Aug. 21, 1962 C. E. LOMAX 3,050,590

PBX TOLL CONNECTOR PROVIDING SPECIAL SERVICE

Filed Dec. 8, 1958 2 Sheets-Sheet 1

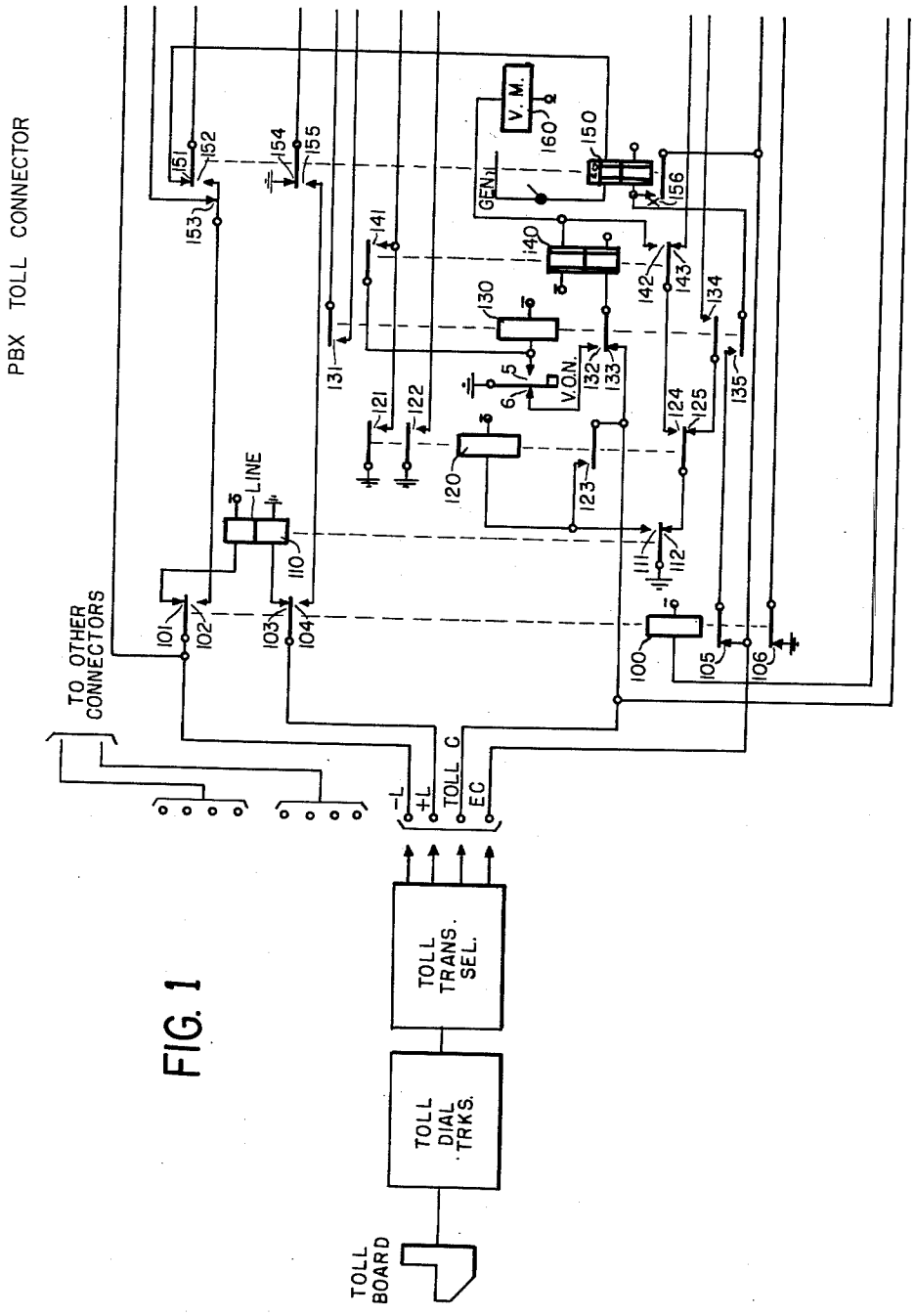


FIG. 1

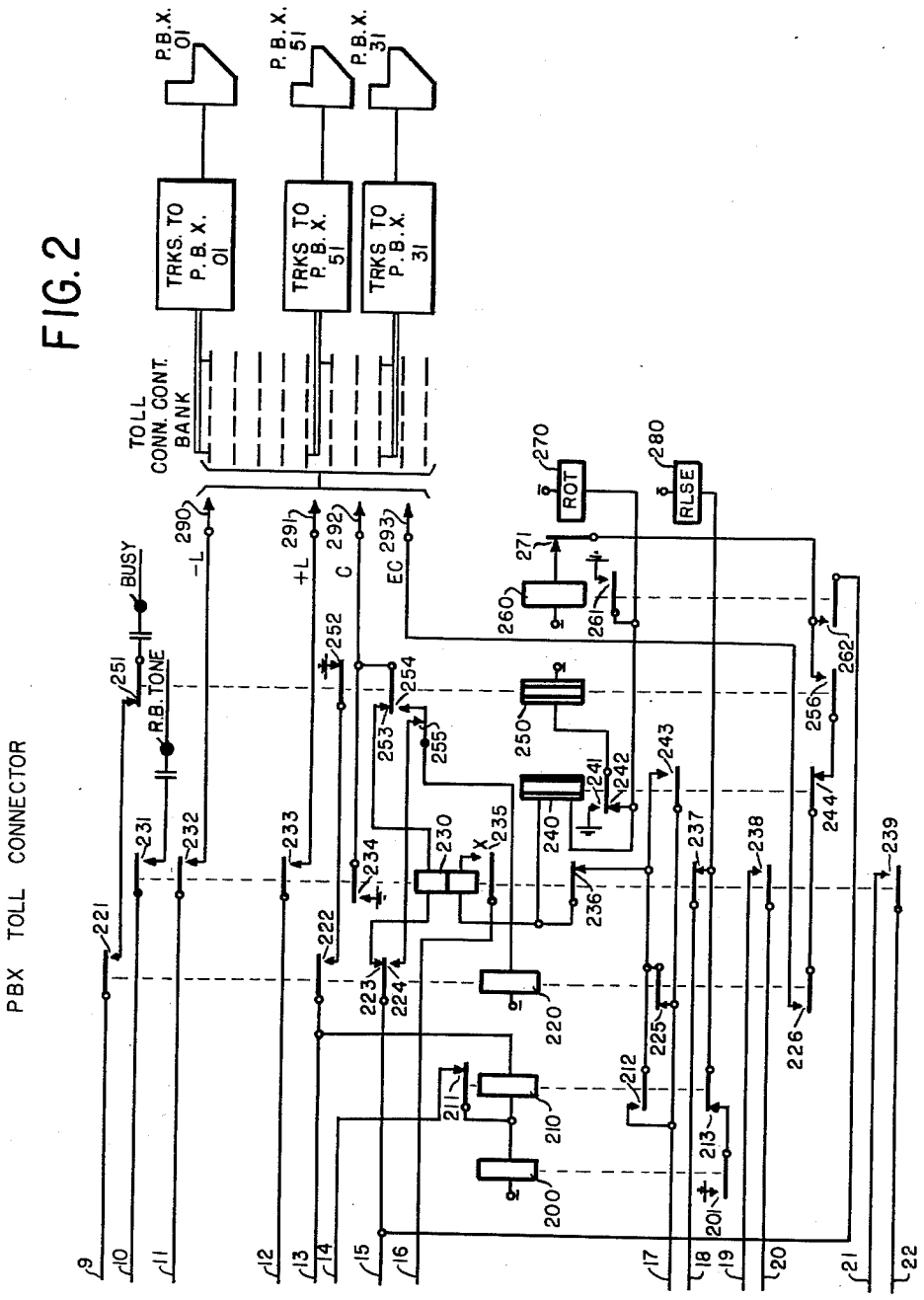
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FIG. 2



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3,050,590

PBX TOLL CONNECTOR PROVIDING SPECIAL SERVICE

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6 Claims. (Cl. 179—27)

The present invention relates to telephone systems in general, but more particularly to such systems employing the use of PBX toll connectors providing certain special services.

It is a primary object of the present invention to provide a PBX toll connector incorporating new and improved circuit arrangements, whereby this connector will extend a toll connection to a selected PBX in an efficient and reliable manner with a minimum consumption of time when taken into use by a toll operator.

Another object of the present invention is the provision of a partial release or modified, camping service by the improved PBX toll connector.

In accordance with the above-mentioned objects, a feature of the invention relates to the inclusion of means in the toll connector for releasing only this connector in the switch train in the event that a PBX trunk group, or single trunk PBX, is called and found busy.

Another feature of the invention relates to means for maintaining the released toll connector in a partial release camping condition while the preceding switches in the switch train are maintained in the operated condition.

Another feature of the invention relates to means in the toll connector controlled by the toll operator for operating the connector from its partial release camping condition to retest the same PBX trunk group, or single trunk PBX, for an idle trunk.

Still another feature of the invention relates to means in the toll connector for returning busy tone to the toll operator after the connector has released and is in its partial release clamping condition.

A further feature of the invention relates to the toll connector being reoperated to test the busy PBX trunk group, or PBX trunk, responsive to the toll operator dialing only the last two digits of the call number.

