

Feb. 22, 1944.

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2,342,279

AUTOMATIC TOLL TICKETING SYSTEM

Filed Dec. 31, 1942

5 Sheets-Sheet 1

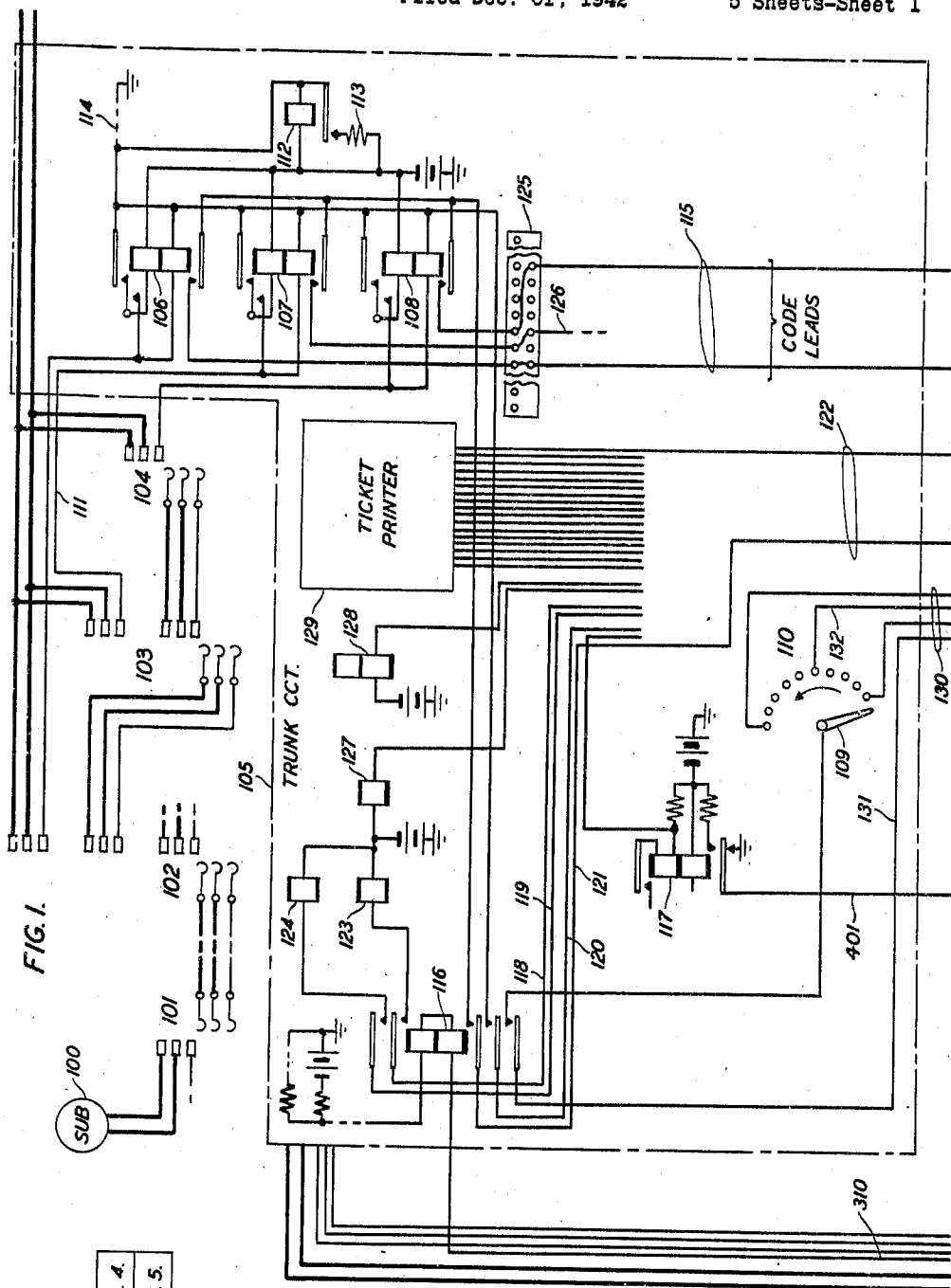


FIG. 6.

FIG. 1.	FIG. 4.	FIG. 5.
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5 Sheets-Sheet 2

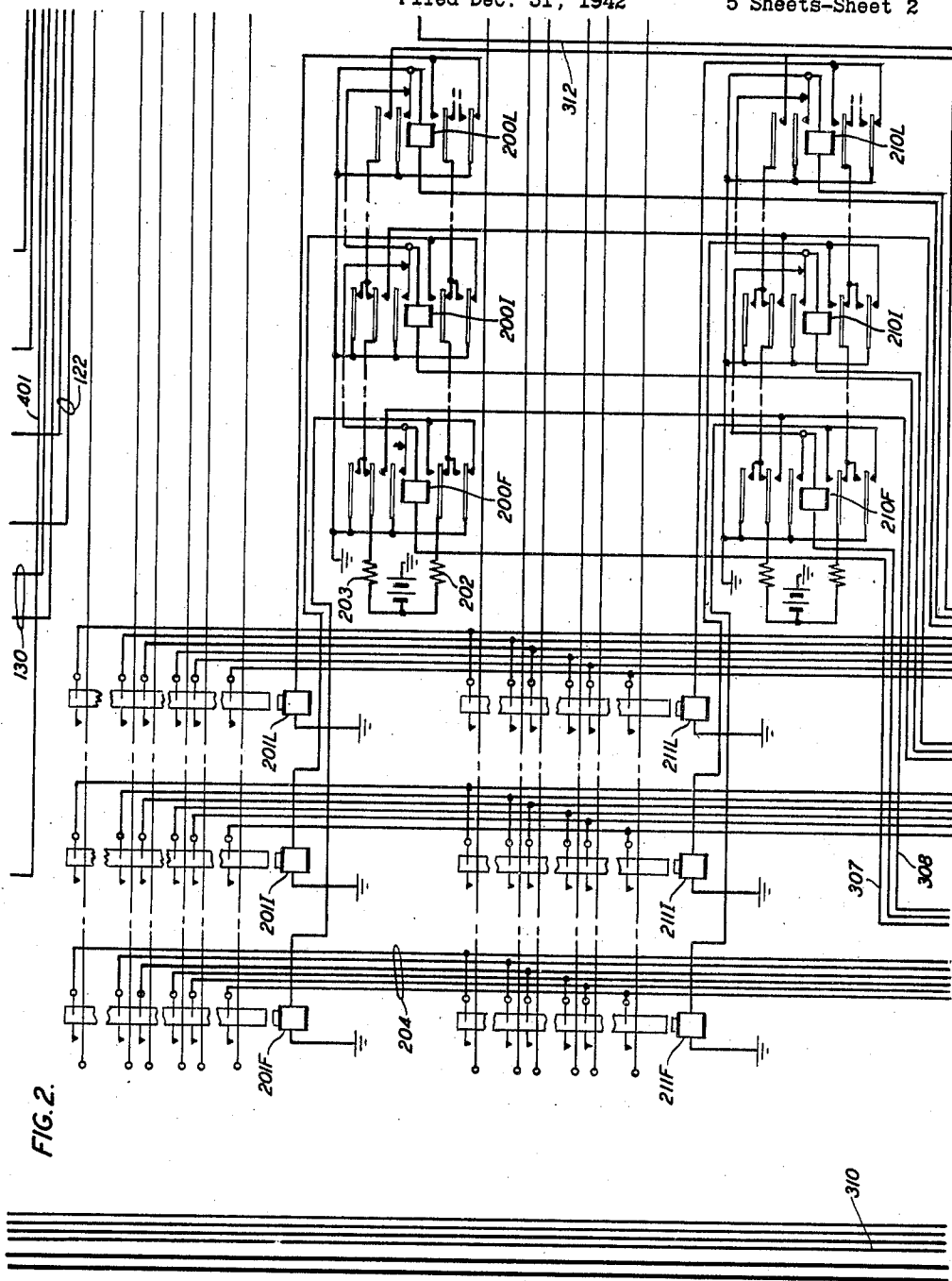


FIG. 2.

