March 4, 1947. O. MYERS 2,416,711

TOLL TRUNK SELECTION

Filed Sept. 7, 1945 3 Sheets-Sheet 1

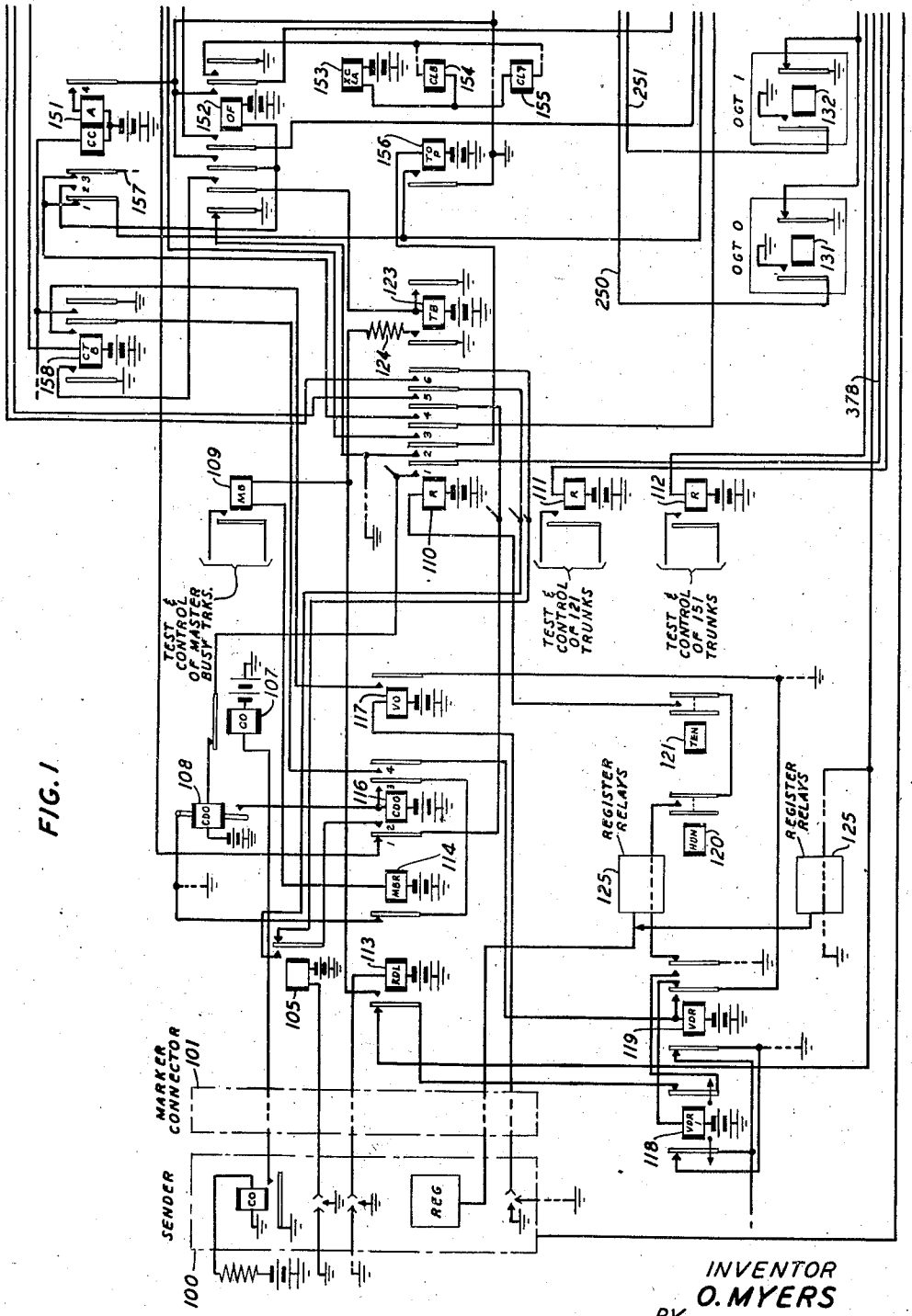


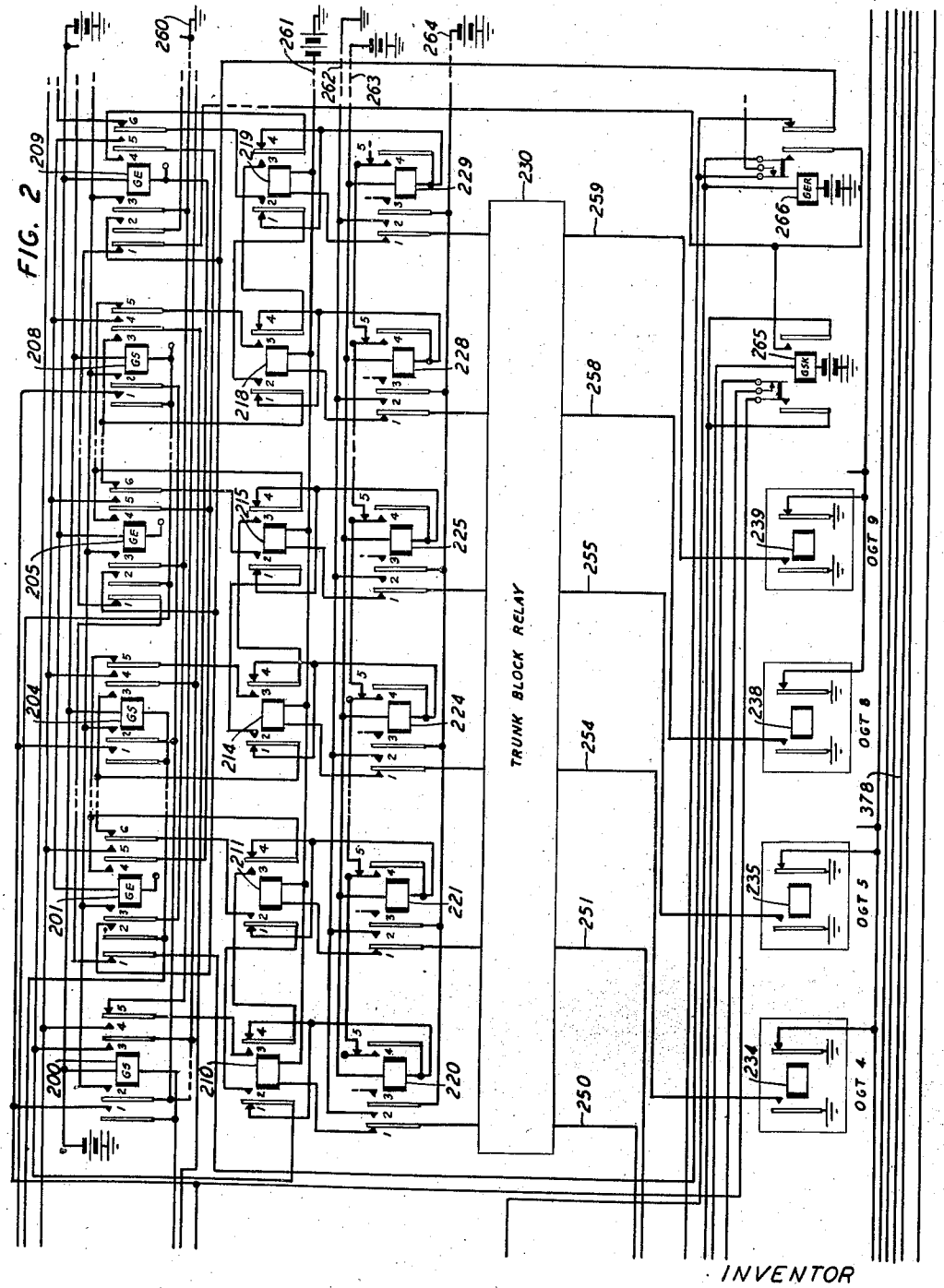
FIG. 1