Another feature of the invention relates to an arrangement of the above-mentioned features in connection with a plurality of the improved toll connectors, wherein each of the connectors will restore to a partial release clamping condition responsive to a PBX trunk group, or PBX trunk, being tested and found busy. All the connectors may be reoperated responsive to the dialing of the last two digits of the call number and the first connector to connect with the idle PBX trunk group, or PBX trunk, will switch through and busy these trunks to the other connector to cause them to restore to the partial release camping conditions.

Another feature of the invention relates to the connector release relay in the toll connector, and means for holding the release relay operated by ground over the toll C conductor from the preceding switches.

These and other objects and features of the invention will become apparent upon a further perusal of the specification and claims taken in conjunction with the acompanying drawings comprising FIGS. 1 and 2. which shows by means of the usual diagrams a sufficient amount of the apparatus to enable the invention to be described and understood and in which:

The left-hand side of FIG. 1 discloses block diagrams representing the preceding switching elements of a toll switch train, with respect to the toll connector. The right-hand side of FIG. 1 discloses in schematic form,

a portion of the improved circuit representing the PBX toll connector.

The left-hand side of FIG. 2 discloses in schematic form, the remaining portion of the improved circuit representing the PBX toll connector. The right-hand side of FIG. 2 discloses the toll connector contact bank with trunks of various PBX groups connected thereto for extending connections to a plurality of PBX switchboards.

In order to more clearly understand the illustrated application of the invention, it is though advisable to point out that the drawings should be arranged so that the conductors on the left-hand of FIG. 2 will be aligned opposite the like-numbered conductors on the right-hand side of FIG. 1.

It is further thought advisable to point out that while the instant disclosure shows a PBX toll connector as being included in a toll switch train that is relatively simple, this connector may also be included in a much more complex toll switch train, wherein the services offered by this connector are required.

In its preferred form, such as disclosed in the present application, a brief description of the invention will hereafter be given.