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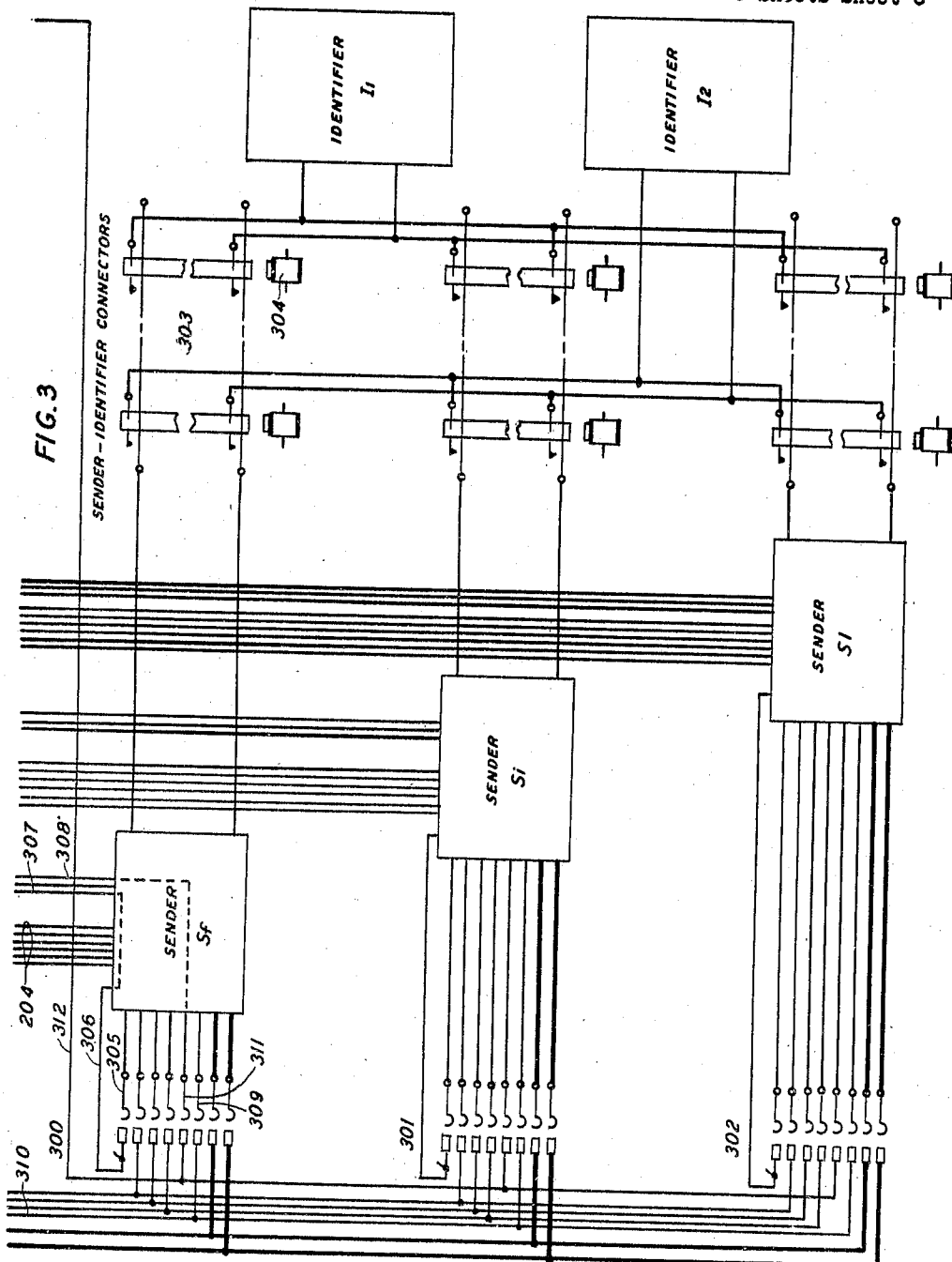
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5 Sheets-Sheet 3



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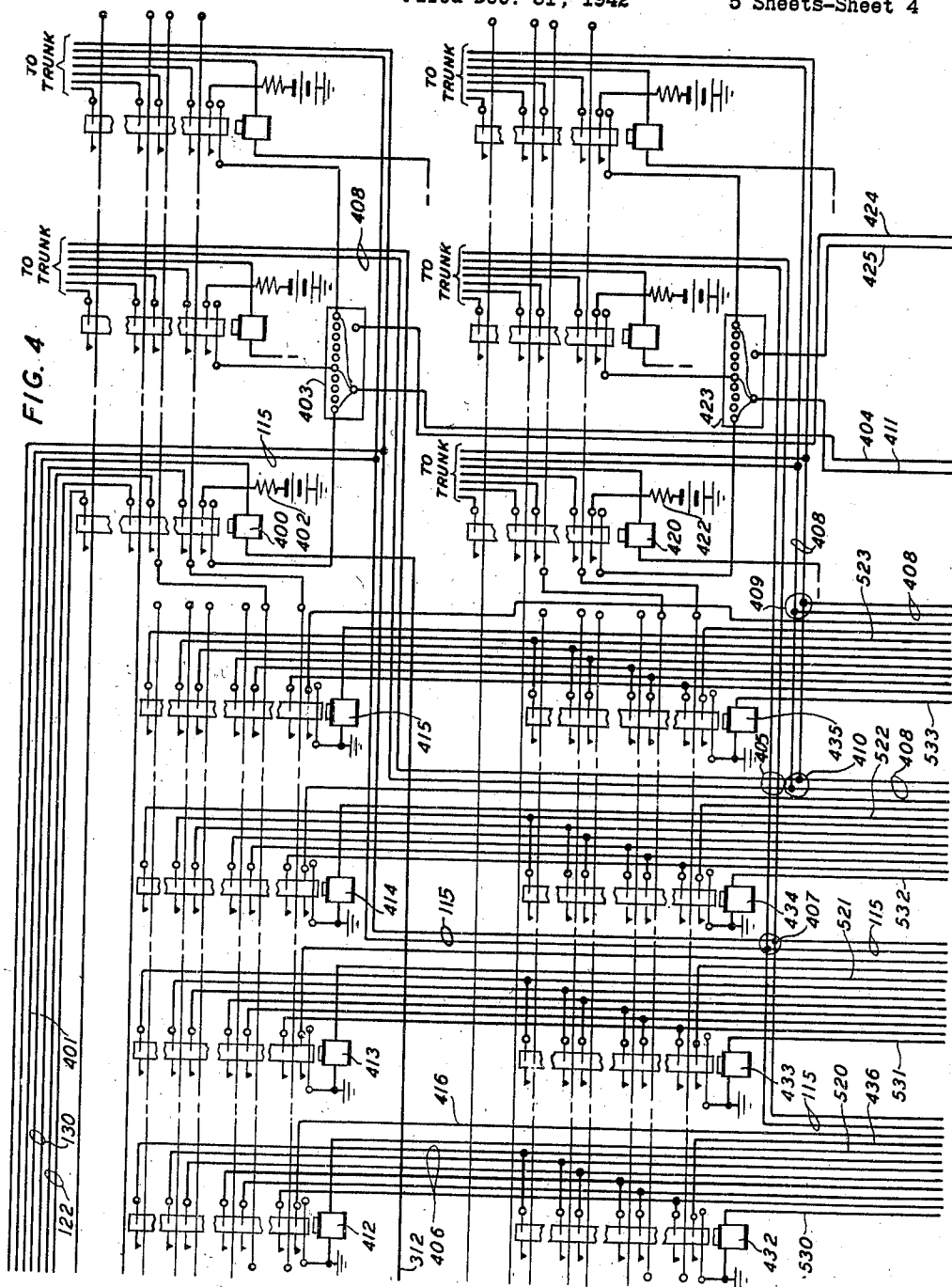
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AUTOMATIC TOLL TICKETING SYSTEM