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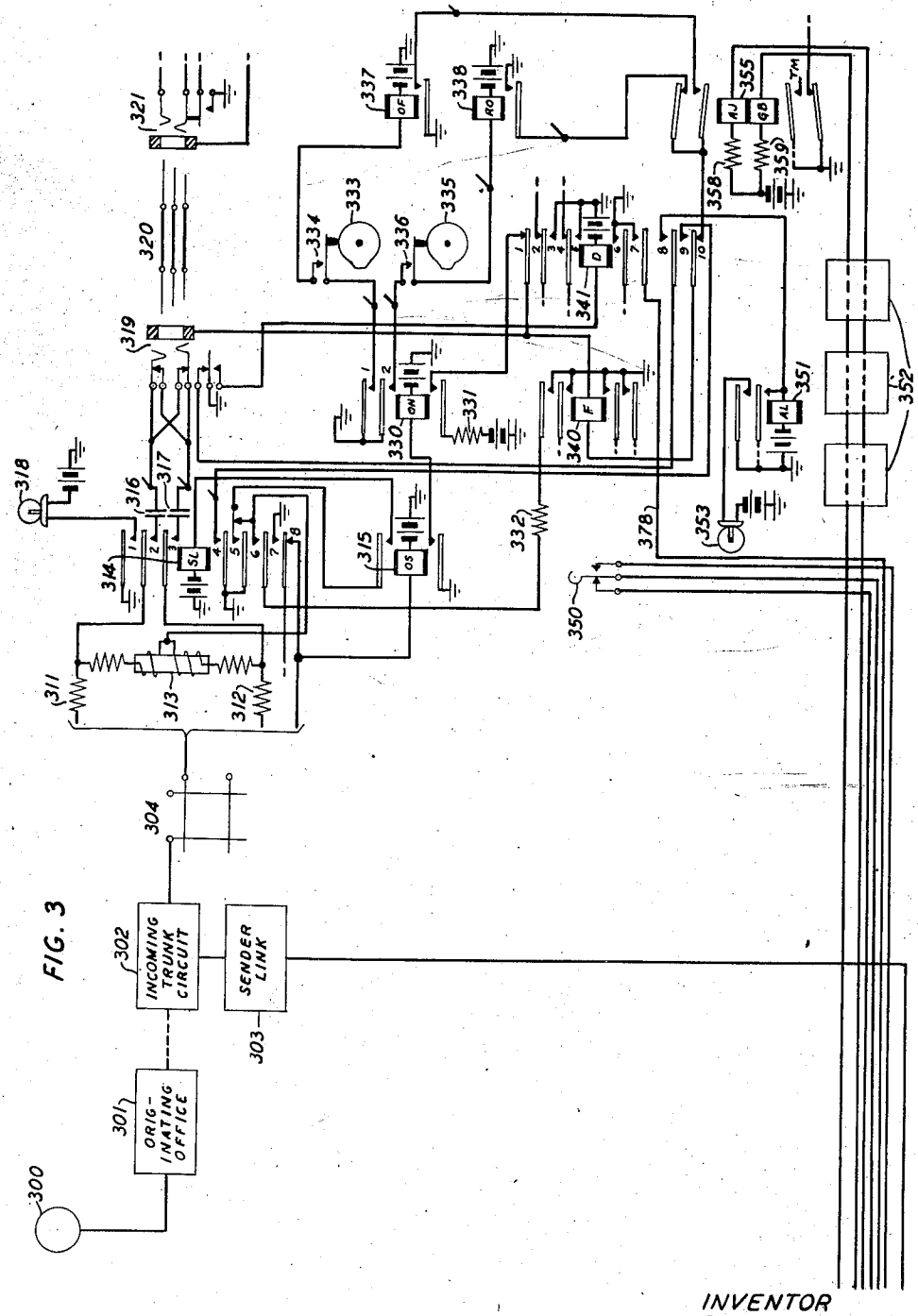