BRIEF DESCRIPTION

The toll dial trunks are taken into use in a well-known manner responsive to the toll operator initiating a call, while the toll transmission selector also operates in a well-known manner responsive to the toll operator dialing the preliminary digits of the call number of the desired PBX trunk, or group. The toll transmission selector is thereby operated to search for an idle PBX toll connector. The idle condition of a PBX toll connector is indicated by the presence of battery on the toll C conductor, which is applied thereto through the lower winding of the changeover relay such as 140. At the time that the toll C wiper of the toll transmission selector encounters this battery potential on the toll C conductor of an idle toll connector, a circuit is completed for operating the stop relay (not shown) in the toll selector, whereby the selector stops hunting and switches through to seize the idle toll connector in a well-known manner.

The toll operator then dials the remaining digits of the call number of the desired PBX trunk or PBX group, to operate the toll connector to establish a signaling connection therewith. If the desired trunk or a trunk in the group is idle, the connector operates to complete the signaling connection and subsequently completes the talking connection in response to the answering of the call by the called party. In the event that the trunk is busy, or all trunks in the group are found busy, the toll connector restores its wipers to normal and busy tone is sent to the operator, while at the same time the preceding switches do not release. If desired, the toll operator can leave the connection set up in this busy condition, handle other calls, and then return to the busy connection and redial the last two digits of the call number, with toll connector switching through if the trunk or a trunk in the group is found idle, and again restoring its wipers to send busy tone to the operator if they still test busy. The operator may repeatedly make these tests by redialing the last two digits of the call number until the called trunk or a trunk in the called group is found idle, thereby saving effort and time and also providing the thandling of simultaneous calls to the same busy trunk or trunk group.

A detailed description of the invention including the previously described permanent features and the operations involved in setting up connections in a system em-

bodying the same will now be given, reference being had in particular to FIGS. 1 and 2.

DETAILED DESCRIPTION

PBX Call With First Trunk of Group Being Idle

It will be assumed that the toll operator at the toll board has been asked to extend a connection to the PBX such as 01, and that a group of ten trunks are accessible from the tenth level of the toll connector to this particular PBX. Responsive to the operator initiating the call, the toll dial trunk and the toll transmission selector are taken into use in a well-known manner. The toll transmission selector also operates in a well-known manner responsive to the operator dialing the preliminary digits of the particular call number, whereby the selector hunts for an idle PBX toll connector.

It is further assumed that the toll transmission selector is a battery searching selector of the well-known type, and that an idle PBX toll connector indicates such condition by placing battery potential on the toll C conductor. It is also assumed that the PBX toll connector disclosed in FIGS. 1 and 2 is the first idle connector encountered by the toll selector. Therefore, when the toll C wiper of the toll selector encounters this above-mentioned battery potential on the toll C conductor of the illustrated connector, a series circuit is completed for operating the stop relay (not shown) in the selector and for operating the changeover relay such as **140** in the connector. This circuit may be traced as extending from ground (not shown) in the selector, through the selector stop relay (not shown), the selector toll C wiper, the toll C conductor engaged by the toll C wiper, contacts **133** and through the lower winding of changeover relay **140** to battery.

The resulting subsequent operations of the toll selector are well-known and essentially briefly entails the operation of the stop relay (not shown) for preventing further hunting and stopping the selector wipers on the bank contacts terminating the conductors of the idle toll connector and the operation of the selector switching relay (not shown) for extending the closed loop circuit into the toll connector to complete a circuit for operating the connector line relay **110**. This circuit for line relay **110** may be traced as extending from ground through the lower winding of line relay **110**, contacts **103**, the +L line conductor engaged by the +L wiper of the toll transmission selector, over the closed loop, the —L wiper of the toll transmission selector and the engaged —L line conductor, contacts **101** and through the upper winding of line relay **110** to battery.

Changeover relay **140** operates over the above-traced circuit before line relay **110** operates, and in actuating its contacts **141** prepares a point in the operating circuit for relay **130**, at contacts **142** prepares both a point in the holding circuit for itself and a point in the pulsing circuit to vertical magnet **160** and at contacts **143** opens a point in the pulsing circuit to rotary magnet **270**.

In actuating its contacts, line relay **110** completes an obvious circuit at contacts **111** for operating release relay **120** and opens a point at contacts **112** in the pulsing circuit.

In actuating its contacts, release relay **120** applies a control ground at contacts **121** for operating relay **130** over an obvious circuit and for additional use by the connector, prepares a point at contacts **122** in a future locking circuit for the switching relay **230**, locks itself operated at contacts **123** to the ground toll C conductor, prepares a point at contacts **124** in the pulsing circuit and opens a point at contacts **125** in the release circuit of release magnet **280**.

In actuating its contacts, relay **130** completes an obvious shunting circuit at contacts **131** for relay **210**, shifts the previously described operating circuit of changeover relay **140** at contacts **132** from the grounded toll C conductor and contacts **133** to a new circuit, which provides ground by way of the vertical off-normal (VON) spring contact **6**, prepares a point in the circuit at contacts **134** for the release magnet **280** and completes an obvious circuit at contacts **135** for operating ring cut-off relay **150**. This circuit for ring cut-off relay **150** may be traced from ground potential (not shown), applied by the toll operator in any well-known manner and forwarded over the EC conductor, contacts **105**, **135** and through the lower winding of relay **150** to battery. Relay **150** is constructed as being slow-to-operate and will do so after a predetermined period of time.

In actuating its contacts, ring cut-off relay **150** completes its own locking circuit by way of "X" contacts **156** to the grounded EC conductor, at contacts **151** and **154** prevents the application of ringing current to the connection for the present and performs no useful function for the time being at contacts **152** and **155**.

The toll connector is now in condition to receive the last two dialed digits of the call number, which for the purpose of the present description shall be assumed to be the digits 01 and represents the group call number.

Line relay **110** responds responsive to the dialing of the digit 0 and restores and operates a total of ten times each, during which time vertical magnet **160** receives ten pulses of ground potential over an obvious circuit by way of contacts **112** to vertically step the connector wipers **290** through **293** in a well-known manner to the tenth, or 0 level. It will be noted that each time that contacts **111** are opened, release relay **120** is not affected, since it is locked operated to the toll C conductor by way of its own contacts **123**.