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5 Sheets-Sheet 4



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AUTOMATIC TOLL TICKETING SYSTEM

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5 Sheets-Sheet 5

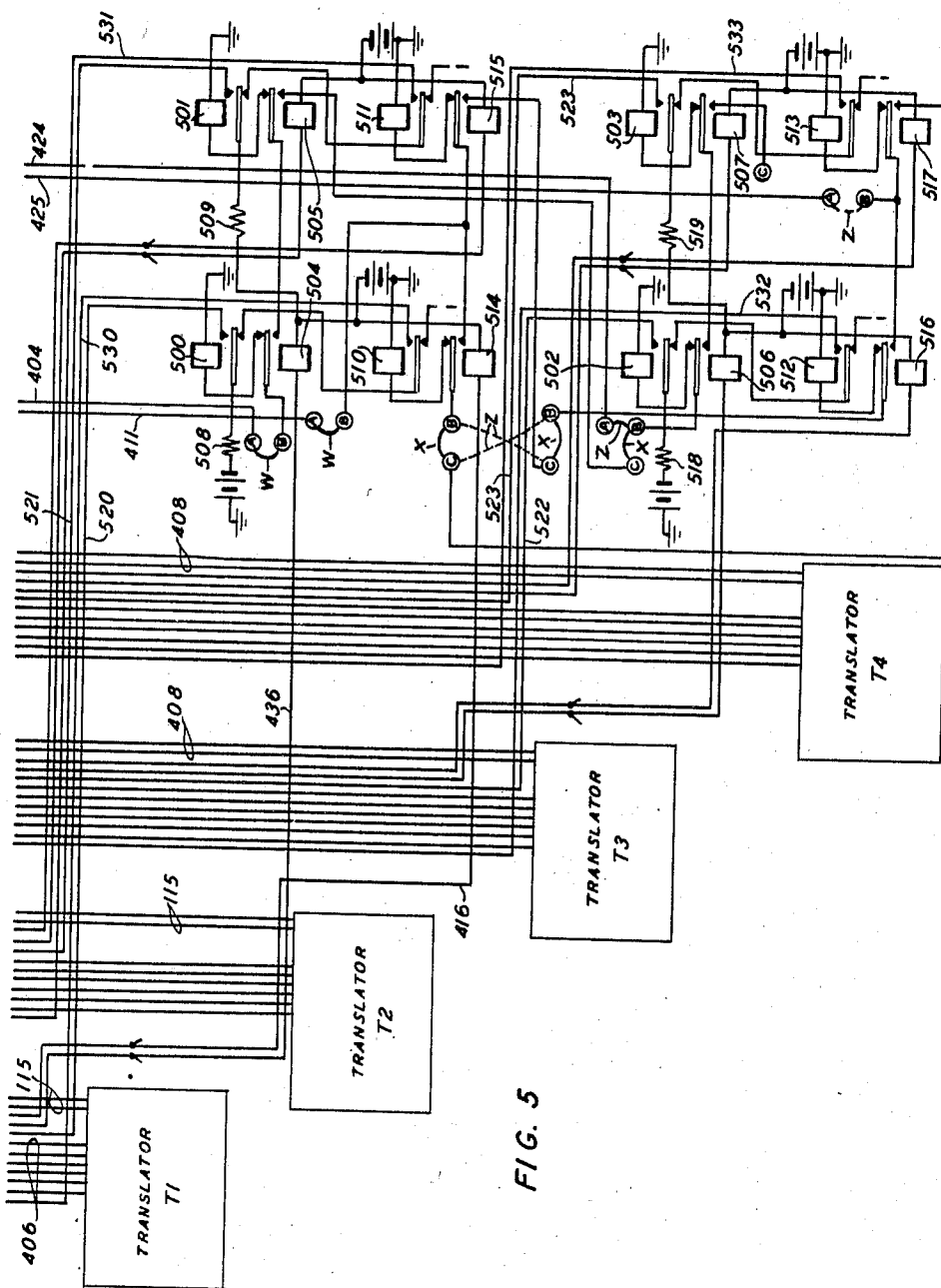


FIG. 5

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AUTOMATIC TOLL TICKETING SYSTEM

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Application December 31, 1942, Serial No. 470,790

8 Claims. (Cl. 179—18)

This invention relates to telephone systems and more particularly to a system for automatically preparing toll tickets for established toll connections.

As fully disclosed in the application of J. W. Gooderham, Serial No. 448,782, filed June 27, 1942, it has been proposed to enable subscribers to establish toll calls to nearby toll points by dialing. This is accomplished through the provision of a group of automatic ticketing trunks, each provided with a ticket printer, outgoing from an office and having access to all of the nearby toll offices to which subscribers are given access on a dialing basis. An idle one of these trunks may be seized for the extension of a connection in response to the dialing of one, two or three digits or letters of the office designation of a wanted line terminating 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 a 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 from his line 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 a sender-identifier-connector following the seizure of the sender and which identifier is then connected directly with the calling trunk over an identifier-trunk-connector circuit.

Since 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. The sender is provided with registers for registering the remaining digits of the called line number dialed by a calling subscriber and with registers for registering information concerning the desired connection secured by the identifier associated with it. 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 and on still other calls the trunk may be seized by a third selector in response to the dialing of three office code digits. 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 office code digit or the thousands numerical digit.

As soon as a first digit has been registered in the sender, which digit may be either the third office code digit, the thousands numerical digit or the hundreds numerical digit, an idle identifier is associated with the sender over a sender-identifier-connector and the identifier is associated directly with the trunk over an identifier-trunk-connector. Thereupon one of a plurality of code leads selected in accordance with whether the trunk was seized over a first, second or third selector bank level, causes the establishment of 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. 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 line and the manner in which the call from the calling line to the called line shall be ticketed. The identifier also proceeds to secure information concerning the identity of the calling line and to transfer such information to the sender. The sender then proceeds to establish a direct connection with the calling trunk over a sender-trunk-connector, over which connector it controls the printer of the trunk in accordance with the information concerning the call which it has secured from the identifier.