FIG. 3

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Patented Mar. 4, 1947

2,416,711

UNITED STATES PATENT OFFICE

2,416,711

TOLL TRUNK SELECTION

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Application September 7, 1945, Serial No. 614,957

10 Claims. (Cl. 179—27)

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This invention relates to telephone systems and has for its object to facilitate the completion of toll connections during busy calling periods.

Toll offices, in general, serve to establish telephone connections between exchange areas, such connections including those outgoing from a local exchange for completion through a toll office in a distant exchange area, those incoming from a toll office in a distant exchange area for completion at a local exchange and those for interconnecting two distant toll offices.

The number of toll lines provided between two toll offices is based on the normal volume and nature of the traffic between the offices and, consequently, during busy periods there are occasions when the demand for lines to certain toll offices is greater than the number of lines extending thereto and the completion of connections to these offices is delayed.

In manual toll offices it is a simple matter for the toll operator to explain the delay, but in automatic switching toll offices, special means must be provided to relieve the operators at the calling exchange from making repeated fruitless attempts to secure an idle line for a desired toll connection.

In the toll switching circuits disclosed in Patent No. 2,382,893, granted Aug. 14, 1945, to B. McKim and O. Myers, connections are set up under the control of register senders and markers in response to the registration of pulses designating the desired route. These markers are provided with means, responsive to the registration of the designation, for automatically rerouting all incoming calls for a congested route to a special operator's position irrespective of the busy or idle condition of the trunks. Means is also provided in the marker, to indicate when the special operator is calling, which means disables the automatic rerouting means and permits her to complete the call when an idle trunk is available.

Indicating means is also provided to inform the special operator when one of the trunks of the congested route becomes available.

It has been found that when an entire trunk group is reserved for use by the special operators, it is not possible for the operators to use the group at highest efficiency.

In accordance with the present invention means is provided in cases of traffic congestion for reserving a portion of a trunk group for the exclusive use of the special operators.

Furthermore, means is provided, effective when certain trunks are so reserved, for varying the

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number of the remaining trunks made accessible to incoming calls in accordance with the nature of such calls.

These and other features of the invention will be more apparent from a consideration of the following description in connection with the accompanying drawings, in which

Fig. 1 shows a part of a marker at a toll office for controlling the routing of incoming calls;

Fig. 2 shows some of the trunk testing relays of the marker; and

Fig. 3 shows, in diagrammatic form, a connection from a calling subscriber's line to the toll office and, in detail, an overflow trunk.

These figures are based on Figs. 3, 4 and 5 of the above-identified McKim-Myers patent and reference is made thereto for a more comprehensive description of the toll switching system to which the present invention relates.

Assuming that the subscriber at substation **300**, associated with office **301**, wishes to make a toll call, he will dial the appropriate code and be connected with the toll operator's position at office **301**. This operator will make a record of the details of the call and, finding that the call must be routed through the cross bar toll office will seize a toll trunk line leading to that office where it terminates in the incoming trunk circuit **302**.

The seizure of the toll trunk line causes the transmission of a signal to the incoming trunk circuit **302** which responds thereto to bring about the operation of sender link **303** in order to connect the trunk line with an idle register sender of the proper type, for example sender **100**.

The toll operator then transmits the code and numerical digits identifying the wanted line to the sender **100** where they are registered on the sender registers. As soon as the code digits have been registered, the marker connector **101** is operated to connect sender **100** with the marker, parts of which are shown in Figs. 1 and 2. The code digits are then transferred to the marker registers **125**. From the marker registers, control relays **120** and **121** are operated, after which a route relay is operated to control the selection and test of a trunk outgoing to the wanted office. For example, route relay **110** is operated in a circuit from battery through its winding, over contacts of control relays **121** and **120**, contacts of the register relays **125** to ground at the back contact of relay **119**.