At the time that the connector wipers take their first vertical step, the VON spring contact **6** opens and VON spring contact **5** closes, thereby completing an obvious holding circuit for relay **130** and opening the previously described holding circuit for changeover relay **140**. However, since changeover relay **140** is constructed as being slow-to-release, it is held operated by the pulses from contacts **112** of line relay **110** during the remainder of the vertical pulsing.

At the end of the vertical pulsing, changeover relay **140** is no longer held operated and therefore restores before the last digit of the call number is dialed. In restoring its contacts, changeover relay **140** opens the previously traced operating circuit of relay **130** at contacts **141**, opens both the pulsing circuit to vertical magnet **160** and the pulse holding circuit to itself at contacts **142** and prepares a point in the pulsing circuit to rotary magnet **270** at contacts **143**. It will be remembered that relay **130** is now held operated to ground by way of VON spring contact **5**.

The toll connector is now in condition to receive dial pulses representing the last digit **1** of the group call number. Line relay **110** responds responsive to the digit **1** being dialed and restores and operates a total of one time each, during which time rotary magnet **270** receives one pulse of ground potential, by way of contacts **112** of line relay **110**, to horizontally step, or rotate, the connector wipers **290** through **293** in a well-known manner to engage the first bank contacts of the tenth level. This pulse of ground potential also completes a circuit for operating relay **240** in series with rotary magnet **270** and further completes a circuit for preenergizing relay **250** so that it will operate as soon as relay **240** operates. The series circuit for relay **240** and rotary magnet **270** may be traced as extending from ground, contacts **112**, **124**, **143**, conductor **17**, contacts **225**, **236**, the winding of relay **240** and through the winding of rotary magnet **270** to battery. The circuit for preenergizing relay **250** may be traced as extending over the first part of the above-traced circuit, through the winding of relay **240**, contacts **242** and through the winding of relay **250** to battery.

In actuating its contacts, relay **240** completes the operating circuit at contacts **241** for the preenergized relay

250, opens the previously traced preenergizing circuit at contacts 242, prepares both an alternate point at contacts 243 in the pusing circuit to rotary magnet 270 and in the pulse holding circuit for itself and opens a point at contacts 244 in the energizing circuit to the rotary step relay 260.

In actuating its contacts, relay 250 opens a point at contacts 251 in the busy tone circuit, removes an operating ground at contacts 252 from the present incomplete circuits of relays 200 and 210, opens a point at contacts 253 in the operating circuit of switching relay 230, completes the busy test circuit at contacts 254 to the busy relay 220, opens a point at contacts 255 in the locking circuit of busy relay 220 and prepares a point at contacts 256 in the energizing circuit of relay 260.

At this point in the operational description, it will be summarized that the dialing of the last digit 1 of the call number has ceased, wipers 290 through 293 are engaged with the first bank contact in the tenth level terminating the first trunk of the trunk group, the pulse holding circuit to relay 240 is no longer effective and this slow-to-release relay is now in the process of releasing and a busy test has just been initiated of this first trunk in the trunk group assigned to the PBX 01.

Relay 240 restores before the busy test is effective and opens the previously mentioned operating circuit of relay 250 at contacts 241, prepares an alternate holding circuit at contacts 242 for relay 250 in the event that this particular first trunk of PBX 01 should test busy, opens the previously mentioned alternate point in the pulsing circuit at contacts 243 and closes the previously mentioned point in the circuit to the rotary step relay 260 at contacts 244.

It will be assumed, as previously mentioned, that there are a total of ten PBX trunks in the trunk group assigned to PBX 01 and that each of them terminate at a different bank contact in the tenth level. It will also be noted that while it is not shown, all the C and EC bank contacts of each trunk but the last one in each group are connected, or strapped, together in a well-known manner, whereby the busying ground normally applied to the C conductor is also sent out over the EC conductor to provide means in order for the toll connector to automatically trunk hunt until an idle trunk is found, or until all trunks have been tested and an all-trunk busy condition exists, as will be explained in detail later on in the specification.

For this part of the description it will be assumed that the first trunk connected to the first set of bank contacts assigned to PBX 01 is idle, the connector will operate as hereafter described.

Since this first trunk in the group of PBX 01 is idle, as mentioned above, there will be no busying ground on its C and EC conductors connected to the respective bank contacts, which are engaged by the connector C and EC wipers 292 and 293 respectively. Battery (not shown), which is indicative of the idle condition of the trunk, is connected to the C conductor in any well-known manner or method. This battery potential is encountered by C wiper 292 and EC wiper 293 of the connector with no apparent effect on the connector for the present until slow-to-release relay 250, which is not held operated, has had time to restore.

Upon its release, relay 250 closes a point in the busy tone circuit at contacts 251, prepares a point in the circuits to relays 200 and 210 at contacts 252, completes the circuit at contacts 253 for operating switching relay 230, opens a point at contacts 254 in the busy test circuit to busy relay 220, prepares a point at contacts 255 in the locking circuit to busy relay 220 and opens a point at contacts 256 in the circuit to the automatic rotary stepping relay 260. The circuit for operating switching relay 230 may be traced as extending from ground at contacts 121, conductor 15, contacts 223, the upper winding of switching relay 230, contacts 253, C wiper 292 and engaged bank contact to the above-mentioned battery in the seized trunk.

In actuating its contacts, switching relay 230 completes its own locking circuit for an obvious path at "X" contacts 235, prepares a point at contacts 231 in the ringback tone circuit, prepares points at contacts 232 and 233 in the extension of the talking conductors to the trunk, applies both a holding and busying ground for the trunk and completes a shorting circuit for its upper winding at contacts 234, opens the pulsing circuit to relay 240 and rotary magnet 270 at contacts 236, opens a point in the circuit to the release magnet 280, closes an alternate holding circuit at contacts 238 to the ring cut-off relay 150 and at contacts 239 completes an obvious circuit from the grounded toll C conductor to operate relay 100.