From the foregoing brief description of an automatic ticketing system heretofore proposed for use, it will be noted that the identifier of such system has two principal functions, first that of reconstructing the called office code from data submitted to it from the trunk over the identifier-trunk-connector and from data transmitted to it from the sender over the sender-identifier-connector, and, secondly, that of identifying the calling line and transmitting the identification data obtained from such identification to the associated sender. Thus the main purpose in connecting the identifier with the

trunk over the identifier-trunk-connector is to secure called office code data.

It is the object of the present invention to simplify a system of this type by eliminating the identifier-trunk-connector therefrom and in simplifying the identifier.

To attain this objective it is proposed to limit the functions of the identifier to that of identifying the calling line only and to reconstruct the called office code digits in a separate circuit which section may be termed a translator. The translator must be capable of association with both the trunk and the sender to receive data from which it may reconstruct the called office code digits and transmit such reconstructed code digits to the sender, and the sender must be capable of connection with the trunk as has been done heretofore over a sender-trunk-connector, to provide control paths between the sender and the ticket printer of the trunk. With the proposed arrangement, however, no paths between the identifier section and the trunk are required since the alternating current signal which has been transmitted from the identifier for enabling the identification of the calling line may be sent from the identifier through the sender to the calling line or from the sender to the calling line.

In accordance with the present invention an enlarged sender-trunk-connector is provided for establishing all of the paths formerly established by the sender-trunk-connector and the identifier-trunk-connector, which enlarged connector has access over certain of its contacts and contacts of the connector relay individual to the ticketing trunk with the trunk and which has access over other of its contacts and certain contacts of a translator-sender-trunk-connector relay with a translator. The trunk also has access over other contacts of its connector relay and over contacts of the translator-sender-trunk-connector relay with a translator. One translator may be found sufficient to serve an entire office building since its holding time is very short. In this case all of the office code leads from all of the ticketing trunks of the offices would be wired directly into the single translator. As an alternative arrangement two or more equivalent translators could be provided in each of which all of the code leads would appear and each would be first choice preference to a different portion of the trunks. As a further alternative arrangement two or more translators could be provided in one of which the code leads from a portion of the trunks would appear and which would be the choice of such trunks to reconstruct a portion of the total called office routes and in another of which the code leads from another portion of the trunks would appear and which would be the choice of such trunks to reconstruct another portion of the total routes. Thus in accordance with this invention a saving in the office code reconstruction equipment may be attained as there may be a smaller number of translators than there are identifiers and a considerable saving in multicontact relays constituting the connectors would be secured.

For a clearer understanding of the invention attention is now directed to the following detailed description thereof taken in connection with the accompanying drawings in which:

Fig. 1 shows schematically a calling line, a line finder and first, second and third selector switches for extending connections from the calling line to an automatic ticketing trunk and

a portion of the equipment of a ticketing trunk including a digit register and a ticket printer;

Figs. 2 and 4 taken together disclose two of the sender-trunk-connectors for associating the trunk with any one of a plurality of senders and translator-sender-trunk-connector relays which form a part of the sender-trunk-connector for associating the trunks and senders with the translators shown in Fig. 5;

Fig. 3 shows schematically three of the senders of the originating office or office building and their associated trunk-finders, the identifiers and sender-identifier-connectors for connecting any seized sender with an idle identifier;

Fig. 5 shows schematically the translators and associated preference relay circuits; and

Fig. 6 is a diagram showing the manner in which the several figures of the drawings should be arranged to completely disclose the invention.

The line finder 101 and the first, second and third selectors 102, 103 and 104 of Fig. 1 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 105, the equipment of which is enclosed in the dot-dash rectangle. The trunk 105 is disclosed as having bank level appearances in the first, second and third selectors disclosed, and as provided with a sleeve relay, such as relays 106, 107 and 108 for each such appearance, which relays control the establishment of circuits over code leads to inform a translator concerning the value of office code digits which have been dialed to set the first, second or third selector switches to seize the trunk. The trunk is also equipped with a small step-by-step rotary switch 110, one brush 109 and associated terminal arc of which are disclosed, for registering the first digit dialed by the calling subscriber following the seizure of the trunk, and with a ticket printer. The apparatus of a complete ticketing trunk is fully disclosed and described in the Gooderham application hereinbefore referred to.

The trunk-finders 300, 301 and 302 schematically disclosed in Fig. 3 are of the well-known double brush step-by-step type and are individualized to the senders indicated by the boxes S_j, S_i and S_l. These trunk-finders and senders are fully disclosed in the Gooderham application.

Since a trunk-finder does not have sufficient brushes in both of its brush sets to accommodate all of the control conductors required between a trunk and a sender, a plurality of sender-trunk-connector circuits is provided, two of which are disclosed in Figs. 2 and 4. Ten of such connector circuits would be provided for each one hundred trunks each comprising a multicontact relay individual to each sender, as shown in the left portion of Fig. 2, and each comprising ten multicontact relays, such as those disclosed in the right portion of Fig. 4, individual respectively to ten trunks. For interconnecting senders, trunks and translators ten translator-sender-trunk-connector relays would be provided for each translator for cooperation with the ten sender-trunk-connector circuits. If four translators are provided forty of such relays would be necessary, eight of which are disclosed in the left portion of Fig. 4. The sender-identifier-connector circuits disclosed in Fig. 3 are also of the multicontact relay type one being provided for each sender and each having as many multicontact relays as there are identifiers.

The identifiers indicated by the boxes I1 and I2 Fig. 3 are similar to the identifiers fully disclosed in the Gooderham application above referred to except that the apparatus for reconstructing the called office code digits dialed by a calling subscriber has been removed therefrom and installed in apparatus units which have been termed translators. Four of such translators are indicated by the boxes T1, T2, T3 and T4 of Fig. 5. Each of these translators is equipped with a route relay for each called office route for which such translator is assigned to reconstruct the office code digits, a register for receiving any digit registered by the digit register of an associated trunk and transferred thereto, a register for receiving any digit registered by the first dial pulse register of the associated sender and transferred thereto, relay equipment for receiving and registering information concerning office code digits dialed to select the ticketing trunk which has been associated with the translator and transmitted to the translator over one of the code leads extending to it from the trunk, other relay equipment for assembling this data to operate an appropriate one of the route relays, and relay equipment operable by the route relay to transmit the digits of the reconstructed called office code to the associated sender.

To more clearly set forth the novel features of the invention it will be assumed that the subscriber whose substation is identified by the numeral 100 in Fig. 1 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 101 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 102, paired with the line finder 101 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 DEL-1345 and that a ticketing trunk over which the connection to that line may be extended may be reached over the second bank level of the second selector 103. The calling subscriber upon hearing the dial tone therefore proceeds to dial the office code letters D, E, L and the numerical digits 1, 3, 4 and 5. In response to the dialing of the first code letter D, which has a numerical equivalent 2, the brushes of the first selector 102 are raised to a position opposite the second level of its bank whereupon they rotate to select an idle second selector 103. In response to the dialing of the second code letter E, which has a numerical equivalent 2, the brushes of the second selector 103 are raised to a position opposite the second level of its bank whereupon they rotate to select an idle ticketing trunk assumed to be the trunk 105.

