, the lower front contact of relay 411, conductor 321, the winding of lock-out relay 320F of the No. 3 code-conductor circuit allocated to the first identifier, and over over the lower normal contacts of the lock-out relays of the code-conductor circuit allocated to the other identifiers, to ground. Relay 320F operates if the No. 3 code-conductor circuit is not in use with another identifier on another call, locks directly to ground over its lower alternate contacts and establishes the circuit of multicontact relay 322F extending from battery through resistance 323 over the inner upper front contact of relay 320F and through the winding of relay 322F to ground.

With relay 322F operated, the code leads of the

third third of the ticketing trunks in which the calling trunk 115 is assumed to be located, are extended over its contacts to the identifier. Relay 322F also completes over its upper contacts the previously traced circuit for relay 418 whereupon a circuit is established from battery through resistance 419, over the inner contacts of relay 412, the contacts of relay 418, the No. 2 contacts of relay 402F, conductor 420, the inner contacts of relay 263 of the trunk 115, over the terminal of the bank of switch 200 with which brush 204 is engaged, the lower contacts of sleeve relay 209, brush 205 and the terminal of the bank with which it is engaged, code lead 274, the No. 2 contacts of multicontact relay 322F and code lead 431 extending to the identifier. The code leads extending from the trunk 115 and controlled by the sleeve relays 256 and 257 thereof would in a similar manner be extended over contacts of relay 322F to code leads such as 432 and 433 extending to the identifier.

It will be noted that the banks of the out-trunk secondary switch 200 are divided into three sections each of which sections provides terminals for seven trunks and that the terminals of each section of the bank associated with brush 205 are strapped together and connected respectively to the three code leads 224, 254 and 274 extending over terminals of the rack 350 to the three code-conductor circuits of Fig. 3. The trunk capacity of each out-trunk switch has thus been increased from twenty to twenty-one trunks. Since all of the code leads of all trunks terminate in a single cross-connecting rack 350, it is a simple matter to shift the code leads of any trunk on such rack when the trunk has been reassigned from one trunk group to another. Furthermore by the addition of the three code-conductor circuits, the number of contacts on the multicontact relays of the ten trunk-identifier-conductor circuits is materially reduced since none of the code leads now extend over the contacts of such relays.

What is claimed is:

1. In a telephone system, a plurality of trunks divided into a plurality of groups each of which is divided into a plurality of subgroups and said trunks being further regrouped into a plurality of auxiliary groups, each comprising one subgroup of each of said groups, control apparatus, a plurality of control conductors extending from said apparatus, switching means individual respectively to said groups of trunks, means operative upon the seizure of any trunk for operating the switching means allocated to the group of trunks in which said seized trunk is located for associating certain of said conductors with said trunk, auxiliary switching means individual respectively to said auxiliary trunk groups and means operative in response to the operation of a first switching means for operating the auxiliary switching means allocated to the auxiliary group in which the seized trunk is located for associating others of said conductors with said trunk.

2. In a telephone system, a plurality of trunks divided into a plurality of groups each of which is divided into a plurality of subgroups and said trunks being further regrouped into a plurality of auxiliary groups each comprising one subgroup of each of said groups, control apparatus, a plurality of control conductors extending from said apparatus, switching means individual respectively to said groups of trunks, means operative upon the seizure of any trunk for operating

the switching means allocated to the group of trunks in which said seized trunk is located for associating certain of said conductors with said trunk, auxiliary switching means individual respectively to said auxiliary trunk groups, a connecting rack common to said auxiliary switching means, control conductors individual to each of said trunks terminating in said rack, and means operative in response to the operation of a first switching means for operating the auxiliary switching means allocated to the auxiliary group in which the seized trunk is located for connecting the control conductors of the seized trunk to others of said control conductors extending from said control apparatus.