In actuating its contacts, relay 100 disconnects line relay 110 from the previously mentioned closed loop circuit at contacts 101 and 103, closes points at contacts 102 and 104 for extending the talking connection through to the connector wipers, opens the previously traced operating circuit at contacts 105 to ring cut-off relay 150 and opens the previously mentioned alternate holding circuit at contacts 106 to the ring cut-off relay 150. Ring cut-off relay 150 is still held operated by way of its "X" contacts 156 to the grounded EC conductor. The removal of line relay 110 from the loop circuit causes the operator to be notified or signaled in a well-known manner to inform her that she has line seizure supervision and that she may thereafter initiate the application of ringing current to the connection. The release of line relay 110 and the closing of its contacts 111 and the opening of its contacts 112 have no effect on the connector during the remainder of the description.

In order to initiate ringing, the operator momentarily removes the previously mentioned ground potential from the EC conductor, which thereby allows ring cut-off relay 150 to restore.

In restoring its contacts, ring cut-off relay 150 applies ringing current at contacts 151 and 154 to the line conductors of the called trunk line in a well-known manner to sigal the operator at the PBX 01, opens the conductors of the talking connection at contacts 152 and 155 for the time being, completes an obvious circuit at contacts 153 for the application of ringback tone to the —L line conductor leading to the preceding switches to inform the calling operator that a signaling connection has been established and opens its previously described holding circuit at "X" contacts 156.

After a reasonable length of time the call is answered at PBX 01 and ring cut-off relay 150 is operated responsive to the answering in a well-known manner. In actuating its contacts, relay 150 completes its previously traced locking circuit to the EC conductor at "X" contacts 156, removes the application of ringing current over the called trunk line at contacts 151 and 154, opens the ringback tone circuit to the —L line conductor leading to the calling operator at contacts 153 and completes the talking connection by closing contacts 152 and 155. The toll operator has answering supervision, due to the closed loop of the called trunk being extended through the connector to the preceding equipment.

The preceding equipment is arranged in a well-known manner to prevent the release of the connection while the called party is still on the line. However, at the end of conversation and responsive to the called party hanging up, the toll operator can release the connection by removing the forwarding grounds from the EC conductor and from the toll C conductor. Relay 100 and release relay 120 restore due to the ground being removed from the toll C conductor, with ring cut-off relay 150, starting to release but then being held temporarily by contacts 106 of relay 100, since relay 100 restores at once.

In restoring, release relay 120 removes the operating

ground from the connector to restore switching relay 230 and prepares a point in the operating circuit at contacts 125 to the release magnet 280.

Switching relay 230 now restores and at contacts 237 opens the above-mentioned holding circuit to the ring cut-off relay 150 and completes the circuit to the release magnet 280 at contacts 237. This circuit for release magnet 280 may be traced as extending from ground, contacts 112, 125, 134, conductor 18, contacts 237 and through the winding of release magnet 280 to battery. Relay 150 restores at this time.

Release magnet 280 operates to restore the connector wipers to their normal position in a well-known manner, at which time VON springs 5 open to remove the locking circuit from relay 130. Relay 130 thereafter restores to return the connector to its normal unoperated condition.

The equipment is now at normal and conditioned to handle future calls.

Automatic Trunk Hunting With First Trunks of PBX Group Being Busy

A description will now be given wherein it is assumed that the first trunk and an undetermined number of subsequent trunks in the trunk group assigned to PBX 01 are busy and that automatic trunk hunting takes place in response to these trunks being individually tested in succession and found busy.

In describing the operation of the connector during this type of call, it will be pointed out that the same operations take place as described in the previous section, wherein the call was initiated, the toll connector was seized and the last two digits 01 of the call number were dialed to operate the connector to engage its wipers with the first set of bank contacts in the tenth, or 0, level. As previously mentioned, this first set of bank contacts in the 0 level are connected with the first trunk in the trunk group that is assigned to PBX 01. Also as previously mentioned, it will be again pointed out that there are ten trunks assigned to this particular PBX and that the C and EC bank contacts corresponding to all trunks but the last one in the group are individually connected, or strapped, in order to provide the automatic rotary trunk hunting which will hereafter be described.

It is therefore assumed that the last digit 1 of the call number has been dialed and the connector has rotated its wipers 290 through 293 into engagement with the first set of bank contacts representing the first trunk of the PBX group in the tenth level and a busy test of this trunk is made.

Since it has been stated that this first trunk is assumed to be busy and due to the previously mentioned strapping arrangement, the busying ground normally encountered by the C wiper 292, is also encountered by the EC wiper 293.

At this point in the description, it is pointed out that relay 250 has operated to cause the various conditions in the connector circuitry as previously described and the pulse holding circuit in ineffective for holding slow-to-release relay 240 operated. However, before relay 240 has had time to release, the busying ground potential encountered by the C wiper 292 completes an obvious circuit for operating busy relay 220.

In actuating its contacts, busy relay 220 prepares a point in the busy tone circuit at contacts 221, prepares a point at contacts 222 in the circuit to both shunt relay 210 and operate the release control relay 200, opens a point in the energizing circuit of switching relay 230 at contacts 223, prepares a point in the locking circuit to itself at contacts 224, opens a point in the rotary dialing circuit at contacts 225 and prepares a point in the circuit to the rotary step relay 260 at contacts 226.