Upon the seizure of trunk 105 the line relay thereof (not shown) is operated to cause an idle sender to become associated with the trunk. Following the seizure of the trunk the next digit dialed by the calling subscriber, assumed to be the third code letter L, having the numerical equivalent 5, is registered in register 110 of the trunk thereby advancing the brush 109 of such register to the No. 5 terminal of its arc. Thereafter the remaining numerical digits 1, 3, 4 and 5 dialed by the calling subscriber are registered in

the registers of the sender which has become associated with the trunk. It will be assumed that upon the seizure of the trunk 105, the trunk-finder 300 was operated to find such trunk and to connect the sender Sf associated therewith with the trunk. As soon as a digit has been registered in the sender, in the case assumed the thousands numerical digit 1, an idle identifier, for example the identifier I1 is connected to the sender Sf over the identifier-sender-connector 303 by the operation of the multicontact relay 304 of such connector as described in the application of J. W. Gooderham hereinbefore referred to.

Also upon the seizure of the trunk 105 sleeve relay 107 of such trunk appertaining to the bank level appearance of the trunk in the bank of the second selector 103 is operated over a circuit which may be traced in part from ground applied over the test brush of the second selector 103, over sleeve conductor 111, through the lower winding of sleeve relay 107, through the winding of relay 112 to battery, and in parallel with the winding of relay 112 over the back contact of relay 112 and through resistance 113 to battery. Relay 107 thereupon operates, locks from battery through its upper winding and over its upper front contacts to ground applied to conductor 114 as a result of the operation of the line relay of the trunk, and extends that ground to sleeve conductor 111 to hold the line finder 101 and operated selector switches 102 and 103 from releasing. Relay 107 also prepares a circuit to one of the code leads in the cable 115 extending to translators T1 and T2 for a purpose to be later described.

With the trunk-finder 300 operated a circuit is established from battery supplied from the associated sender Sf over brush 305 of such trunk-finder to one of ten conductors which informs the sender with respect to the subgroup of ten trunks in which the calling trunk is located. It will be assumed that the trunk is located in the first subgroup and that therefore the sender-trunk-connector circuit serving such group and appearing in the upper portion of Figs. 2 and 4 should be used. Battery is therefore connected from the sender over brush 305 to conductor 307, through the winding of preference relay 200F allocated to the first sender-trunk-connector circuit and to the first sender Sf, over the inner upper normal contacts of the preference relays of the first sender-trunk-connector circuit allocated to the intermediate and last senders, such as relays 200I and 200L, to ground. Preference relay 200F operates if the sender-trunk-connector circuit has not been taken for use by some other sender on another call, locks over its inner upper alternate contacts to ground; establishes an operating circuit for the multicontact relay 201F from ground through the winding of such relay, over the inner lower front contact of relay 200F, through resistance 202 to battery and establishes a circuit from battery through resistance 203, over the middle upper front contact of relay 200F, conductor 308 to the sender Sf, thence in the manner fully described in the Gooderham application, to trunk-finder brush 309 of the trunk-finder 300, thence over conductor 310 through the windings of connector relay 116 of the calling trunk 105 to ground. A circuit is also established from battery through resistance 203, over the middle upper front contact of relay 200F, conductor 309 to the sender Sf, thence over brush 311 of the trunk-finder 300, conductor 312, through the winding of multicontact relay 400 allocated to the calling

trunk 105, conductor 401 to ground at the back contact of the tip party test relay 117 of the trunk.

With multicontact relays 201F and 400 of the sender-trunk-connector circuit allocated to the sub-group of ten trunks in which the calling trunk is located, both operated, and the connector relay 116 of the calling trunk 105 also operated, a plurality of control conductors 118, 119, 120 and 121 of cable 122 are extended over the upper four contacts of multicontact relays 400 and 201F, and over conductors of cable 204 to the sender S_f and from such sender over contacts of the sender-identifier connector 303 to the identifier taken for use, such as identifier 11. The identifier when seized by the sender or, alternatively, the sender after it has been signaled that an identifier has been seized is ready to proceed with the identification of the calling line, causes the connection of tone current from a source of 270-cycle alternating current to conductor 120 and thence over the middle lower contacts of connector relay 116 of the trunk 105, over the upper contacts of the operated sleeve relay 107 to the sleeve conductor 111 which has been extended by the operated selector switches 103 and 102 and the line finder 101 to the sleeve conductor of the calling line for line identification purposes. The identifier then proceeds to identify the calling line. If from this identification the identifier determines that the attempted call is one for which automatic ticketing service is to be denied the calling subscriber, the identifier causes the connection of ground to conductor 118 and thence over the inner upper contacts of connector relay 116 of the trunk thereby completing the circuit of relay 123 in the trunk. If the call is one for which no ticket should be printed, the identifier causes the connection of ground to conductor 119 and thence over the upper contacts of connector relay 116 thereby completing the circuit of relay 124. The identifier also causes the connection of battery to conductor 121, thence over the inner lower contacts of connector relay 116 and the lower contacts of the operated sleeve relay 107 to a terminal on cross-connecting rack 125 which is connected to a code lead such as 126 of cable 115, indicative of the fact that the trunk 105 was seized as the result of the calling subscriber dialing a first code digit 2 and a second office code digit 2.

Other conductors of the cable 122 are also extended from control relays such as 127 and 128 and from the ticket printer 129 of the trunk, over other contacts of the multicontact relays 400 and 201F and other conductors of cable 204 to the sender S_f over which conductors the sender controls such relays and controls the printer to print toll data for the call established over the trunk 105 in accordance with registrations set up upon registers of the sender.

When multicontact relay 400 operates, it establishes a circuit from battery through resistance 402 to a terminal on cross-connecting rack 403 which rack has corresponding terminals for all trunks of the same subgroup of ten trunks. The rack 403 is also provided with two terminals which may be connected to the winding of translator preference relay 500 or 502. Each subgroup of ten trunks is provided with a similar cross-connecting rack there being thus ten such racks for the main group of one hundred trunks. The rack associated with another of the ten subgroups of trunks is indicated by the numeral 423, the ten upper terminals of which rack are con-

nected to contacts of the multicontact relays allocated to the ten trunks of the subgroup and the lower two contacts being connectable to the winding of translator preference relay 501 or 503.

For enabling the trunks to have access to one or more of the translators in accordance with the requirements of the toll traffic, the translator busy and preference relays of Fig. 5 are provided. For each sender-trunk-connector circuit four preference relays, such as 500 to 503, inclusive, one for each of the four translators, and four translator busy relays, such as 504 to 507, inclusive, one for each of the four translators, are provided. Relays 500 to 507, inclusive, are allocated to the sender-trunk-connector circuit disclosed in the upper portion of Fig. 4 and preference relays 510 and 513, inclusive, and translator busy relays 514 to 517, inclusive, are allocated to the sender-trunk-connector circuit disclosed in the lower portion of Fig. 4. It is to be understood that if there are one hundred trunks divided into ten 10-trunk subgroups, eight additional groups of these preference and busy relays would be provided.