With route relay **110** operated, a trunk block relay indicated by rectangle **230** is operated to connect the trunk test relays of the marker with a group of trunks identified by the route relay.

As described in detail in Patent 2,236,246 to G. V. King, J. B. McKim and O. Myers, granted March 25, 1941, there are forty test relays of which only six are shown in Fig. 2 with each of which is associated a group start or a group end relay and a select relay. Trunk groups may include any even number of trunks, the route relay controlling circuits for determining which of the test relays shall be effective in testing a particular trunk group. As indicated in the drawing, the trunk group selected by trunk block relay 230 includes ten trunks, of which six trunks are indicated by the rectangles OGT0 to OGT9. With route relay 110 operated, group start relay 200 is operated in a circuit from ground on conductor 157, contact 3 of relay 151, contact 4 of route relay 110, contact 1 of relay 116, winding of relay 200 to battery. At the same time group end relay 209 is operated in a circuit from ground on conductor 157, contacts 3 and 1 of relay 151, normally closed contact 2 of relay 265, contact 3 of relay 110, winding of relay 209 and battery.

Included in each trunk circuit is a relay as indicated in the rectangles, which operates when a trunk is taken for use to mark it busy, connecting ground to a path which is extended by the trunk block relay, when operated, to a corresponding test relay in the marker. When trunk OGT0 is busy, relay 131 is operated, and ground is connected to conductor 250 so that with trunk block relay 230 operated a circuit is completed over contact 1 of relay 220 through the winding of relay 210 to battery over conductor 261. All trunks that are busy, therefore, are indicated by the operation of the corresponding test relays, as soon as the trunk group is associated therewith. A measured interval later, ground is connected to conductor 260 to complete a circuit for operating one of the trunk selecting relays 220 to 229. Assuming, that only trunk OGT0 is busy, and therefore that relay 210 is the only test relay operated, ground connected to conductor 260 completes a circuit that may be traced over contact 3 of relay 209, contacts 2 and 3 of relay 200, contact 2 of test relay 210, contact 1 of relay 211, winding of relay 221 to battery over conductor 263. Relay 221 operates in this circuit, locking over its contact 4 and connecting battery from conductor 264 over its contact 3 to the select magnet individual to the selected trunk. Relay 221 at its contact 2 connects ground to conductor 251 to mark the trunk busy and initiates the further operation of the marker to operate the necessary cross bar switches to connect the incoming trunk circuit with an outgoing trunk leading to the wanted office.

If all of the trunks of the selected group had been busy, as indicated by the operation of test relays 210 to 219, inclusive, the circuit completed by the grounding of conductor 260 would have extended as above traced to contact 2 of relay 210 and thence over contact 2 of relay 211, contact 6 of relay 201, contacts of the relays associated with the third and fourth trunks, over contacts 2 of relays 214 and 215 and contact 6 of relay 205, over similar contacts of the relays associated with the seventh and eighth trunks, contacts 2 of relays 218 and 219, contact 5 of relay 209 to the winding of relay 158 and battery. Relay 158 in turn operates relay 151 and these relays control the operation of the marker in testing additional trunk groups, testing overflow trunks or in rerouting the call to an operator.

Associated with each group of trunks is a group busy relay such as relay 355 which is held operated by ground supplied from idle trunks as indicated. When all of the trunks become busy, the group busy relay releases. Relay 151, when operated as above traced, locks to ground, opens the operating circuit for the group start relay 200 and, if relay 156 is operated to indicate a trunk group having overflow trunks associated therewith, closes a circuit for overflow relay 152. Relay 152 locks and prepares the marker to test the overflow trunks which belong to this group and are associated with the test relays immediately following the test relays used to test the working trunks.