Slow-to-release relay 240 restores at this time and opens the energizing circuit to the slow-to-release relay 250 at contacts 241, prepares a point in the holding circuit to relay 250 at contacts 242 opens a multiple point in the rotary dialing circuit at contacts 243 and completes a circuit for energizing the rotary step relay 260 at contacts 244. Relay 250 does not release for the present, since it is constructed as being slow-to-release. The circuit for relay 260 may be traced from the ground (not shown) encountered by the EC wiper 293, contacts 226, 244, 256, 262, 271, and through the winding of relay 260 to battery.

In actuating its contacts, relay 260 completes obvious circuits at contacts 261 for holding relay 250 operated and for operating rotary magnet 270 and completes a locking circuit for itself at contacts 262. This locking circuit for relay 260 may be traced as extending from ground at contacts 121, conductor 15, down through contacts 262, 271 and through the winding of relay 260 to battery.

Upon energization, rotary magnet 270 first steps the connector wipers 290 through 293 to the next successive set of bank contacts and toward the end of its operative movement opens the previously traced circuit to relay 260 at interrupter contacts 271. In this manner, relay 260 is held operated over its locking circuit until the wipers have engaged the new set of bank contacts. In restoring, relay 260 opens the circuits to relay 250, rotary magnet 270 and the locking circuit for itself. However, relay 250 remains operated due to its slow-to-release characteristics and only rotary magnet 270 restores. It should be noted that the circuit to the busy relay 220 will be momentarily opened during the time that the C wiper 292 is leaving the C bank contact of the first busy trunk and engaging the C bank contact of the next trunk. However, since the next, or second, trunk is assumed to be busy, busy relay 220 will remain operated from the ground encountered by the C wiper 292 on the C bank contact of this second trunk over a circuit such as previously traced. Therefore, when rotary magnet 270 restores its interrupter contacts 271 at the end of the first automatic rotary step, the busying ground from the second engaged busy trunk is extended to the EC wiper 293 as previously described for operating the rotary step relay 260 over the previously traced circuit. Relay 260 operates and completes the circuits as previously described to cause the rotary magnet 270 to advance the connector wipers 290 through 293 to the next successive set of bank contacts which represent the third trunk of the group.

If it is assumed that this third trunk and the fourth, fifth, and sixth trunks are all busy, the above-described interaction between the rotary step relay 260 and the rotary magnet 270 will continue until the wipers are advanced to engage a set of bank contacts representing a trunk that is idle, which in this case is assumed to be the seventh trunk.

At the time that the connector wipers engage the bank contacts that are connected to the seventh trunk, the busy ground is no longer encountered by the C wiper 292 and EC wiper 293, and battery potential, which indicates an idle trunk, is encountered. This battery potential shunts the busy relay 220 so that this relay restores to open the circuit to the rotary step relay 260. Since relay 260 does not operate over the EC conductor, rotary magnet 270 will not operate and slow-to-release relay 250 will eventually restore to complete the previously traced energizing circuit for operating switching relay 230.

From this point onward, the connector operates in the same manner as described in the previous section entitled "PBX call with First Trunk of Group Being Idle," wherein the signaling connection is extended to PBX 01 by way of the seized seventh trunk and the talking connection is thereafter established.

At the end of conversation, the connector is restored in the same manner as previously described and conditioned to handle future calls.

Release Camping With All-Trunks-Busy

A description will now be given wherein it is assumed that all of the trunks in the trunk group assigned to PBX 01 are busy and that automatic trunk hunting takes place subsequent to the group call number being dialed and in response to each of these trunks in the group being tested and found busy.

In describing the operation of the connector during this type of call, it will be pointed out that the same operations have taken place as were described in the previous sections wherein; the call was initiated at the toll operator's position and the toll connector was seized; the last two digits 01 of the call number were dialed to operate the connector to engage its wipers with the first set of bank contacts in the tenth or 0 level; and automatic trunk hunting has taken place in the search for an idle trunk in the group, since it has been stated that all of the trunks in the group are assumed to be busy. In this description, the automatic trunk hunting takes place to successively test each busy trunk in the same manner as previously described.

It will be pointed out at this time that the C and EC bank contacts representing the last trunk in the group are not connected together. Therefore, when all of the preceding trunks have been tested and found busy and when the connector wipers are advanced to engage the set of bank contacts representing the last trunk of the group, the busying ground encountered by the C wiper 292 is not encountered by the EC wiper 293.

At this point in the description it is also pointed out that when the rotary magnet 270 operated to advance the wipers 290 to 293 into engagement with the set of bank contacts representing the last trunk of the PBX group, the busying ground of this last trunk was encountered only by C wiper 292 for operating busy relay 220, while the interrupter springs 271 of rotary magnet 270 then opened the circuit of rotary step relay 260. Busy relay 220 operates and rotary step relay 260 restores to cause the various operations as previously described, namely wherein the various circuits are prepared by busy relay 220 and relay 260 opens its holding circuit and both the holding circuit to relay 250 and the operating circuit to rotary magnet 270.

Rotary magnet 270 therefore restores and since there is no ground encountered by the EC wiper 293, the closing of interrupter springs 271 have no effect on rotary step relay 260 so that no further attempt is made to advance the connector wipers beyond the set of bank contacts representing the last trunk of the group.

After a period of time, slow-to-release relay 250 restores and completes an obvious busy tone circuit to the calling operator at contacts 251, completes both an operating circuit for the release control relay 200 and a shunting circuit for relay 210 at contacts 252, closes contacts 255 in order to provide a locking circuit for the busy relay 220 before its energizing circuit is opened by contacts 254, performs no usual function for the present at contacts 253 and opens a point in the energizing circuit to relay 260 at contacts 256.

The shunting circuit for relay 210 may be traced as extending from ground at contacts 252, contacts 222; and in one direction down to the right-hand side of the winding of relay 210; and in the other direction over conductor 13, contacts 131, conductor 14 and contacts 211 to the left-hand side of the winding of relay 210. The operating circuit for relay 200 may be traced as extending from ground at contacts 252, contacts 222, conductor 13, contacts 131, conductor 14, contacts 211 and through the winding of relay 200 to battery.