Each sender-trunk-connector circuit is also provided with as many multicontact translator connector relays, such as 412 to 415, inclusive, as there are translators. When any one of these relays operates to connect its associated translator to a calling trunk served by the sender-trunk-connector circuit of which it forms a part, it is instrumental in operating all of the translator busy relays appertaining to such associated translator and allocated to all of the sender-trunk-connector circuits with the exception of the particular sender-trunk-connector circuit in which the operated translator connector relay is located. For example, if connector relay 412 is operated it closes a circuit from ground over its lower contacts and conductor 416 to battery through the winding of translator busy relay 514 allocated to the translator T₁ and to the sender-trunk-connector circuit disclosed in the lower portion of Fig. 4 and in parallel to battery through the windings of similar busy relays allocated to the translator T₁ and to all other sender-trunk-connector circuits with the exception of the circuit of which the operated connector relay 412 is a part. As another example, if connector relay 432 is operated it closes a circuit from ground over its lower contacts and conductor 436 to battery through the winding of translator busy relay 504 allocated to the translator T₁ and to the sender-trunk-connector circuit disclosed in the lower portion of Fig. 4 and in parallel to battery through the windings of similar busy relays allocated to the translator T₁ and to all other sender-trunk-connector circuits with the exception of the circuit of which the operated connector relay 432 is a part.

To afford flexibility in the assignment of translators to serve the trunks, cross-connection terminals A, B and C are provided, the terminals A being connected to conductors terminating in the cross-connecting racks 403, 423, etc., the terminals B being connected to the armatures of the translator busy relays and the terminals C being connected to the front contacts of the translator busy relays. When these terminals are interconnected by W and X strappings and the Z strappings are omitted, any trunk may be served by any one of the four translators, one of the translators being a first choice preference for certain of the trunks, another of the translators being first choice preference for certain oth-

ers of the trunks, etc. When these terminals are interconnected by W and Z strappings and the X strappings are omitted, one half of the trunks may be served by two of the translators certain of such trunks having first choice preference of one of such translators and the others of said trunks having first choice preference of the other of such translators, and the other half of the trunks may be served by the other two translators, certain of the latter half of the trunks having first choice preference to one of such translators and the others of such trunks having first choice preference of the other of such translators.

It will first be assumed that the W and X strappings are provided and that the toll traffic is such that all four translators T1 to T4, inclusive, are required. With this assumption all of the code leads extending from all of the trunks through cables 115 and 403 would be multiplied into all of the translators at the cross-connection points 405, 407, 409 and 410. In the foregoing discussion it has been assumed that the trunk 105 has been seized on a toll call and that multicontact relay 400 individual to the calling trunk has been operated. With relay 400 operated and assuming that the translator T1 which has been made a first choice preference for trunk 105 by the cross-connection at the rack 403 of the terminal thereon individual to the trunk 105 to the terminal connected to conductor 404, is at the time idle, a circuit is established from battery through resistance 402 over the lower contacts of relay 400, terminals of rack 403, conductor 404, strapping W, over the back contacts of translator busy relay 504 allocated to translator T1, to ground through the winding of preference relay 500. Relay 500 thereupon operates and establishes a circuit from battery through resistance 508, over the front contact of relay 500 and conductor 520 to ground through the winding of translator connector relay 412 associated with the sender-trunk-connector circuit serving the subgroup of ten trunks including the calling trunk 105.

Multicontact relay 412 upon operating establishes over its lower contacts the previously traced circuit of translator busy relay 514 and the similar relays appertaining to other sender-trunk-connector circuits to render the translator T1 busy to the trunks of all other subgroups.

Multicontact relay 412 upon operating also extends eleven conductors of cable 130 extending from the trunk over contacts of operated multicontact relay 400, contacts of multicontact relay 412 and conductors of cable 406 to the seized translator T1. The translator upon its seizure connects battery to conductor 131 of cable 130, thence over the lower contacts or connector relay 116 of the trunk 105 to brush 109 of the digit register 110 and since it has been assumed that this brush has been set upon the No. 5 terminal of its arc to register the third code digit letter L, which has the numerical equivalent of 5, a circuit is completed back over conductor 132 of cable 130 and over the connection established by operated relays 400 and 412, over a conductor of cable 406, through a register relay in the translator to ground. Such register relay is therefore operated to register the third code letter L transferred thereto from the digit register 110 of the trunk.

Multicontact relay 412 upon operating also extends ten conductors of cable 204 extending from the sender over contacts of multicontact relay 201F, contacts of relay 412 and conductors of cable 406 to the translator T1 over which con-

ductor the sender transfers the setting of the first dial pulse digit register set in response to the first digit dialed into the sender Sf by the calling subscriber or, in the case assumed, the thousands numerical digit 1 of the wanted line number, to a sender-digit-register of the seized translator T1. Since a circuit over a code lead of cable 115 has already been established between the trunk and translator, the translator now has all of the information required to reconstruct the office code digits of the wanted line number dialed by the calling subscriber.

The translator now proceeds in the manner fully described in connection with the operation of similar equipment disclosed in the Gooderham application hereinbefore referred to, to cause the operation of a route relay indicative of the route required to extend a connection to the wanted line. The route relay upon operating then causes the selected grounding of other conductors of cable 406 extended over contacts of multicontact relay 412, contacts of multicontact relay 201F, and conductors of cable 204 for setting registers of the sender Sf to register the reconstructed office code digits and the thousands numerical digit if such digit was initially registered in the trunk register.

The identifier I1 has in the meantime proceeded with the identification of the calling line and has registered therein the digits which identify the office unit in which the line terminates, the numerical number of such line and its class. When these registrations are completed they are transferred to the sender Sf over contacts of the sender-identifier-connector 303 in the manner fully set forth in the Gooderham application.

When the sender has registered therein the office code and numerical digits of the wanted line number it proceeds to control selector switches to extend a connection from the trunk 105 to the wanted line and when the data concerning the calling line has been transferred to the sender, the sender proceeds to control the printer over control conductors extending through cable 204, over contacts of relay 201F, contacts of relay 400, and conductors of cable 122 to print on a toll ticket all of the data relating to the toll call which has been registered in the sender, including the number of the calling line, the number of the called line, the initial rate to be charged for the call, the month, day, hour and fraction of the hour of the time the call was made and secured by the sender from a month, day and hour circuit and other information.

Had the translator T1 been busy at the time the trunk 105 attempted to connect therewith through the operation of relay 400, then when relay 400 operated and connected battery to conductor 404 a circuit would have been completed over the upper front contact of busy relay 504, now operated, and over the back contact of busy relay 505 to ground through the winding of relay 501, whereupon relay 501 would have operated to establish a circuit from battery through resistance 509, the front contact of relay 501, conductor 421 to ground through the winding of translator connector relay 413. With relay 413 operated the translator T2 would have been rendered busy to other trunks by the operation of translator busy relays, such as 515, and would have been connected to the trunk 105 and sender Sf. Had the translator T2 also been busy the previously traced circuit over conductor 404 would have been extended over front contacts of relays 504 and 505, strapping X, thence over

the back contacts of relay 506, if the translator T3 was idle, to ground through the winding of relay 502 thereby resulting in the connection of translator T3 to the trunk 105 and sender Sf through the operation of connector relay 414 over conductor 522. Had the translator T3 also been busy, the previously traced circuit over conductor 404 would have been extended over front contacts of relays 504 and 505, strapping X, over the front contact of relay 506 and the back contact of relay 507, if the translator T4 was idle, to ground through the winding of relay 503 thereby resulting in the connection of translator T4 to the trunk 105 and sender Sf through the operation of connector relay 415 over conductor 523.