When an idle overflow trunk is found the cross bar switches, represented by switch 304, are operated extending the incoming trunk circuit 302 to the overflow trunk shown in Fig. 3. When the overflow trunk is seized, relay 315 is operated, in turn operating relays 330 and 314. With relay 314 operated, the simplex circuit connecting the tip and ring conductors of the trunk and the windings of coil 313 is extended over contact 6 of relay 314, through resistance 332 and a contact of relay 340 to ground. Relay 340 is intermittently operated under the control of overflow interrupter 335 or reorder interrupter 333 depending on the operated or non-operated condition of relay 355. Whenever a call is directed to an overflow trunk, ground is supplied to the armatures of interrupters 333 and 335 so that relays 337 and 338 are operated intermittently, relay 337 being operated thirty times per minute, while relay 338 is operated one hundred times per minute. These relays in turn supply ground to contacts of the trunk busy relays such as relay 355. With relay 355 released in response to an all trunks busy condition as assumed above ground from the contact of relay 337 is connected over contact 2 of relay 355 and contact 10 of relay 341 to the winding of relay 340, the circuit of relay 340 extending over contact 1 of relay 341, contact 3 of relay 330, and through resistance 331 to battery. Therefore relay 340 operates thirty times a minute to intermittently ground the simplex circuit as a signal that all of the trunks leading to the wanted office are busy. When one or more of these trunks become idle, relay 355 reoperates and transfers the circuit of relay 340 over contact 1 of relay 355 to the contact of reorder relay 338, thereby operating relay 340 at a rate of one hundred twenty times per minute as a reorder signal to the calling operator.

If a particular route becomes congested so that there is a considerable delay in completing calls thereover, the overflow trunks individual to that route may be connected to a delay operator's position by inserting a patching cord in the jack associated with the trunk and in a jack connected to a circuit leading to the delay position, for example cord 320 may be inserted in jacks 319 and 321, after which calls directed to the overflow trunk of Fig. 3 will be answered by the delay operator who can inform the calling operator as to the probable delay. The insertion of the plug of cord 320 in jack 319 closes an obvious circuit for operating relay 341, which, at contacts 1 and 10 opens the circuit of relay 340 to prevent the transmission of the overflow and reorder signals to the calling operator, and at contact 9 prepares a circuit for operating relay 340 under the control of the delay operator to transmit an answer signal instead. At contact 7 relay 341 connects ground over conductor 378, contact 1 of relay 110, back contact of relay 107, winding of polarized relay 108 to battery.

Relay 108 in turn operates relay 116 which locks over its contact 3. With relay 116 operated only a limited number of trunks of the group belonging to the route are available for use by incoming calls in general. The group start circuit previously traced to the winding of relay 200 now extends from contact 4 of route relay 110, over contact 2 of relay 116, back contact of relay 105, contact 6 of relay 110 to the winding of relay 208 and battery. Therefore, incoming calls of all types have access to trunks OGT8 and OGT9.

In addition it may be desirable to permit the trunks used by cordless board operators at the toll office or certain groups of incoming trunks to have access to a larger portion of the trunk group. When such trunks are connected with a sender, the sender receives an indication of the nature of the trunk and supplies ground for operating relay 105. With relay 105 operated the group start circuit extends from contact 4 of relay 110, over contact 2 of relay 116, front contact of relay 105, contact 5 of relay 110 to the winding of relay 204 and battery. Therefore, incoming trunks of these types have access to trunks OGT4 to OGT9 in the group corresponding to route relay 110.

In either case, if all of the trunks of the group are found busy, relay 158 is operated as previously described, in turn operating relay 151. These relays dispose of the calls as described in the McKim-Myers patent previously identified, certain calls, for example those incoming from one distant office for extension to another distant toll office, being routed automatically to the delay operator's position.