In actuating its contacts, relay 200 completes an obvious circuit for operating the release magnet 280, which upon operating causes the connector wipers 290 through 293 to restore to normal in a well-known manner.

When the connector wiper shaft restores to normal, VON springs 5 open the holding circuit to relay 130, which thereupon restores.

Upon restoring, relay 130 completes a previously traced circuit for operating changeover relay 140 at contacts 133 and opens both the previously traced shunting circuit of relay 210 and the operating circuit of the release control relay 200 at contacts 131. The restoring of relay 130 has no effect upon the connector at the remainder of its contacts. The opening of contacts 131 by relay 130 now allows relay 210 to operate in series with the release control relay 200 over an obvious circuit.

In actuating its contacts, relay 210 opens another point in both the aforementioned shunting circuit to itself and an operating circuit to relay 200 at contacts 211, closes an alternate point in the rotary pulsing circuit at contacts 212 and opens a point in the circuit to the release magnet 280 at contacts 213.

Changeover relay 140 operates over a previously described circuit from the toll C conductor to prepare the vertical pulsing circuit and to reoperate relay 130, also as previously described. In reoperating, relay 130 has no effect on the circuits of the connector other than to lock the changeover relays 140 operated by way of VON springs 6 and its contacts 132.

At this point in the operational description, it will be noted that the connector is now in the partial release camping condition and in this stage, relays 110, 120, 130, 140, 150, 200, 210, and 220 are operated. The connector will remain in this partial release camping condition until it is either released by the toll operator or until the toll operator again dials the last two digits of the PBX group call number. It will be further noted that since the busy relay 220 is locked operated, busy tone is continuously being sent to the toll operator's position. It will be appreciated that when the toll operator first received this busy tone after the last two digits 01 of the PBX group call number had been dialed, it was an indication to the operator that all trunks were busy. However, when the operator continues to receive this busy tone after the lapse of a short period of time it is then an indication that the connector is in the partial release camping condition. The operator may now leave the connection, as it is set up, in this busy condition and handle other calls. This busy tone being transmitted back to the toll operator can also serve to inform the operator when she returns to this connection that the connector is still camping.

When the operator returns to the camping connector she may again dial the last two digits 01 of the call number to test as to whether or not there is still an all trunk busy condition. When the digit 0 is dialed, relays 200, 210, and 220 remain operated since the connector wipers are being stepped in the vertical direction. However, when the rotary digit 1 is dialed, relay 240 operates in series with rotary magnet 270 in the same manner as previously described, since relay 210 has made this rotary pulsing possible by means of its closed contacts 212.

At this stage of the operation, the connector again tests for an idle trunk in the same manner as previously described. If no idle trunks are found at the time that the counter wipers engage the contacts representing the last trunk of the group, the connector wipers will be restored and the connector will camp in the same manner as previously described. However, if an idle trunk is found, the connector will switch through to connect with this idle trunk in the same manner also as previously described, wherein relay 250 operates responsive to the above-mentioned operation of relay 240 and causes relays 200, 210 and 220 to restore, and since an idle trunk is found as mentioned, the busy relay 220 will not reoperate.

It is thought advisable to point out at this time that while the partial release camping features of this connector have been disclosed as being used with a PBX toll connector, it would be obvious to also incorporate this

partial camping feature in a connector providing local service, with little if any modifications thereto.

At the end of conversation, the connector is restored in the same manner as previously described and conditioned to handle future calls.

Having described my invention, what is considered new and desired to have protected by Letters Patent will be pointed out in the appended claims.

What is claimed is:

1. In a telephone system, a two-motion multi-level connector switch, a set of wipers included in said switch, a plurality of groups of trunk lines, each of said groups of trunk lines being connected to a different one of said levels, said trunk lines accessible to said connector switch by means of said set of wipers, a preceding switch train having access to said connector switch operated in response to the initiation of a calling connection thereover for including said switch in said calling connection, means for directively operating said connector switch over said connection to move said wipers in one of said motions to select one of said groups of trunk lines in one of said levels, means for further directively operating said connector switch over said connection to move said wipers in the other of said motions to engage the first trunk in said selected group, busy testing means in said connector switch for testing the busy condition of each trunk in said selected group, means operated in response to said first trunk testing busy by said busy testing means for automatically operating said connector switch to move said wipers in said other motion to successively hunt for an idle trunk in said selected group, means including wiper restoring means operated in response to the last trunk in said selected group being engaged by said wipers and found busy for automatically restoring only said wipers to normal, means for maintaining said connector switch in said calling connection with said preceding switch train subsequent to restoration of said wipers to normal, and means including means operated in response to said restoration of said wipers to normal for preparing said connector switch for subsequent reoperation of said wipers in the same above-mentioned said two directive motions whereby the busy condition of said trunks in said selected group is retested.

2. In a telephone system such as claimed in claim 1, including a source of busy tone, a normally incomplete circuit for applying said busy tone to said calling connection, and means operated in response to the operation of said means including said wiper restoring means for completing said busy tone circuit to apply said busy tone to said connection, both before said release of said wipers to normal and subsequently thereafter.