Had the initiated toll call seized a trunk in another subgroup of ten trunks resulting in the operation of a multicontact relay 211F and a multicontact relay 420 of the sender-trunk-connector serving that subgroup, then assuming that such trunk is a trunk to which the translator T2 is a first choice preference, the operation of relay 420 establishes a circuit from battery through resistance 422, over the lower contacts of relay 420, over a cross-connection on rack 423, conductor 411, strapping W, over the back contacts of translator busy relay 515 allocated to translator T2, it being assumed that such translator is idle, to ground through the winding of preference relay 511. Relay 511 upon operating establishes a circuit from battery through resistance 509, over the back contact of relay 501, the front contact of relay 511, conductor 531 to ground through the winding of translator connector relay 433 thereby causing the connection of translator T2 to the calling trunk and to the sender taken for use. Had the translator T2 been busy then the circuit over conductor 411 would have been extended over the front contact of relay 515, then operated with translator T2 busy, over strapping X and the back contact of relay 516, assuming translator T3 to be idle, to ground through the winding of relay 512 thereby resulting in the operation of translator-connector relay 434 over conductor 532 and the connection of translator T3 to the calling trunk and to the seized sender. Had the translator T3 been busy then the circuit over conductor 411 would have been extended over the front contacts of relays 515 and 516 and the back contact of relay 517, assuming translator T4 to be idle, to ground through the winding of relay 513, thereby causing the operation of translator-connector relay 435 over conductor 533 and the connection of translator T4 to the calling trunk and to the seized sender. Had the translator T4 been busy then the circuit over conductor 411 would have been extended over the front contacts of relays 515, 516 and 517 and the X strapping, over the back contact of relay 514 to ground through the winding of relay 510 thereby causing the operation of translator-connector relay 432 over conductor 530, and the connection of translator T1 to the calling trunk and to the seized sender.

In a similar manner, a trunk in another subgroup would be given first choice preference to translator T3 and subsequent choices to translators T4, T1 and T2 in the order named, and a trunk in another subgroup would be given first choice preference to translator T4 and subsequent choices to translators T1, T2 and T3 in the order named.

It will be obvious that if the toll traffic is not heavy enough to require the services of four translators, some of such translators together with their associated connector relays, busy re-

lays and preference relays could be omitted. For example, should the traffic be so light that only one translator would be required then the terminals of all trunks appearing on cross-connecting racks 403, 423, etc., would be connected to 404, 424, etc., and over the back contacts of translator busy relays, such as 504 and 506, would be connected to the windings of preference relays, such as 500 and 502, if the translator was idle, or to a suitable alarm circuit should the translator be busy.

As an alternative arrangement one-half of the trunks could be given access only to translators T1 and T2 on a preference basis and the other half of the trunks could be given access only to translators T3 and T4 on a preference basis. Under this condition the code leads in cable 115 serving one-half of the trunks would be multipled at point 407 into the two translators T1 and T2, and the code leads in cable 408 serving the other half of the trunks would be multipled at points 409 and 410 into the two translators T3 and T4 and the multiplying at point 405 would be omitted. Also strappings W and Z would be used in Fig. 5 and strapping X omitted. It will now be assumed that trunk 105 is one which is to be served by either translator T1 or T2 and that therefore its terminal on the rack 403 is cross-connected to conductor 404. When therefore, the trunk 105 is calling and its relay 400 is operated to connect battery to conductor 404, a circuit is completed over strapping W and the back contact of relay 504 to ground through the winding of relay 500 to thereby cause the operation of relay 500 and the connection of translator T1 to trunk 105 through the operation of connector relay 412, if translator T1 is idle, or if it is busy and busy relay 504 is operated, such circuit is extended over the front contact of relay 504 and the back contact of relay 505 to ground through the winding of relay 501, whereby relay 413 is operated to connect translator T2 to the trunk 105. If translator T2 is also busy and relay 505 is therefore operated, the circuit from conductor 404 may not be extended further, over the front contact of relay 505 to another translator, since the front contact of relay 505 is not strapped to the armature of relay 506.

In a similar manner if the trunk to which relay 420 is individual is calling and is connected over rack 423 to conductor 411, and is to be served by translators T1 and T2, conductor 411 is extended over strapping W and the back contact of busy relay 515, if translator T2 is free, to ground through the winding of relay 511 whereupon connector relay 433 is operated to connect translator T2 as a first choice preference to the calling trunk.

Other trunks in the same subgroups could be arranged to be served by either translator T2 and T3 by the cross-connection of their individual terminals on the racks, such as 403 and 423, to conductors such as 424 and 425. If connected to conductor 424 the operation of the relay, such as 400, individual to the trunk establishes a circuit from conductor 424 over the Z strapping and the back contact of busy relay 506, if the translator T3, is idle to ground through the winding of relay 502 whereby relay 502 is operated to establish a circuit from battery, through resistance 518, over its front contact and conductor 522, through the winding of connector relay 414 to connect translator T3 as a first choice preference to the trunk. If, however, translator T3 is busy this circuit from conductor 424 is ex-

tended over the front contact of busy relay 506 and the back contact of relay 507 to ground through the winding of relay 503 whereby relay 503 is operated to establish a circuit from battery through resistance 519, over its front contact and conductor 523, through the winding of connector relay 415, to connect translator T4 as second choice preference to the trunk. Similarly, if the terminal of a calling trunk is connected to conductor 425, a circuit is completed from such conductor, over Z strapping, and the back contact of relay 517, through the winding of relay 513 to ground whereby relay 513 is operated to establish a circuit from battery through resistance 519, over the back contact of relay 502 and the front contact of relay 513 and conductor 533 to ground through the winding of connector relay 435 to connect translator T4 as first choice preference to the trunk. If, however, translator T3 is busy, the circuit over conductor 425 is extended over the front contact of busy relay 517, strapping Z, over the back contact of relay 516 and through the winding of relay 512 to ground whereby relay 512 is operated to establish a circuit from battery through resistance 518, over the back contact of relay 502 and the front contact of relay 512, and over conductor 532 to ground through the winding of connector relay 434 to connect translator T3 as second choice preference to the trunk.

If one-half of the trunks may be served by a single translator, translators T1 and T3 would only be required and translators T2 and T4 with their associated connector relays 413, 433, etc., 415, 435, etc., preference relays 501, 503, 511, 513, etc., and busy relays 505, 507, 515, 517, etc., would be omitted and the individual terminals of one-half of the trunks would be connected over conductors, such as 404, to the armatures of relays, such as 504, 514, etc., and the terminals of the other half of the trunks would be connected over conductors, such as 424, to the armatures of relays, such as 506, 516, etc.

Instead of dividing the trunks of each subgroup to be served half by the translators T1 and T2 and half by the translators T3 and T4, the two translators T1 and T2 could be allocated to serve all of the trunks in one half of the subgroups and the two translators T3 and T4 could be allocated to serve all of the trunks in the other half of the subgroups. The same provision could of course be retained for giving certain of the trunks first choice preference of a translator and others of the trunks first choice preference of another translator.