3. In a telephone system, a plurality of trunks divided into a plurality of groups each of which is divided into a plurality of subgroups and said trunks being further regrouped into a plurality of auxiliary groups each comprising one subgroup of each of said groups, control apparatus, a plurality of control conductors extending from said apparatus including control conductors allocated respectively to each of said auxiliary groups of trunks, means associated with each of said trunks for determining the selection of that one of said control conductors which is allocated to the auxiliary group in which said trunk is located, switching means individual respectively to said groups of trunks, means operative upon the seizure of any trunk for operating the switching means allocated to the group of trunks in which said seized trunk is located for associating certain of said conductors with said trunk, auxiliary switching means individual respectively to said auxiliary trunk groups, and means operative over the selected control conductor upon the operation of said first switching means for operating the auxiliary switching means allocated to the auxiliary group in which the seized trunk is located for associating others of said conductors with said trunk.

4. In a telephone system, a plurality of trunks divided into a plurality of groups each of which is divided into a plurality of subgroups and said trunks being further regrouped into a plurality of auxiliary groups each comprising one subgroup of each of said groups, control apparatus, a plurality of control conductors extending from said apparatus including a control conductor allocated respectively to each of said auxiliary groups of trunks, means associated with each of said trunks for determining the selection of that one of said control conductors which is allocated to the auxiliary group in which said trunk is located, switching means individual respectively to said groups of trunks, means operative on the seizure of any trunk for operating the switching means allocated to the group of trunks in which said seized trunk is located for associating certain of said conductors with said trunk, auxiliary switching means individual respectively to said auxiliary trunk groups, a connecting rack common to said auxiliary switching means, control conductors individual to each of said trunks terminating in said rack, and means operative in response to the operation of a first switching means for operating the switching means allo-

cated to the auxiliary group in which the seized trunk is located for connecting the control conductors of the seized trunk to others of said control conductors extending from said control apparatus.

5. In a telephone system, an incoming trunk, a plurality of outgoing trunks divided into a plurality of groups each of which is divided into a plurality of subgroups and such trunks being further regrouped into a plurality of auxiliary groups each comprising one subgroup of each of said groups, a switch in which said incoming trunk terminates having access to a plurality of outgoing trunks divided among said auxiliary subgroups, control apparatus, a plurality of control conductors extending from said apparatus, switching means individual respectively to said groups of trunks, means operative upon the seizure of any trunk for operating the switching means allocated to the group of trunks in which said seized trunk is located for associating certain of said conductors with said trunk, auxiliary switching means individual respectively to said auxiliary trunk groups, one of said control conductors being individualized to each outgoing trunk of a group over one bank of said switch and individualized to each of the auxiliary switching means over another bank of said switch and means operative in response to the operation of a first switching means for operating the auxiliary switching means allocated to the auxiliary group in which the seized trunk is located for further extending said one control conductor.

6. In a telephone system, an incoming trunk, a plurality of outgoing trunks divided into a plurality of groups each of which is divided into a plurality of subgroups and such trunks being further regrouped into a plurality of auxiliary groups each comprising one subgroup of each of said groups, a switch in which said incoming trunk terminates having access to a plurality of said outgoing trunks divided among said auxiliary groups, control apparatus, a control circuit, switching means individual respectively to said groups of trunks, means operative upon the seizure of one of said trunks through said first switch for operating the switching means allocated to the group of trunks in which said seized trunk is located for extending said control circuit to all trunks of the group in which the seized trunk is located, means individual to said seized trunk for further extending said control circuit to a terminal of one bank of said switch individual to the seized trunk, auxiliary switching means individual respectively to said auxiliary trunk groups, further extensions of said control circuit individual respectively to said auxiliary switching means and terminating in terminals of another bank of said switch which are multiplied together in accordance with the auxiliary groups in which the trunks to which the switch has access are allocated, and means operable upon the operation of a first switching means for operating the auxiliary switching means allocated to the auxiliary group in which the seized trunk is located for completing said control circuit.

ALOYSIUS J. BUSCH.