When the delay operator attempts to complete a call, an indication is given to the sender which responds by operating relay 107 in the marker which it seizes. With relay 107 operated, the circuit of relay 108 is opened and relay 108 cannot operate even if the route selected has been reserved. Therefore, the group start lead extends as originally traced to the winding of relay 200 and the call may use any trunk of the group. It is therefore apparent that trunks OGT0 to OGT3 are reserved for the exclusive use of the delay operator, while other calls have access to different portions of the group in accordance with their class.

It will be apparent that the numbers of trunks shown as included in the total and fractional groups are illustrative only and that the various route relays will be wired to provide trunk groups and subgroups of the size demanded by the traffic over the associated routes.

What is claimed is:

1. In a telephone system, an automatic switching office, a plurality of other offices, said automatic switching office having incoming trunks from said other offices and outgoing trunks to said other offices in groups according to the code designation of said other offices, control means common to said trunks, trunk testing means in said control means, means responsive to the registration of the code designation of one of said offices in said control means to connect said trunk testing means with the trunks outgoing to said office, means under the control of said trunk testing means normally effective to select any idle one of said group of outgoing trunks to route a call to said one office, means to render a plurality of said outgoing trunks unavailable to said selecting means, an operator's position, and means under the control of said operator's position to render all of said trunks available to said selecting means.

2. In a telephone system, an automatic switching office, a plurality of other offices, said automatic switching office having incoming trunks from said other offices and outgoing trunks to said other offices in groups according to the code designations of said other offices, control means common to said trunks, means for seizing said control means over said incoming trunks, means responsive to the registration of the code designation of one of said offices in said control means to connect said control means with the trunks outgoing to said office, means in said control means normally effective to select an idle one of said group of outgoing trunks to route a call to said one office, means to render a number of said outgoing trunks unavailable to said control means, means under the control of said incoming trunk to vary the number of trunks made unavailable, an operator's position, and means under the control of said operator's position to render all of said trunks available to said control means.

3. In a telephone system, an automatic switching office, a plurality of other offices, said automatic switching office having trunks of a plurality of classes incoming from said other offices and outgoing trunks to said other offices arranged in groups according to the code designations of said other offices, control means common to said trunks, means for seizing said control means over one of said incoming trunks, means responsive to the registration of the code designation of one of said offices in said control means to connect said control means with the trunks outgoing to said office, means in said control means normally effective to select an idle one of said group of outgoing trunks to route a call to said one office, means to arbitrarily render a number of said outgoing trunks unavailable to said control means during times of heavy demand, means to vary the number of trunks made unavailable in accordance with the class of said incoming trunk, an operator's position and means under the control of said operator's position to render all of said trunks available to said control means.

4. In a telephone system, an automatic switching office, a plurality of other offices, said automatic switching office having trunks of a plurality of classes incoming from said other offices and outgoing trunks to said other offices arranged in groups according to the code designations of said other offices, control means common to said trunks, means for seizing said control means over one of said incoming trunks, means responsive to the registration of the code designation of one of said offices in said control means to connect said control means with the trunks outgoing to said office, means in said control means normally effective to select an idle one of said group of outgoing trunks to route a call to said one office, a special operator, means for arbitrarily reserving a number of said trunks for the exclusive use of said special operator during times of heavy demand and means under the control of said incoming trunk to render a variable number of the remaining trunks available to said control means.

5. In a telephone system, an automatic switching office, a plurality of other offices, said automatic switching office having trunks of a plurality of classes incoming from said other offices and outgoing trunks to said other offices arranged in groups according to the code designations of said other offices, control means common to said trunks, means for seizing said control means over

one of said incoming trunks, means responsive to the registration of the code designation of one of said offices in said control means to connect said control means with the trunks outgoing to said office, means in said control means normally effective to select an idle one of said group of outgoing trunks to route a call to said one office, a special operator, means for arbitrarily reserving a number of said trunks for the exclusive use of said special operator during times of heavy demand, means under the control of said incoming trunk to render a variable number of the remaining trunks available to said control means, and means effective if all of said remaining trunks are busy to connect said incoming trunk with said special operator's position.