3. In a telephone system, a two-motion multi-level connector switch, a set of wipers included in said connector switch, a plurality of groups of trunk lines, each of said groups of said trunk lines being connected to a different one of said levels, said trunk lines accessible to said connector switch by means of said set of wipers, a preceding switch train having access to said connector switch operated in response to the initiation of a calling connection thereover for including said switch in said calling connection, means for directively operating said connector switch over said connection to move said wipers in one of said motions to one of said levels to select one of said groups of trunk lines, means for further directively operating said switch over said connection to move said wipers in the other of said motions to engage the first of said trunks in said selected group, busy testing means in said connector switch for testing the busy condition of each trunk in said selected group, means operated in response to said first trunk testing busy by said busy testing means for automatically operating said connector switch to move said wipers in said other motion to successively hunt for an idle trunk in said selected group, a release control relay, means for operating said release control relay subsequent to the last trunk in said selected group being engaged by said wipers and found busy, a wiper release magnet, a normally incomplete operating circuit for said wiper release magnet, means operated in response to said operation of said release control relay for completing said circuit to operate said wiper release magnet, whereby only said wipers are restored to normal, means for maintaining said connector switch in said calling connection with said preceding switch train subsequent to said restoration of said wipers to normal, and means including means operated in response to said restoration of said wipers to normal for preparing said connector switch for subsequent reoperation of said wipers in the same above-mentioned said two motions, whereby the busy condition of said trunks in said group is retested.

4. In a telephone system having a two-motion multi-level connector switch including a connection from a toll operator over a toll switch train in response to said operator dialing the preliminary digits of a call number, a set of wipers included in said switch, a plurality of groups of trunk lines, each of said groups of trunk lines being connected to a different one of said levels, said trunk lines accessible to said connector switch by means of said set of wipers, each of said groups of trunk lines being assigned a pair of individual digits for representing the final digits of said call number, means for directively operating said connector switch over said connection to move said wipers in one of said motions to select one of said groups of trunk lines on one of said levels in accordance with the dialing of a first one of said final digits, means for directively operating said connector switch to move said wipers in the other of said motions to engage the first trunk in said selected group in accordance with the dialing of a last one of said final digits, busy testing means for testing the busy condition of each trunk in said selected group, means operated in response to said first trunk testing busy by said busy testing means for automatically operating said connector switch to move said wipers in said other motion to successively hunt for an idle trunk in said selected group, means operated in response to the last trunk in said selected group being engaged by said wipers and found busy for restoring only said wipers to normal, means for maintaining said connector switch in said calling connection from said toll operator subsequent to said restoration of said wipers to normal, motion preparing means including control means operated responsive to said restoration of said wipers to normal for preparing said connector switch for the subsequent directive operation thereof to move said wipers in said one motion, relay means, an operating circuit for said relay means, a shunting circuit normally rendering said operating circuit ineffective, means operated responsive to said operation of said motion preparing means for opening said shunting circuit to thereby render said operating circuit effective for operating said relay means, and means operated in response to said operation of said relay means for preparing said connector switch for the subsequent directive operation thereof to move said wipers in said other motion.

5. In a telephone system, a plurality of groups of trunk lines, each group of trunk lines being assigned a pair of individual digits for representing the final digits of a call number, a connector switch having access to said trunk lines, an operator's position, a preceding switch train, means for establishing a connection from said operator's position to said connector switch over said switch train in accordance with the dialing of the preliminary digits of said call number by said operator, means for operating said connector switch to select a group of said trunk lines in accordance with the dialing of a first digit of a certain pair of said final digits in said call number, means for thereafter operating said connector switch to connect the first of said trunks in said selected group in accordance with the dialing of the last digit of said certain pair of said final digits in said call number, busy testing means for testing the busy condition of each trunk in said select-

ed group, means operated in response to said first trunk testing busy by said busy testing means for automatically operating said connector switch to successively hunt for an idle trunk in said selected group, release means in said connector switch, means for operating said release means in response to the last trunk in said selected group testing busy by said busy testing means for causing said release means to restore said connector switch from only said trunk selecting and said testing operations, means for maintaining said connector switch in said established connection from said operator's position over said switch train subsequent to said release, and means operated in response to said restoration for rendering said connector switch reoperative to the subsequent redialing of said certain pair of said final digits to reselect said same group of trunk lines and reconnect with said first trunk in said reselected group, whereby said connector switch is automatically reoperated to perform a second trunk hunting operation for retesting said trunks of said reselected group by said busy testing means.

6. In a telephone system, a connector switch, an operator's position, a switch train controlled by said operator, means for extending a connection from said operator's position over said switch train in accordance with the dialing of the preliminary digits of a call number to seize said connector switch, a first release means in said connector switch, means operated in response to said seizure for operating said first release means, holding means for maintaining said first release means operated under supervision of said operator-controlled switch train, means operated by said operation of said first release means for thereafter rendering said holding means effective, other means controlled by said first release means for rendering said connector switch responsive to subsequent dialing operations, trunk lines arranged in groups, each said group of trunk lines being assigned a pair of individual digits representing the final digits of said call number, wipers in said connector switch having access to said trunks, means for directively operating said connector switch to raise said wipers to select one of said groups in accordance with the dialing of a first digit of a certain pair of said final digits, means for thereafter directively operating said connector switch to rotate said wipers to connect with the first trunk in said selected group in accordance with the dialing of the last digit of said certain pair of said final digits, busy testing means for testing the busy condition of each trunk in said selected group, means operated in response to said first trunk testing busy by said busy testing means for automatically operating said connector switch to rotate said wipers to successively hunt for an idle trunk in said selected group, a second release means in said connector switch, a first and a second operating circuit for said second release means, means operated in response to the last trunk in said selected group being tested and found busy by said busy testing means for completing said first operating circuit to operate said second release means to restore only said wipers, means operated in response to said restoration of said wipers for rendering said connector switch reoperative to the subsequent redialing of said certain pair of said final digits, whereby said same group of trunks is reselected and said first trunk thereof is reconnected therewith, means responsive to said first trunk being tested and found idle by said busy testing means for extending the said connection thereover from said operator's position, said holding means rendered ineffective over said operator controlled switch train responsive to said extended connection being terminated at said operator's position for restoring said first release means, whereby said connector switch is rendered unresponsive to subsequent dialing operations, and means operated in response to said restoring of said first release means for completing said second operating circuit to operate said second release means to restore said wipers.

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