What is claimed is:

1. In a telephone system, a calling subscriber's line, a trunk, means for extending a connection from said line to said trunk, a plurality of senders, means responsive to the seizure of said trunk for associating an idle one of said senders therewith, a plurality of identifiers for determining the identification of the calling line, means responsive to the seizure of a sender for associating an idle identifier therewith, a translator for reconstructing called office code digits dialed by the calling subscriber, a first connector relay individual to said trunk, a second connector relay operable by said sender, a third connector relay operable by said translator, and circuits established by said relays for interconnecting said sender and said trunk and for connecting said translator with said trunk and with said sender.

2. In a telephone system, a calling subscriber's line, a plurality of trunks divided into subgroups,

means for extending a connection from said line to an idle one of said trunks, a plurality of senders, means responsive to the seizure of a trunk for associating an idle one of said senders therewith, a plurality of identifiers for determining the identification of the calling line, means responsive to the seizure of a sender for associating an idle identifier therewith, a translator for reconstructing called office code digits dialed by the calling subscriber, a plurality of sender-trunk-connector circuits equal in number to said subgroups of trunks and each comprising multicontact relays individual respectively to said senders, a multicontact relay individual to said translator and multicontact relays individual respectively to the trunks of the subgroup to which such circuit appertains, and means responsive to the connection of a sender to a calling trunk to operate multicontact relays of a connector circuit allocated to the subgroup of trunks in which such trunk is located to interconnect said sender and said trunk and to connect said translator with said trunk and with said sender.

3. In a telephone system, a calling subscriber's line, a plurality of trunks divided into subgroups, means for extending a connection from said line to an idle one of said trunks, a plurality of senders, means responsive to the seizure of a trunk for associating an idle one of said senders therewith, a plurality of identifiers for determining the identification of the calling line, means responsive to the seizure of a sender for associating an idle identifier therewith, a plurality of translators for reconstructing called office code digits dialed by the calling subscriber, a plurality of sender-trunk-connector circuits equal in number to said subgroups of trunks and each comprising multicontact relays individual respectively to said senders, multicontact relays individual respectively to said translators, and multicontact relays individual respectively to the trunks of the subgroup to which such circuit appertains, and means responsive to the connection of a sender to a calling trunk to operate multicontact relays of a connector circuit allocated to the subgroup of trunks in which such trunk is located to interconnect said sender and said trunk and to connect one of said translators with said trunk and with said sender.

4. In a telephone system, a calling subscriber's line, a plurality of trunks divided into subgroups, means for extending a connection from said line to an idle one of said trunks, a plurality of senders, means responsive to the seizure of a trunk for associating an idle one of said senders therewith, a plurality of identifiers for determining the identification of the calling line, means responsive to the seizure of a sender for associating an idle identifier therewith, a plurality of translators for reconstructing called office code digits dialed by the calling subscriber, certain of which translators are allocated to serve certain of said trunks and others of which are allocated to serve others of said trunks, a plurality of sender-trunk-connector circuits equal in number to said subgroups of trunks and each comprising multicontact relays individual respectively to said senders, multicontact relays individual respectively to said translators, and multicontact relays individual respectively to the trunks of the subgroup to which such circuit appertains, and means responsive to the connection of a sender to a calling trunk to operate multicontact relays of a connector circuit allocated to the subgroup of trunks in which such trunk is located to inter-

connect said sender and said trunk and to connect the translator allocated to serve such trunk with said trunk and with said sender.

5. In a telephone system, a calling subscriber's line, a plurality of trunks divided into subgroups, means for extending a connection from said line to an idle one of said trunks, a plurality of senders, means responsive to the seizure of a trunk for associating an idle one of said senders therewith, a plurality of identifiers for determining the identification of the calling line, means responsive to the seizure of a sender for associating an idle identifier therewith, a plurality of translators for reconstructing called office code digits dialed by the calling subscriber, one of which translators is allocated to serve certain of said trunks and the other of which is allocated to serve the remainder of said trunks, a plurality of sender-trunk-connector circuits equal in number to said subgroups of trunks and each comprising multicontact relays individual respectively to said senders, multicontact relays individual respectively to said translators and multicontact relays individual respectively to the trunks of the subgroup to which such circuit appertains, and means responsive to the connection of a sender to a calling trunk to operate multicontact relays of a connector circuit allocated to the subgroup of trunks in which such trunk is located to interconnect said sender and said trunk and to connect the translator allocated to serve such trunk with said trunk and with said sender.

6. In a telephone system, a calling subscriber's line, a plurality of trunks divided into subgroups, means for extending a connection from said line to an idle one of said trunks, a plurality of senders, means responsive to the seizure of a trunk for associating an idle one of said senders therewith, a plurality of identifiers for determining the identification of the calling line, means responsive to the seizure of a sender for associating an idle identifier therewith, a plurality of translators for reconstructing called office code digits dialed by the calling subscriber, certain of which translators are allocated to serve certain of said trunks and others of which are allocated to serve others of said trunks, a plurality of sender-trunk-connector circuits equal in number to said subgroups of trunks and each comprising first multicontact relays individual respectively to said senders, second multicontact relays individual respectively to said translators, and third multicontact relays individual respectively to the trunks of the subgroup to which such circuit appertains, means responsive to the connection of a sender to a calling trunk to operate a first relay

individual to the sender and a third relay individual to the calling trunk of the connector circuit allocated to the subgroup of trunks in which such trunk is located for establishing control circuits between said sender and said trunk, and means controlled by the operation of said third relay for operating a second relay of said connector circuit individual to the translator allocated to serve such trunk to establish circuit paths from said trunk to said translator and to establish circuit paths between said translator and said sender.

7. In a telephone system, a calling subscriber's line, a trunk, means for extending a connection from said line to said trunk, a plurality of senders, means responsive to the seizure of said trunk for associating an idle one of said senders therewith, an identifier for determining the identification of the calling line, means responsive to the seizure of a sender for associating said identifier therewith, a translator for reconstructing the called office code digits dialed by the calling subscriber, a first connector relay individual to said trunk, a second connector relay operable by said sender, a third connector relay operable by said translator, and circuits established by said relays for interconnecting said sender and said trunk and for connecting said translator with said trunk and with said sender.

8. In a telephone system, a calling subscriber's line, a plurality of trunks divided into subgroups, means for extending a connection from said line to an idle one of said trunks, a plurality of senders, means responsive to the seizure of a trunk for associating an idle one of said senders therewith, an identifier for determining the identification of the calling line, means responsive to the seizure of a sender for associating said identifier therewith, a translator for reconstructing called office code digits dialed by the calling subscriber, a plurality of sender-trunk-connector circuits equal in number to said subgroups of trunks and each comprising multicontact relays individual respectively to said senders, a multicontact relay individual to said translator, and multicontact relays individual respectively to trunks of the subgroup to which such circuits appertain, and means responsive to the connection of a sender to a calling trunk to operate multicontact relays of a connector circuit allocated to the subgroup of trunks in which such trunk is located to interconnect said sender and said trunk and to connect said translator with said trunk and with said sender.

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