6. In a telephone system, an automatic switching office, a plurality of other offices, said automatic switching office having incoming trunks from said other offices and outgoing trunks to said other offices in groups according to the code designation of said other offices, control means common to said trunks, a plurality of test relays in said control means, means responsive to the registration of the code designation of one of said offices in said control means to connect said test relays with the trunks outgoing to said office, means under the control of said test relays normally effective to select any idle one of said group of outgoing trunks to route a call to said one office, means to render a plurality of said testing relays ineffective, an operator's position, and means under the control of said operator's position to render all of said testing relays effective.

7. In a telephone system, an automatic switching office, a plurality of other offices, said automatic switching office, having incoming trunks from said other offices and outgoing trunks to said other offices in groups according to the code designations of said other offices, control means common to said trunks, a plurality of test relays in said control means, means for seizing said control means over said incoming trunks, means responsive to the registration of the code designation of one of said offices in said control means to connect said test relays with the trunks outgoing to said office, means under the control of said test relays normally effective to select an idle one of said group of outgoing trunks to route a call to said one office, means to render a number of said testing relays ineffective, means under the control of said incoming trunk to vary the number of testing relays made ineffective, an operator's position, and means under the control of said operator's position to render all of said testing relays effective.

8. In a telephone system, an automatic switching office, a plurality of other offices, said automatic switching office having trunks of a plurality of classes incoming from said other offices and outgoing trunks to said other offices in groups according to the code designations of said other offices, control means common to said trunks, a plurality of test relays in said control means, means for seizing said control means over said incoming trunks, means responsive to the registration of the code designation of one of said offices in said control means to connect said test relays with the trunks outgoing to said office, means under the control of said test relays normally effective to select an idle one of said group of outgoing trunks to route a call to said one office, means to render a number of said testing relays ineffective, means to vary the number of

testing relays made ineffective in accordance with the class of said incoming trunk and the code designation registered, an operator's position, and means under the control of said operator's position to render all of said testing relays effective.

9. In a telephone system, an automatic switching office, a plurality of other offices, said automatic switching office having incoming trunks from said other offices and outgoing trunks to said other offices in groups according to the code designations of said other offices, control means common to said trunks, means for seizing said control means over said incoming trunks, a plurality of testing relays, means responsive to the registration of the code designation of one of said offices in said control means to connect said testing relays with the trunks outgoing to said office, a trunk selecting circuit, means in said control means normally effective to place said selecting circuit under the control of a particular one of said test relays to select an idle one of said group of outgoing trunks to route a call to said one office, means to arbitrarily place said selecting circuit under the control of a different one of said testing relays to render a number of said outgoing trunks unavailable to said control means, means operated in accordance with the nature of said incoming trunk to determine the testing relay to which said selecting circuit is connected in order to vary the number of trunks made unavailable, an operator's position, and means under the control of said operator's position to render all of said trunks available to said control means.

10. In a telephone system, an automatic switching office, a plurality of other offices, said automatic switching office having incoming trunks from said other offices and outgoing trunks to said other offices in groups according to the code designations of said other offices, control means common to said trunks, means for seizing said control means over said incoming trunks, a plurality of testing relays, means responsive to the registration of the code designation of one of said offices in said control means to connect said testing relays with the trunks outgoing to said office, a trunk selecting circuit, means in said control means normally effective to place said selecting circuit under the control of a particular one of said relays to select an idle one of said group of outgoing trunks to route a call to said one office, means to arbitrarily place said selecting circuit under the control of a different one of said testing relays to render a number of said outgoing trunks unavailable to said control means, means operated in accordance with the nature of said incoming trunk and the code designation registered to determine the testing relay to which said selecting circuit is connected in order to vary the number of trunks made unavailable, an operator's position, and means under the control of said operator's position to render all of said trunks available to said control means.

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